

# A Modified Model For The Allocation Of General Industrial Costs In The Light Of The Agency Alliances Theory And Moral Hazard - A Theoretical And Practical Study

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## Abstract

The issue of allocating general industrial costs is one of the controversial topics that have met a lot of academic research in the accounting field . The researcher noticed that the majority of the studies conducted in this area neglected the effect of the different cost centers' behaviors in reaching the satisfactory allocation of these costs . Therefore, this research relied on the analytical study to show the effect of agents on the cost allocation plan . Accordingly, the research began with a statement of the objectives, conditions for allocating the cost, then proceeded to explaining the effect of establishing a negotiating relationship between the sole agent and the principal, and then this was followed by a move to the more realistic case, which is the case of multiple agents, and the occurrence of side alliances between them in order to divide the outcome of the supposed match between them.

According to the foregoing, we reviewed the accounting models for the allocation, and concluded from that to the failure of these models to highlight the previous case . Therefore, the main objective of the research was focused on trying to arrive at a model suitable for use in creating a fair and satisfactory allocation of general industrial costs in light of the multiplicity of cost centers and the occurrence of negotiations between them during the allocation process . In the meantime, the current study will try to make use of the current state of the new advanced systems of production and the effect of this modified technology upon the allocation process of overhead, in the area of alliances and collusion.

This resulted will be concluded in reaching a proposed model that harmonizes the conditions and the theoretical and practical dimensions of the objective allocation of cost in terms of fairness of allocation, the ability to load and causality, and the effect of the negotiating actions of the agents in terms of showing the effect of the alliances expected to be established between these agents on the outcome of the allocation.

Keywords: Cost allocation, agency theory, fair allocation, collations.

### Introduction :-

The issue of cost allocation is considered one of the topics that have received a lot of study and analysis in the accounting field long time ago, and still engage a wide area of discussion. However, most of these studies neglected the negotiating effect of those who would bear the allocated costs before the cost allocation process itself was stabilized. The general assumption, that most of the previous studies followed, was that the cost allocation process is nothing but a central process that takes place only with the knowledge of the senior management of the project, which was sometimes described as Neutral Cost Allocation. As the departments or centers charged with the cost cannot, through their internal decisions, make a change in the outcome of the allocation, which requires a certain pause of deliberation and study, which is what we will pay part of the attention during this research. In addition to the foregoing, some of those who assigned the previous topic, part of the study assumed that the project under study consists of one production department<sup>[1]</sup>, by studying the contractual relationship between the agent and his client and its impact on the cost allocation process, but the previous situation was considered illogical or It is impractical, given the necessity to recognize the existence of many internal departments that have negotiation effects among themselves. It is noted that the importance of this research is focused on the vital aspect that it included, as all previous studies that dealt with this topic have insisted on the necessity of studying the problem of cost allocation<sup>[2,3]</sup>, the effect also of some mathematical solutions also considered without reaching to the objective of this work<sup>[52,53,54]</sup>, the case of multiple agents, taking into account the effect of side negotiations between them and the need to come up with a model that proves its suitability to solve the former problem<sup>[2,3,4]</sup>, which will be investigated during the progress of this work, including the different agents irrational effects. It has being indicated Magee<sup>[5]</sup> to this problem by saying:

"The cost allocation system must reduce the degree of conflict between the interests of decentralized decision-makers ie at the level of performance centers and with the general interests of the project as a whole". In other terms, the task objective of the current work is to narrow the gap between the different parts of the game supposed played here".

### Research objective and limitations:

This work aims to arrive at a modified new quantitative model for the allocation that harmonizes between the conditions and theoretical and practical dimensions of the reliable allocation of cost, with a focus concern to the impact of negotiation actions among the internal agents, and finally with their positive and negative effects on the outcome of the final performance of the firm. Perhaps the new suggested model at the end of this work will be important and featured, as it provides many solutions to the problems previously raised regarding the internal negotiation effects, the case of multiple operating departments, on the cost allocation process, and it comes in response to what many writers and researchers have demanded in other places and models<sup>[6,7,8,9,10, 48,55]</sup>.

Despite the importance of the above, there are other points that have been left without discussion, especially those related to the limits of delegation of authority, and its impact on the negotiation process. Also, the in-depth analytical study of cost allocation models that are currently commonly covered in the accounting field, will not be dealt with here in detail because many writers have undertaken this task<sup>[11,12,13,14,47]</sup>. This is in addition to focusing on the aspect of allocating indirect general industrial costs without taking into account the allocation of costs between the various production centers resulting from the transfer of goods and services between them, which is known as transfer prices<sup>[15]</sup>. Also the

problem of cost allocation through the supply chain<sup>[50,51,55]</sup>, where excluded from the current work.

### Research plan:

Perhaps from the previous discussion, it can be determined that the plan of this research will include a theoretical, quantitative and analytical study of the requirements for cost allocation, taking into account the different internal negotiation situations, and the extent of their impact on the cost allocation process. Perhaps all of this will represent the extent to which the practical application of agency theory affects the cost allocation process. Therefore both of the term cost center managers, agent were used synonymously throughout the research.

According to the foregoing, it is believed that the research plan should be divided into a group of integrated sections that seek to achieve the previous goal. In the first section, the researcher will conduct a brief analytical critical study of the basic dimensions of cost allocation in the currently common models in the accounting field. The second section will deal with cost allocation and its relationship to the decision-making authority, and the third section deals with the study of cost allocation models in the case of taking into account the negotiation relationships, (the case of one cost center). Finally the researcher will root the previous problem, taking into account the state of negotiation when there are multiple cost centers, and the extent of this, on the cost allocation model, which in turn will result in the mathematical configuration of the proposed model for privatization, along with an indication of its most important advantages and characteristics. Then the research concludes with the presentation of the most important proposals and recommendations necessary for establishing and specifying scientific research in the current problem.

### (1) Critical view concise basic dimensions of allocation

The researcher believes that there are basic dimensions that must be met in the allocation models, which are the time dimension, the structural dimension, the planning and control dimension, and finally the development dimension, and during this research the researcher will try to review the availability of these dimensions in the common cost allocation models in the accounting field.

### 1/Time dimension:

The temporal dimension of the cost allocation process is a necessity to fulfill many of the purposes of the costing system. The time dimension here means the timing of cost measurement and allocation. Is the current measurement after or before? The dimensional allocation of cost components is the one that depends on counting the cost elements that have been spent, and then allocating them among the beneficiary centers according to certain approximate bases (cost drivers)<sup>[46]</sup>, in order to achieve an adequate distribution of these costs. In this point. Rayburn<sup>[16]</sup> has pointed to this dimensional trend which may stem mainly from the effect that cost allocation is proceeding according to the needs of financial reporting and not according to the needs of project management or performance evaluation purposes. As for the pre-allocation of cost elements, it is concerned with measuring and predicting the impact of the allocation process on decision-makers, and trying to predict the appropriate level of utilization of the available energy elements in order to make the most appropriate allocation decisions<sup>[48,49]</sup>. Characterized by common customization models currently in use as Nmaz<sup>[17]</sup> dimensionality, ie after the use, and perhaps of the problems that hinder the prediction of cost and avoid wasteful and similar problems.

### 1/2 Structural dimension:

This means by which the extent of coverage of the allocation model of the intellectual and sports on all the indicators on the cost allocation process. Current models has put place in front of her allocation one of three goals as : a ability to bear ,Causation and effect and finally, fairness .Given these goals, the researcher finds that to achieve them, certain considerations are not required, or perhaps it is better to express them with the necessary effects .The first of these influences is that to determine the ability to bear, as well as causation and influence, the influences that must be recognized must be tribal influences .Ex-ante It is not a dimension ex-poste. The researcher necessarily concerns here the behavioral effects of both the assignee and the one who will bear the allocated cost . There, we must admit that there is something similar to the framework of the match or negotiation that takes place between the previous parties, especially with regard to the divisions that will be charged at the cost, and as a result, as the researcher will explain later, what looks like alliances coalitions ,Which prepares its operational plans in advance and after a certain amount of negotiation bargaining Among them<sup>[48]</sup>. It follows that a certain expectation of benefiting a specific amount to reach and the achievement of certain goals . Here, if we want to verify the extent to which the objectives of causation, influence, justice, or endurance are achieved, the researcher finds that what has been achieved is a part and not the whole, and in order to achieve the most accurate application, it is necessary for the allocation model to include the impact of all the previous behavioral considerations on the allocation process and that previously the researcher referred to it.

In addition, the structural dimension of the accounting allocation model currently has a certain assumption, which is that this model considered that the operators or cost centers in the project are averse<sup>[18]</sup> , although in the general function of project productivity, it assumes a basic assumption, and perhaps necessary, as we will see later, that these centers and those agents aim is to maximize the results of their activities , and here , the matter calls for the researcher to stop at this structural conflict . In the first case, the case is the director of the assignment center, which we will call later the word agent, which is just a tool for implementing the orders of the project owner, whose performance function consists of his productivity on one side and his cost on the other side, and his position in this case and facing the dangers of performance is just risk-averse<sup>[19,20]</sup> or what we can call it risk-averse .But the above represents an illogical dimension that is far from the practical reality, so of course there are perhaps a limited number of decisions in which department managers are not allowed to interfere or influence, and they are related to the general policy of the project as a whole, but if it comes to performing the departments, here we cannot describe departments remain silent or not influence their decisions, which we will later use a tool to evaluate their performance . So the directors of the departments ( agents) can not be described only as risk-averse, but also have a certain amount of freedom and decision - making in order to maximize the activity or improve their departments performance, which makes him risk-neutral<sup>[21]</sup>, and offered him more freedom(of course absolute restricted freedom) . Here, the agent can be described as the person who moves to a certain extent and then stops moving when he feels that he has reached a certain amount of gains from the negotiation, then he becomes indifferent risk-neutral. Whether it is better to continue the adventure or wait for the sure return, which can be described as having reached a state of conservative .Perhaps the previous structural dimension of matters that questions the validity of the currently popular models for cost allocation in the accounting field.

### 1/3 Dimensional planning and oversight:

It is noticed that, the planning process and the subsequent monitoring of what has been implemented needs an advanced data on the expected performance and the expected cost, in the light of which the implemented activity is counted and aspects of deviation are discovered. As previously noted, the allocation models currently available, are considered models for cost inventory and distribution based on what has actually been performed. Therefore, the predictive aspect of these models is considered to be deficient for the reasons previously stated. The primary purpose of these models, whether based on actual benefit, endurance, causation, or justice, are all goals that take into account the extent of actual benefit from costs and not assignment based on the expected benefit, which requires taking into account all the side effects of negotiations between the expected productive divisions. They benefit from a certain cost. Perhaps building plans according to this consideration will help to provide necessary and important data to help in planning and the consequent benefit of using it as a tool to control the actual implementation and in effecting an amendment to the existing plans according to the feedback system, which of course is lacking in the current models for allocation, which receives the need to take into account. In the proposed allocation form.

### 1/4 Modification dimensions :

The common allocation models are not useful in influencing the degree of exploitation of available resources, since they are not actual models or effective models, they ignore the behavioral side effect of both the assignee and who will bear the assigned cost, as well as the dimensional models. Ex-poste performance is done after the end of the performance, including the extravagance and abundance it contains. The role of the person in charge of the privatization process has become knowledge of a benefit, and the choice of the method that he deems appropriate from his point of view to link the benefit and the cost of this benefit, without giving him the opportunity to decide what the benefit should be, in order to help in bringing about development. Also, the future cost (incurred) must bear a certain number without giving it the opportunity to move the silence of that number according to the relative ambition of this section, and according to the expected opportunities in front of it in the future. In other words, the personal incentive for development here for the manager of the department (the agent) in the previous allocation process is almost non-existent, which in turn leads to the limitation or perhaps the absence of the developmental dimension of the previous allocation process. The question that arises here is how do you apply the principles of accountability to the agent in terms of evaluating his performance in his department, and does not take into account his role and behavioral impact in the cost allocation process?

In sum, it is believed that the previous dimensions that must be met in the acceptable model for cost allocation have been neglected and have not been achieved to the appropriate extent, as if the main purpose of the person in charge of the allocation process is merely creating a distribution process for the resources that were used according to what he deems appropriate from the basis of benefit, without emphasizing what it should allocate resources, how it should be allocated, and finally the proportionality of the benefit with the cost allocated. Also, the wire dimension of the assignee did not attach appropriate importance, and what is more, the behavioral effect of the one who will bear the cost has finally neglected to consider it as an effective influence in the allocation process, and all of the above considerations must be taken into account if these models are to be objective, and the above mentioned dimensions should be verified.

Therefore, the main purpose of this research will try to focus on the previous deficiencies and the researcher is about to formulate a proposed model for modification, and perhaps the validity of the model will appear when the researcher reviews the extent to which the proposed model fulfills the necessary dimensions for allocation, previously presented in the previous pages.

In a few words to achieve the previous objectives, the researcher believes that the proposed model for cost allocation must contain a process of motivating agents or different departments to participate in implementation risks, so it is the opposite of what is assumed in accounting thinking, especially in models of Gangolies, Moriarity And the well known Shapley verification, that is risk-free and risk-aversion. The proposed model would assume that they share the risks, i.e risk-sharing ,which is the case that is consistent with the neutral assignment formula or the neutral allocation ,according to which the agent must first be considered involved in the risks to a certain degree, after which he becomes indifferent between continuing the risks or obtaining a return with a great degree of certainty . However, in addition to this, there is still a final point that the researcher must refer to before starting the analytical study, and it is mainly focused and related to the study of the contractual relationship between the project management and the agents in charge of the actual implementation, which is related to the degree of delegation of authority. Here, the matter may be central or it may be decentralize, as there may be degrees between the two previous cases, so in the next part, the researcher will deepen the study of the relationship between the organizational framework of the authority within the project, and the cost allocation process

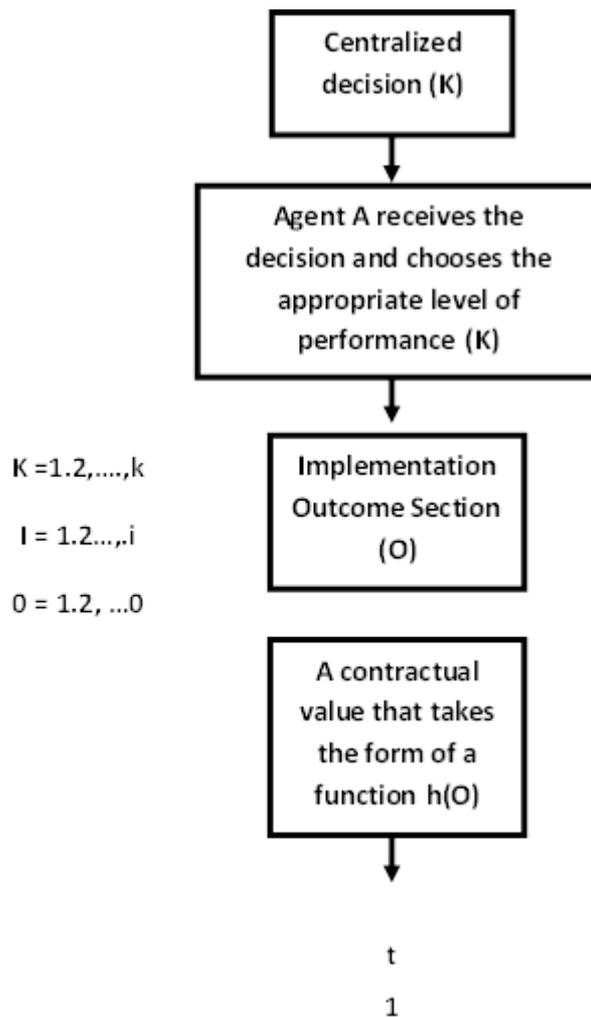
## 2)Cost allocation and the internal decision- making authority:

It is noticed that the organizational framework of the project has a clear impact on the decision-making process. The decision to exploit resources in a certain way may be centralized or it may be decentralized, which has been reviewed by Melumed and Reichelstein<sup>[19]</sup>, in terms of four organizational forms, and will be summarized in the following, with an explanation of their impact on cost apportionment decisions .

### 2/1 Centralized decision making:

Here, it is assumed that the principal makes cost allocation decisions without referring to his agents who are in charge of the actual implementation, depending on his past experience and his awareness of the actual performance level, and the extent of the needs of each performance center in the project . In this case, the listing of events related to the timing of the contract between the agent and his client regarding a specific decision-making ( central of course ) passes according to the flow chart in Figure:(1)

It is noticed that the agent's information on the method of the specialization decision to be taken will not have a visible impact, either on the quality of the decision or on the size of the contract between him and his client regarding determining the remuneration of that agent . In addition, this bonus is considered a tribal selection ex-ante. The value of the performance expected from the agent to implement the decision of his client, which will be considered a random or probabilistic component in terms of its number, and its probability distribution is F (O| K, P, i).

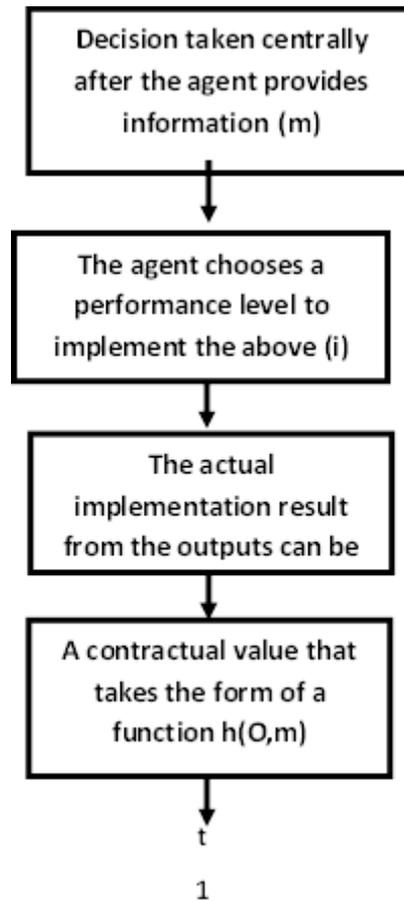


***2/2 The case of centralized decision with influence of the agent:***

In this case, the agent's role is not only limited to choosing the level of executive performance of central decisions, but also he has to disclose the private information he has about the nature of the activity for which a specific decision or decisions must be taken.

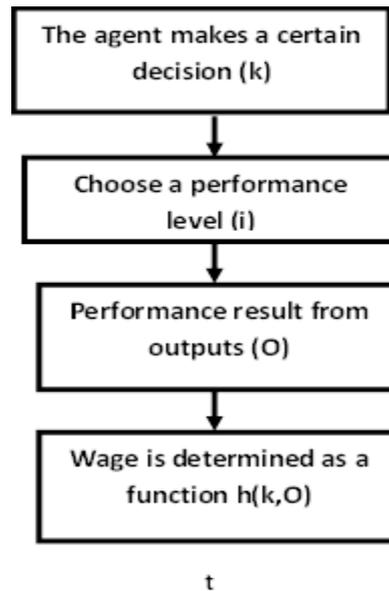
Here, the agent's reward will not only be determined based on his executive performance, but also for the information he provided ( $m$ ), to rationalize the allocation decision. Of course, the reliability of the information provided to the central administration is a matter that must be taken into account, and accordingly, the decision-making stages pass, as shown in Figure.(2)

Of course the conditional probability distribution of the level of performance expected of an agent takes a probability function in the following figure  $F(O | K, M, i)$ . Likewise, the quality and credibility of the information provided has become one of the effective and influential factors in the extent to which the desired decision can be implemented and on the level of performance implemented by the agent, which in turn reflects the expected behavior of the agent, and whether he is in favor of the public interest of the project. (organization-oriented) or whether he is selfish in his own interest (self-oriented)<sup>[22]</sup>.



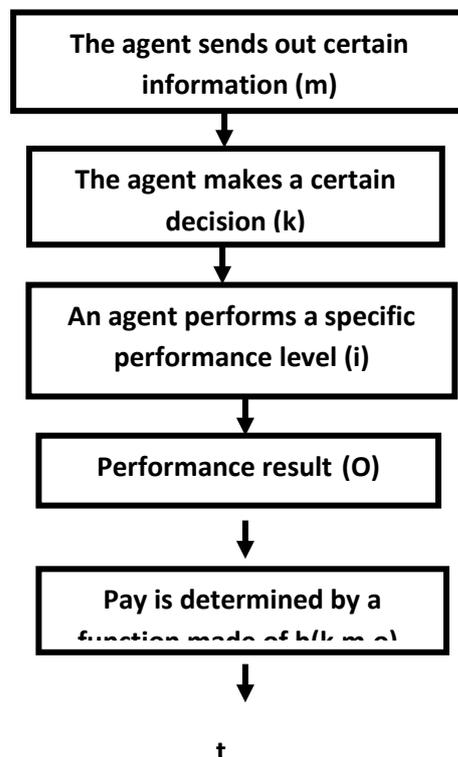
2/3 Decentralization Case:

In this case, the decision-making authority has been fully delegated to the agent or the cost center manager regarding the allocation of his available resources according to the alternative uses that he deems suitable for him, and at the same time he becomes responsible for any decision he makes. Therefore, the contract with the agent in terms of determining the category of his wages and remuneration is a function of the decision that he takes and also the outcome of this decision, that is,  $h(K, O)$ . It is also noted here that the function of the cost center manager's goal is to maximize his personal income not from the minimum that he can get in the labor market, but other than the average wage rate and the prevailing incentive in similar projects. This is achieved by the following inequality relationship  $h_3 > h$  whereas  $h_3$  Represents the average return prevailing on comparable projects of similar managers. The above can be represented by the following flow chart (Figure. 3).



2/4 Case of decentralization of decision with an existing line of communication between the Director and Manager:

In this case, there is an amount of information that is submitted first-hand from the cost center manager to the project manager, and despite that, the decision-making authority is still the responsibility of the cost center manager. This situation gives the project manager a preconceived idea of the target aspects of the use of the resources available to the cost center, and makes both the center manager and the project manager participating in the outcome, albeit implicitly for the project manager. This is achieved mainly because in the event that any deviation in the decision is felt from the specified line for the project, then in this case the project manager intervenes to resolve the matter. The previous state can be represented by the following flow chart ( Figure. 4 ):



It was noted that in the previous four cases, there is a common element that governs all of them and is a basis for motivating the agent, which is the expected level of performance to implement the decision. ( i )Of course, if the principal is able to determine the level of performance in advance, then in such a case there is no need for an incentive to motivate the agent, and it is only sufficient to determine a fixed wage in advance, as there is no great deal of uncertainty here<sup>[23,24]</sup>.

Perhaps the two previous cases related to observing the actual performance of the agent, and a case that decides and charts a specific performance level for the agent to perform, are considered to be particularly important for the cost allocation process. Here, before starting the analysis, we will present the simplified form of the proposed model for cost allocation, which includes only two people, one of whom is the principal and the other is the agent, and then follows that in the following parts of the presentation of the most comprehensive and realistic case, which will result in presenting a proposed integrated model for cost allocation. In the case of multiple departments or cost centers ( agents ) and the consequent necessity of recognizing the side alliances that could occur between these centers, and the consequent negotiations to reach each center to the most appropriate level of operation it seeks. In the following subsections, we will try to introduce a detailed analysis regarding the different states of the cost allocation game.

### 3-The case of cost allocation with only two parties in the allocation game:

#### 3/1 Allocation boundaries:

- 1) The agent has sufficient freedom in choosing how much resources to use in his position. Perhaps this is in line with what the researcher has previously indicated about the need for the agent to be a participant in operational risks, which is consistent with what was previously called for. Demski and Sappington<sup>[25]</sup> that more knowledgeable than any other agent appropriate for the level of the operating department, which is headed, and accordingly quantify its resources to be consumed. Here, the principal has to evaluate his agent by comparing the level of targeted performance with what has been achieved, which in fact represents an evaluation based on productivity or the marginal contribution of the resources consumed by the agent.
- 2) Sometimes due to the scarcity of some resources are relatively, may interfere with the client put additional restrictions on the exploitation of that resource, either for lack of availability or relatively in order to raise the contribution limit, and here must be that constraint appears in agent productivity function.
- 3) A situation is determined by the agent's motivation (S) based on the results for his performance (X) Which takes in its random form probability distribution random. The agent's productivity function, upon which his stimulus is determined, is accessed by the function  $S = s(X)$
- 4) In the event that the model includes a cost allocation, the agent will choose a specific level of resource (Y) To be used at its center, and that this resource level will in turn affect the probability or random output of that department (X). This will lead to the client bearing some of the cost (S) Which in turn is a function of the amount of resources (Y) or  $C(Y)$ . Here the agent's stimulus function will not depend on the random or probable outcome (X) Just for the decision, but it'll depend on a function composite of  $C(Y)$ , X take shape  $S = s[X C(Y)]$ . Therefore, the process of studying cost reduction according to this model will be studied through the net return function of the center.

- 5) Based on the above, it can, with more linear analysis of the previously shown function, and by using the regression coefficient, conclude some results, and So form the following relationship :-

$$X = \alpha_0 + C(Y) + U$$

$$\hat{X} = \hat{\alpha}_0 + C(\hat{Y})$$

Which is a cost-production function, by following simple regression analysis Its constant value can be inferred  $\alpha_0$  Which will give an unbiased estimate, unbiased For agent activity level efficiency parameter, As that(Y) here you will not give an estimate of cost so much as you will give marginal productivity, marginal elasticity or productivity of the resources used and their marginal effect on the productivity achieved of the center (of course, the assumption of a linear relationship was for ease of application, but the matter may go beyond that to the necessity to consider the previous function as non-linear).

- 6) It has to be the relationship between(S) Motivation ,(Y) an inverse relationship as the exploitation of more resources must not result in a greater incentive, and this means that partial flexibility partial elasticity For the incentive in its relationship to cost, it must be diminishing, meaning that the sign of the estimated value of this relationship is negative . Also, taking into account that the relationship is a simple regression, the yield of volume returns to scale. For this function, it must be less than or equals to zero and more negativity is evidence of higher efficiency . Perhaps this will lead to Model C, gaining its validity in terms of optimal cost allocation .It indicates the performance level of the agent, which leads in the event of high performance adequacy to the emergence of the inverse relationship between the cost of resources used and the level of incentive .To consider both (Y), (X) serving as indicators for convincingly drawing the agent's incentive policy conventional and enough sufficient It should be expressed mathematically, t hat takes the following relationships into account:

$$\text{if } Y \text{ } \bar{Y} \text{ } \underline{\quad} \quad (1)$$

$$\text{Then } S(X, Y) \cdot S(X, \bar{Y}) \quad (2)$$

And the previous second equation indicates the inverse relationship between the amount of resources used and the performance level of the agent, and hence the incentive to be provided to him.

**3/2 Quantitative study of the relationship between agency theory and cost allocation:**

Here we can define the basic components of the probability return models for both principal and agent as follows:

For the principal objective function model, it is represented by:

$$U = G [ X - C(Y) - S(X,Y) ] \quad (1)$$

whereas  $G [X - C (Y)]$  the function represents the net return from taking a given decision, while  $S (X, Y)$  the incentive function granted to the agent representing his counterpart effort (I suppose the difficulty of observation by the principal, and his observation was decided later by the agent, with observant of the lack of communication tribal prior-communication between agent and client).

Also, the agent objective function can be represented in the following form:

$$U_p = F [ S (X, Y) ] - V (a) \tag{2}$$

As the first part of the function  $S (X, Y)$  represents the stimulus, while  $V (a)$  it represents the level of activity that the agent will perform while making the assigned decision, and the result of the equation represents the net return after bearing the psychological effort represented by  $V (a)$ . Of course here the agent is conservative with regard to the high levels of risk-averse with the availability of the necessary conditions for this case, namely:

First derivative	$( F' (.) ) > 0$
Second derivative	$( F'' (.) ) < 0$
	$V' (.) > 0$
	$V'' (.) > 0$

This is in addition to that  $V'' (.)$ ,  $V' (.)$  indicates that the voltage function is increasing. But with a degree of caution lest mistake (effort-averse). While the client goal function indicates in an image  $G (XC "Y")$  Until the client is less conservative weakly (risk-averse) or risk-seeker To create the client's goal function, we need one variable ( $V$ ) which determines the effective-cost relationship ( $Y$ ) on the outcome of the decision ( $X$ ) Where:

$$\sum_{i=1,2,\dots,i} 1 > r_i > 0$$

And well  $f(r_i)$  represent the probability of occurrence ( $r_i$ ). However, this potential effect is only noticeable by the agent, not the client. The principal problem for the principal is the choice between ( $a, Y$ ) for every possible level ( $r_i$ ) and so does the stimulus function  $S (X, Y)$  that motivates the agent to make the most appropriate decision.

It was noticed that ( $r_i$ ) can be considered as an indicator of the high productivity of the resources used, and here the principal's goal function can be represented as follows:

$$\text{Max: } \sum_{i=1}^2 \sum_{i=1}^2 A_i \cdot Y_i \cdot S(X, Y) \cdot (\sum f(r_i) \cdot [\sum G(X_i - C(Y_i) - S(X_i, Y)) \cdot f(X_i | a_i, Y_i, R_i)]) \tag{3}$$

$$\text{Subject to: } \sum_{i=1}^2 F(r_i) \cdot [F(s(X_i, Y_i))] \cdot f(X_i | a_i, Y_i, r_i) - V(a) = F \tag{4}$$

$$a_i \in \text{argmax} \{ \sum_{i=1}^2 F(S(X_i, Y_i)) \cdot F(X_i | a, Y_i, r_i) - V(a) \} \tag{5}$$

To explain the foregoing, it is noticed that the agent's expected benefit must be greater than the expected benefit in any other alternative business (opportunity) according to the principles of logical choice of the agent's rational choice. But noting that the agent had tested work for his client before observing the internal correlation relationship<sup>®</sup> between the cost benefit or the outcome of the decision i.e. between (Y), (X), in other words, equation (4) represents the additional net incentive benefit for the agent over other opportunities available to him in the market.

In equation (5) the choice of the agent for a specific performance level or activity to maximize his benefit or the level of his return from the agency is shown in the case of choosing the level of resource use. (Y<sub>i</sub>) When you come true (r<sub>i</sub>) that is, in the sense of the state of subordination of the agent at the moment of his client regarding the extent and level of utilization of available resources. In addition to the previous model, new mathematical relationships can be added in the event that the agent does not submit to his client regarding choosing his plan to exploit resources at the level that the principal sees, and here the agent is considered a participant in bearing risk-sharing. It represents a situation where the agent leaves his reservation, so it is instead of choosing (Y<sub>i</sub>) set by the principal, the agent may choose (Y<sub>n</sub>) and performance level (α<sub>i</sub>) Where:

$$N = 1, 2$$

$$n ? i$$

The resulting relationship is in the following picture: .....

$$a_i \in \operatorname{argmax} \left\{ \sum_{i=1}^2 F(S(X_i, Y_n)) \cdot F(X_i | a, Y_i, r_i) - V(a) \right\} \quad (6)$$

So the choice (i) and not (a<sub>i</sub>) especially when the agent follows a level of performance contrary to what was previously followed in (3) which leads to the necessity to choose a different level and use it to exploit the resources as decided by the principal. For example, when an agent notices that (r<sub>i</sub>) it is the list, it follows a performance level (i), which in turn requires the need to use level resources (Y<sub>2</sub>). But this matter represents complete degrees of freedom for the agent to choose whatever resources he wants, and of course that is not possible, which requires intervention from the principal in order to ensure that the agent will be considered to have an acceptable degree of rationality in behavior. And what is indicated by the principal is that if is verified (r<sub>i</sub>) it, agent will choose (Y) and not others. Here, the principal himself, by imposing this restriction, will have a certain degree of control over the management of his own resources and to prevent any major deviations from the duty to occur, and perhaps this in turn will require a certain degree of information circulation between the agent and his client, which we will present later, but with a degree of shortness. To impose the previous restriction, it must take the following form:

$$\sum_{i=1}^2 F \{ (S(X_i, Y_n)) \cdot f(X_i | a, Y_i, r_i) - V(a_i) \} \quad (7)$$

$$\sum_{i=1}^2 F \{ (S(X_i, Y_n)) \cdot f(X_i | \alpha_i, Y_n, r_i) - V(\alpha_i) \} \neq$$

$$S(X_i, Y_i) < S(X_i, Y_n)$$

$$a_i > \alpha_i$$

$$Y_i ? Y_n$$

This is (r i), it will transfer its information from the agent to the client honestly and honestly without any degree of proper behavior, moral hazards as the constraint ensures that by choosing the level of performance, the level of resource utilization, which can be observed by the principal. So the relationship(r i) in terms of its value, it is difficult to manipulate its advertisement and disclosure, and it represents one of the sought-after goals of reducing dishonest behavior in light of the application of agency theory.

All this has led some to assert that the level of resource exploitation (Y) it may be considered in the D model the agent's incentive an effective tool by which to motivate the agent to disclose information, especially what is related to his remuneration process, incentive and the result of his use of resources, or as indicated in Magee<sup>[1][53]</sup>.

"One of the important things in determining the amount of incentive assigned to the agent is to know the degree of exploitation of available resources, which represents one of the main influences on the cost allocation process."

Perhaps what has been explained above brings us back to the need to highlight the unit of analysis, as delegating the authority to use resources after observing the degree of their exploitation is considered equivalent to a case, despite the person delegated to make the decision to exploit the resources after receiving information on the degree of impact of resource exploitation and its quantity (Y) on the probabilities of the output or operating result.

Of course, to solve the previous model of maximizing the benefit of the agent and the extent to which it is subject to the principal's restrictions, which reveal some indications on cost allocation and the extent of the relationship of the incentive to satisfactory cost allocation, the rules of the Lagrangian function must be applied. Lagrangian Considering the linear relationship<sup>[54]</sup>, from which differential rules can be applied to the first function sign (F) In cases of multiple incentives and its effect on (Y), which we noticed as revealed from the analysis, (1) that the agent will choose a higher degree of use of resources in the event that the value of the relationship is more or greater between(X) & (Y) here remains a very important point, which is related to the case of a positive correlation in between (a) & (Y). If both of the previous two elements can be substituted between them, then it is claimed that the agent exerts more activity or performance and less resources used in order to deserve a greater incentive<sup>[52]</sup>.

In the case of both (a) & (Y) Complementary, the increase in the level of performance by the agent and the impact on the level of performance outcome (X), it will require more use of resources, so the relationship here is an upward trend between (S) & (Y), as the increase (Y) it will entail an increase (a) With (x), and the positive effect on (x) it will, in turn, require increased motivation. Therefore, it all has an impact on the process of resource allocation and utilization, as we will point out in the following paragraphs.

And to infer the effect of the foregoing on the cost allocation process cost allocation, as we have previously indicated, the basic relationship function previously studied represents a contractual function dependent on the level of the agent's performance result, represented by what can be called and observed (x) as well as the degree of specific resource use (Y). It is also evident from the above that the researcher's focus on the degree of resource utilization, which is a true indicator of the extent to which a particular center benefits from a certain element or elements of cost, and the effect of this on the incentive granted to the agent, is one of the forms of allocating resources available to the central administration of the project, with what this reflects in terms of raising efficient utilization of resources, which is a basic goal of the resource allocation process.

Here, the researcher points out that the attempt to create a direct influential relationship between the application of agency theory and the development of cost allocation methods is difficult to highlight directly, but we can extract some indirect influential relationships between cost allocation and the application of agency theory. It has indicated by Horngren and Foster<sup>[26]</sup> to the cause-and-effect relationship in the cost allocation process. Accordingly, we find that the agent chooses a certain level of resource use (Y), which in turn affects how much the principal is charged C (Y), so it was suggested Hicks<sup>[27]</sup> that the cost allocation must depend only on the level of utilization of the available resources, and that the allocation to a specific department must have a positive linear relationship with the increasing amount of resources used.

But on the reverse side, given the difficulty of applying the principle of causation and consequence, it has been found for that, which is the application of the principle of carrying capacity, which is considered an indirect indicator of the extent of exploitation. The greater the ability to benefit, the more this indicates the necessity of using more resources. Therefore, relying on the principle of benefit has led to the introduction of a new element into consideration when evaluating cost allocation, so that dependence on the amount of resources used has become (Y) As well as on the result of use (x)

Based on the above referrals, and according to the application of agency theory, the efficient and satisfactory allocation of cost must strike a balance between:

- A - Desire that cost allocation leads to more efficient utilization of available resources. It is not, of course, reasonable that cost allocation leads to an increase in marginal cost for marginal return and marginal benefit, which in turn will lead to a negative net return (loss), which we can call the equilibrium dimension of the allocation.
- B - The involvement of more than the agent in facing project risks must be reduced. The agent may be more conservative in some resource exploitation decisions to the degree that reduces his intervention to participate in performance risks. This, in turn, requires the principal to either bear a greater amount of operational risks, or use more incentives that induce or positively motivate the agent to share the risk to turn into risk-sharing. An example of this is when certain decisions are taken where it is difficult to evaluate their returns in the short term. Here, the application of the principle of causation, influence or the principle of bearing capacity will not be feasible in the process of cost allocation, so

paying the agent to participate in decisions such as these will require the client to follow a motivation system that is contrary to the accepted norm, or to schedule his performance evaluation as appropriate. The quality of the decision taken, such as if its performance is evaluated in the long term instead of the short term, if the allocation decision to be taken has a long-term impact, first and its effects do not appear until after a long period, such as investment decisions in fixed assets.

C - The agent motivation process must include all the decisions delegated to him, whether it is possible in these decisions to substitute between the resources used (Y) and the effort expended from it (a) or, both of the previous two factors were complementary. In the first case, the incentive must have an inverse relationship in its amount with the quantity and value of the resources used, because each shortage of resources will mean an increase in the effort expended. Whereas in the second case, and given the difficulty of assessing the amount of exerted effort with some accuracy, an increase in the amount of resources used will implicitly mean an increase in the effort expended, which means with it the need for a positive relationship between the quantity and value of the resources used and the incentive granted, and perhaps all of that. The best evidence of the effect of an incentive on the cost allocation process is in terms of effectiveness of use, fairness of loading, and causation of use. It is concluded from the model of agency theory by defining a summary of the importance and determinants of the literal allocation of cost as:

"Evaluation of the effectiveness of the use or choose the agent of the resources used as the basis for evaluating its performance and to determine his remuneration, and therefore the reflection on the level of performance achieved on the one hand, and to achieve the dimensions of time, equilibrium, objectivity and counting utilitarianism investigator of customization".

But what has been presented above in analysis is related to the specialized match that contains only an agent and a client, which is considered a prelude to the common case of multiple departments or cost centers (and the subsequent multiplicity of agents) about which the scientific urgency has increased towards the necessity of finding a model for cost allocation that takes into account. This case has special problems<sup>[28]</sup>. Therefore, in the next part, we will present a detailed analysis with the aim of arriving at a model whereby an objective allocation of cost can be made in the case of multiple agents, in addition to the need to highlight that cost allocation is an influential element in the bargaining process in determining the incentives between the implementing agents and the client.

#### 4 Studying the problem of cost allocation in the case of multiple agents:

When expanding the previous model presented on the cost allocation process when there are multiple agents (or centers) that perform actual performance and the consequent problem of cost allocation, the previous results do not remain as they are for the following reasons:

1. The problem of unforeseen alliances between different agents or integrated centers within the project that cannot be avoided or neglected to be recognized due to their impact on achieving the optimum utilization of available resources.

2. The consequence of the foregoing collusion among these departments, which is in a cooperative form constructive for the benefit of the project, or it may be cooperative and not in the interest of the project, but rather for the purpose of achieving the self-interest of those in charge of managing these centers or, finally, the matter may be competitive among these groups, which complicates the application of agency theory.
3. The problem of side negotiations and their impact on the completion of the alliance expected to form, and its impact on the tribal distribution of the revenues and costs of the supposed match between these departments.
4. The problem of defining the organizational hierarchy for determining the connections between the different departments and the distribution of the executive authorities among them.

It is noted that alliances are usually in the interest of the project, especially as they result in something like a cooperative match cooperative-game among the various internal operating departments to the extent that there is a saving in the cost of integrated performance complement for these allied sections. Perhaps this is an important matter and a concern, as it is a desire to eliminate some of the unprofitable competition between these departments, which results in more obstacles to the degrees of integration between the internal departments. And appears on the horizon an apparent relationship and exchange between alliances coalitions on the one hand, and cost allocation on the other hand. The recognition of this mutually influential relationship among alliances, and the extent of its reflection on the cost allocation process, is what called for Dopuch<sup>[29]</sup> to say:

- A) It helps to develop our understanding of the currently used allocation methods. It is not clear in the minds of the accounting field the reason for every economic establishment based on adopting its own method of allocation without others, or in other words does each establishment have its own circumstances from which it was summoned? Following a certain method of assignment that may not be suitable for another facility.
- B) If the top management wants to push the different departments in the project to follow an integrative cooperative alliance policy in the use of common resources, then it is necessary to know what is the allocation method that will push the different departments and even encourage them to make these alliances.

We noted that( a ) appeared in particular to indicate what kind of alliances must exist in the facility, which calls for the necessity to search for a specific method of cost allocation, and(b ) it is looking for appropriate allocation that encourages the creation of certain alliances between departments. .

Perhaps differences between internal departments stems mainly from the supposed match between these sections which represent the framework practiced in the borders of their strategies and various policies, in its progress towards attracting as much of the limited resource available, especially when the resource is rarely shared in the benefit sections other than it, and useful in its use towards achieving the self and internal goal of the department. The process of alliances is basically a necessary means to achieve a positive benefit for all departments based on implementation, because if these departments work alone or independently without taking into account the interest of other departments, this may lead to a diminution of the benefit achieved for any of these departments or perhaps for the project as a whole, on the state of the existence of the alliance between these sections. But is cooperation between departments always the desired and presumed case for the benefit of these departments ?Perhaps this goal is from the point of view of the project as a whole, but in terms of the motive for each division, an alliance between

departments may be necessary, but not for the purpose of cooperation only, i.e. the match between departments will not only be cooperative but it may also be competitive because each division still has its own self-interest, so this type of match is usually called mixed-motivated matches (a mixed motive game). Of course, this duality in the strategies of each department will help, it not be fully cooperative, but also competitive in the event that the self-interest of each department conflicts with the other. This is a mixed match when one of the defendants confessed to his colleagues in a specific crime or the so-called prisoners dilemma-game<sup>[30]</sup>. Before going through the stages and procedures of alliances and how to evaluate their effects on the cost allocation process, it is important for the researcher in this regard to refer to what was expressed by Cyert and March<sup>[31]</sup> when it was stipulated that "the cost allocation followed in practical life basically reflects the forms of alliances existing in projects".

#### 4/1 Alliance (coalition) Theories:

By reviewing the various theories that were commonly mentioned regarding the formation of alliances, especially what works in the field of business, the researcher can summarize these theories in the following<sup>[30]</sup>:

##### 4/1/1 Capellow's theory:

Capellow presented his theory<sup>[32]</sup> of alliance formation, and he set the criterion for forming alliances on the basis that it is based on the initial distribution of the assumed capacity of competitors in the field. Of course, here the term operational energy can be used instead of the concept of capacity expressed by Capellow. The first formulation of a theory has been assumed in the case of the existence of only three sections, but at the end of his presentation he assumed the generality of the principles of his theory and the possibility of applying them to groups of more than three departments, noting that the basic idea of alliances from his point of view is based on the alliance of only two people at a time depending on the idea of rationality for the allied, and all of them are close to each other. Their self-interest in the alliance will automatically resort to it. Of course, Capello's theory faced some difficulties as he did not know the concept of ability power, which the researcher mentioned in a transgression in his presentation that it should represent the operational energy. And the researcher may indicate here that it is better not to take the operating energy number on its cause, but rather it must symbolize this number in a relative form, compared to the rest of the energy of the other two centers, so we can build alliances according to this shape. It also maligned on a model it focused only on forecasting potential alliances among internal divisions, but it did not help predict the potential return from these alliances. All of this has made this model not universal. Given previous difficulties, Chertkoff<sup>[33]</sup> tried to present a development of a theory Considering the case of alliances of equal return between any two allied groups, but his results did not help much in the generalization of the theory of Caplow.

##### 4/1/2 Shapley and Shobak negotiation theory:

Where both Shapley and Shobik<sup>[34]</sup> laid a basis for negotiation among the many parties in the work environment, instead of Kaplow's theory being limited to only three people, the concept evolved to be more comprehensive, and it includes many individuals. Their theory was based on the following assumptions:

- 1- Alliances among project departments are random.
- 2- A new section is added to the alliances with each session, so that the formation of alliances will not become fixed but variable with the change of operating conditions and the pace of

the negotiation result among the different departments, and perhaps due to the other considerations that will come.

- 3- The return or benefit that each division receives from the alliance depends on the marginal contribution of that section to the success of its alliance . The researcher suggests that the marginal productivity of the different departments participating in each alliance can be used as a basis for distributing the benefits of alliances among these departments, perhaps also in the distribution of the burden of costs that should be allocated, based on the independent cost of each division separately . Given the multiplicity of coalition personnel, marginal productivity and its use as a basis for allocating cost totals can be configured to assist in this, by obtaining the weighted weights of these marginal contributions . Therefore, the distribution of match revenues ( and what is allocated in terms of costs ) is proportional to the marginal contribution of each division to the existing alliance, or what may be called the marginal effect of Each division is based on the alliance.

#### 4/1/4 Theories of Komoreta for negotiation:

Komorita has formulated three theories to predict the formation of alliances (coalitions) and the distribution of matches between members of the alliance, the researcher summarizes them as follows <sup>[35]</sup>:

##### (1) The Bargaining theory (1973) :

In theory , it pointed out that individuals will try to defend or support the coalition that leads to maximize their benefit ( in the form of reducing the cost allocated to each of them, which led to the consideration that the concept of cost savings is an implicit indicator reflects the proper utilization of available resources) .Of course, the criticism he formulated the previous theories regarding the nature of stillness and balance that, I relied upon have been treated here . In a theory of negotiation, the other mediating elements that affect the outcome of the match in determining the form of negotiation that will take place and thus the outcome of alliances are recognized .Players theory or sections that Baltv has divided the and Z sections J n, one of them above the average capacity or operational energy which will be asked to return from alliances depending on the proportion of its share in the energy or capacity, while there is the other team ,which is located below the level of the average i energy Which will demand equality among all in distributing the result of the alliance . As a result, it is possible to predict the intended return among the members of any alliance on the basis that it will be in proportion to the maximum expectation of these members compared to what is available to them in other alliances, that is, it will give the maximum potential benefit to members in a particular alliance compared to what could have been obtained. In any other alternative alliances (and here the relationship between the negotiating ability and alternative exploitation opportunities for negotiating divisions ) emerges

- (2) The Weighted - probability theory (1974) :Where Komoreta by adding a new entry in this theory, which is your size and as influential in the formation of alliances . Here, the basic view in the theory is based on the fact that the greater the size of the center, the less likely it will form an alliance with other centers, unless there is an incentive to form this alliance, as is the case when maximizing the utilization of the common resources available to the divisions to be allied .Of course in the case of equal returns(rewards) from the alliance, the departments that will try to enter into such alliances are those that are characterized by equal operational capacity and ability to perform and operate, to the extent that achieves the proportionality of the potential

return expected to them with the relative size of these departments . Perhaps the previous logic stems mainly from the ease of forming alliances between a small number of divisions that are characterized by their small size, due to the ease of correcting any obstacles of such size, while in the case of large divisions it is difficult to correct the differences between the parties to the alliance in such cases . Perhaps the logic of this theory depends on the expected return, expected rewards, the alliance must be distributed in a proportional manner in proportion to the probabilities of each division joining the existing alliance, and with the self-expectation of each individual division compared to its own capacity.

(3) The Equal-excess model (1979) : Where

Komoreta drafted this model, which helps to predict the coalition and the distribution of revenues from the alliance ) cost savings ( in attitudes to related returns ) costs , ( the case are fixed or variable amount, and when they do not have the operational capacity ) resources from the point of view of Komoreta ( Not having an impact on those involved in an alliance) . This theory rests on two important foundations, one of which relies on bargaining power and bargaining strength Which is determined by the available alternatives, for each member of the coalition, in order to participate in other alliances ( of course , in front of which the largest number of other opportunities will become more members of these power) , and perhaps this will represent a monopoly power for this member , while the other is based on the premise that each member of the alliance has an equal share in the surplus revenue that can be obtained by each member compared to the returns that would have been obtained if each member of the alliance had not participated in this alliance and benefited. On his own from other opportunities that he missed . That is, the process of relativity here is in relation to the opportunity cost ( lost returns ) for each member of the alliance as a result of his participation and choice of the current alternative and the sacrifice of other alternative alliances . Members who face new opportunities will demand more from the alliance . Of course, the other opportunities available to the parties to the coalition must be known to all participants in the alliance, and thus it will be considered a negotiating tool . This calls for the necessity of abundant information for everyone information-sovereignty . The opportunities open to all must be convergent in their return to them.

To express the above in the form of mathematical relationships, the researcher assumes the following:

a Phrase for expecting coalition members n From the aliance C In one

$$n c \quad \left[ \begin{matrix} a \\ \end{matrix} \right] \quad (8) \quad \text{Stages of negotiation a.}$$

a  
 $\left[ \begin{matrix} a \\ m k \end{matrix} \right]$  is the highest expectation of an alliance member m from the alliance C

m k (10)

$$\left[ \begin{matrix} a \\ n c \end{matrix} \right] = \max \left[ \begin{matrix} a-1 \\ nk \end{matrix} \right] + \{U(c) - \Sigma \max \left[ \begin{matrix} a \\ mk \end{matrix} \right]\} / C$$

In other alternative alliances in one of the stages of negotiation (a-1) Compared to all coalition members .

The negotiated value has been obtained bargaining set of game theory by following mathematical methods<sup>[36]</sup>, as determined by the value in the light of the burden or by the relative weight of each negotiator imposed on other parties threat and the reaction of the other parties regarding the respect they give to this party counter threats.

Both of Aumann and Machler<sup>[36]</sup> has indicated that when negotiating, there is an attempt by each party in the alliance to obtain the maximum possible expectations, that is, to achieve the maximum expected from the match, and at the same time to preserve the safety and stability of the existing alliance . Therefore, in order to obtain the self-goal of each alliance, he must, as previously stated by the researcher, to reveal in front of the rest of the alliances all the alternatives and opportunities available to him, and therefore if he does not achieve what he aspires for from this alliance, it may be better for him to turn to the second best alternative which gives the alliance negotiating power and what creates a counter threat.

Perhaps the idea of consideration, influencing power, or subjective dread and the corresponding fear in the souls of others for this alliance is what led in the field of game theory mathematics<sup>[30]</sup> to reach at a stable solution .This solution includes all possible pictures of the likely parties to the alliance regarding their participation in the match proceeds . And it may come to mind here that it should not be possible in a straight solution to create side alliances within a single alliance, which creates a logic of strength and weakness that leads to the failure of the main alliance at the end . Therefore, the result of the participation of alliance members should not take the form of an arithmetic sum super additive, i.e. the group is equal to the sum of the match payout.

Ayres<sup>[30]</sup> has been shown that the fewest individuals or centers of resource or capacity are the centers most likely to participate in one alliance, given that as long as everyone is in a position that is not a relatively influential force, the outcome of negotiation among them will not lead to any of them conceding to the other more than expected, and it will not lead either to someone having an advantage over his own ability . For example, if there are three divisions A, B, and C, and each of them has available resources in units, respectively , 50 , 40 and 20 units . The alliance between any of the two centers will of course be of greater benefit compared to the achieved return in case each division works independently in isolation from the others . Therefore, the most vulnerable in these centers are B and C and they are the most likely to ally together, since after the alliance it will become  $B + C \dots < A$ <sup>[37]</sup>.

To evaluate the accuracy of previous theories in predicting potential alliances and in distributing the results of the alliance from returns among its parties , Murnghan<sup>[38]</sup> by conducting a quantitative study on a group of games, it became clear that the negotiation theory is the best theory available for use, and that the Shapley values function is considered one of the least efficient of these theories, and the reason for that is that it did not take into account the negotiating power of the different members of the alliance . The researcher notes that the previous study relied on the stability of the returns allocated to the members of the alliance(the savings in cost ) and that the energies or resources allocated to each center were clearly identified.

In the event that the resources or capabilities of each center are not defined, and in the event that the return resulting from the formation of a particular alliance is variable and

not fixed, this matter leads to the complexity of the problem of choosing the validity of the various alliance theories, and to clarify this, the researcher presents the following example:

If there are three cost centers A, B, and C, it has been found that the alliance between ( A and B ) will give a return of 70 units of return, while the alliance between( B and C) will give the same amount, and that in the case of the tripartite alliance between ( a, b, c) will produce a return rate of 100 units, this type of alliance and thus the games, can be used explicitly in the case of allocating the cost of a particular service center on a number of production centers beneficiary, and is a clear example of the case of changing the allocated variable change . For example, if the service center is an electricity generation center that has a maximum of 100 utility units, while it is known that electricity is neither stored nor produced in advance, and that it is produced based on the actual demand of the operating centers. If the alliance occurs and the benefit from A and B only, then the benefit will not be completed, and here it is assumed that their total needs will reach 70 units of benefit only, the same situation if the benefit occurred by B, C, but if the alliance expanded to include both A, B, and C, then the benefit here may reach the maximum of it's 100 units . Thus, there are other considerations that the researcher will review when determining the form of the satisfactory alliance of the project, taking into account the public interest of the project . This example clearly shows how to form of alliances in a situation where the return or benefit is variable and how important this is for projects in influencing the percentage of utilization of available resources and in affecting productivity and raising efficiency and the cost allocated to the centers of the beneficiary, which was affected not only by the amount of benefit or causation ,but also the form of the alliance that was formed, which provides a new basis for privatization, presented in the form of the existing alliance.

In general, the Shapley values function showed its inability to apply or its generality in the case of matches consisting of more than three alliances or in the case of matches with variable returns or the variable value of the expected return . In these cases, the theory of negotiation and theory of equal surplus equal-excess model, they have proven their worth . The theory of equal surplus was also more acceptable for the following reasons:

- (1) It enables a prediction of the possible forms of alliance and the return to be distributed among the parties to the alliance and the form of this distribution.
- (2) You do not need to specify in advance what resources should be allocated among alliances.
- (3) It can be used in the case of matches whose return is fixed as well as in the case of matches with variable return.
- (4) It takes into account that the alliance is a constantly changing delegating process in order to arrive at the most appropriate form of the alliance by forecasting an approximate value, asymptotic Which allows to deduce and choose the form of the alliance in the successive stages of the negotiation.
- (E) Approximate value asymptotic It can be deduced mathematically from a set of unequal linear relationships, a set of linear inequalities Which equates in its solution or finding its value with the negotiated value calculated using a method Aumann and Maschler<sup>(28)</sup> Previous exposure to it in the previous pages, or in general using the method Kun-Tuncher In the solution in cases of unevenness<sup>[39]</sup>.

Perhaps as a final point, the outcome of bargaining and negotiation among the parties to the alliance is a reflection and a function of the best expected return or benefit for members of the alliance from other alternative alliances ( this point should not be

neglected here because it represents a shortcoming aspect that will be addressed in a final place in this research as it relied only on A future view without regard to the impact of the past and the circumstances of the past employment on the actions of the parties of the alliance ) ,which is what the researcher will be exposed to when studying the scientific origins on which the traditional allocation models have relied in terms of the idea of individual or collective maturity in behavior, which stems mainly from the theory of expected personal benefit subjective expected utility theory ,Which he explained its assumptions and laid the foundations Von-Neumann and Morgensten <sup>[40]</sup>.

#### 4/2 Studying the impact of alliances based on cost allocation:

Taking into account the influence of previous coalition theories that govern the shape of the last alliance that will enter the match, especially in the case of multiple agents(departments ) participating ,has resulted in the recognition of the influence of a set of factors when carrying out the cost allocation process, which we summarize as follows:

- (1) Cooperative and competitive matches that take place between the different departments.
- (2) Distribution of resources and capabilities among the various operating departments.
- (3) Distribution of returns among alliance members(cost savings resulting from achieving optimal operation ).
- (4) Ease of communication, whether between senior management and implementation departments or between members of a single alliance.
- (5) The effect of negotiations for alliances or alliances with greater relative strength than others, which may lead to the effect on the completion of the alliance or the emergence of side alliances within the same alliance.

The importance of the previous points becomes clear from the Ayres claim<sup>[30]</sup> When he pointed out:

It has been evident that researchers - while trying to study the issue of cost allocation - have tried to work in a way that saturates the position of the cart before the horse, which is the opposite of the correct logic . The accounting approach has proceeded on the basis of developing a set of assumptions, and based on them, it creates a framework for allocation that is consistent with the previous assumptions . However, in general, little effort has been directed towards verifying the degree of acceptance of those affected by the assignment process of the previous assumptions.

By reviewing the accounting field and the standard mathematical or quantitative methods that have been applied normative in the cost allocation area, it is specified Thomas<sup>[14]</sup> The prerequisite for a mutually satisfactory allocation of cost is that it is an assignment that has general acceptance . However, he specified that it is difficult to achieve satisfactory allocation on the internal parties in the project, as well as on the parties outside the project, so he indicated critically that the allocation of the cost is considered an ad hoc process and far from objectivity, and perhaps what confirms his saying is that the internal parties to the project resort basically, before satisfaction with the appropriate allocation of costs, to the processes of negotiation and bargaining, which was not recognized in the traditional models, due to the difficulty of measuring on the one hand and weakening the aspect of objectivity on the other hand . The conditions and determinants of fairness and causation in the assignment are important, but until now no selection has been made to the extent of general acceptance of them, and the relative impact of each of them on the degree of acceptance of those affected by the assignment process for these determinants<sup>[41]</sup>, all of

this has not received the necessary research in the accounting field. This encourages the researcher to recommend independent research in it.

Before going into the narration of the criticisms of the current allocation of costs, the researcher gives a brief analysis statement of the most important accounting models currently used in the study of cost allocation, which are represented in the following models:

- 1- Moriarity Model<sup>[42]</sup>. The primary purpose of cost allocation according to this model is to allocate the cost savings. i.e the ratio of independent cost to each division, and accordingly the amount of the allocation should be allocated on the basis that it is allocated to the independent cost of these activities . Moriarity has been used this relationship in cost allocation:

$$C_i = Y_i - \left[ \frac{Y_i}{\sum Y_i} \right] [\sum Y_i - X] \quad (11)$$

whereas X It represents the cost of common products for different departments  $i = 1, 2, \dots, n$  As for ( $Y_i$ ) it represents the independent cost of these sections . Perhaps the main advantage of this model is the ease of its application, and that each goal will not carry more than the cost that it would have incurred for any other method, as the cost of the other alternative represents the independent cost for this purpose.

The main criticism of the previous model and also for what he mentioned, Nauazi <sup>[43]</sup>, among the amendments to his model, he neglected any side negotiations that take place between the different departments within the project, which would lead to the occurrence of side alliances between these departments, which would be reflected in the occurrence of adverse effects on the cost allocation process such as the impact of moral hazards or collusion between these agents . From all this, the previous cost allocation process will not achieve fairness and objectivity <sup>[34]</sup>.

In summary that the basis of the distribution of indirect costs in the form Moriarity is an independent cost between divisions, despite that he had been allowed in the modified form in the year 1982 to configure side alliances, but it did not allow lateral negotiations between the different centers, so it does not considered a template for negotiation <sup>[30]</sup>.

- 2- Gangolly Model <sup>[44]</sup>, where Gangolly inferred a relationship between the distribution of cost savings and the distribution of the (independent ) private cost of each cost center . Therefore, this model works to equal the ratio for each center in its share in the cost savings and between its private cost, and it is called proportional equity. But by referring to this model, we find that it did not present anything new about Moriaretti’s presentation, whether in the original or modified model, since both of them did not allow negotiation equality between the internal departments of the project .
- 3- Sapley Model <sup>[45]</sup>, as previously indicated by the researcher, the Shapley method allows cost savings to be distributed among the different departments in an equal manner, assuming that the operational capabilities of these departments are equal , but it did not allow the effect of side alliances between department. Even if relative weights are to be used to weight the distributed shares until the effect appears. Bargains and side effects of divisional alliances, and the relative differences between these departments, which are difficult to ignore.

Perhaps the modification that was received by Roth and Malouf [46] terms of how to benefit from the Shapley relationship as a means of allocating cost, while taking into account the effect of side negotiations between the agent or internal divisions in the project, in the event that the managers of these internal departments in the project are more daring in the face of risks, or in the event that they are indifferent about Cases of risks facing them, and in this case they will engage in further negotiations. The influence of these agents on the privatization process has not emerged. The proposition in which this case was presented explicitly took that managers have equal bargaining power, hence it was concluded that they deserve an equal share of cost savings, which is considered less realistic given that the department head's ability to negotiate is primarily a function of the opportunities and alternatives available to them. This also necessitates that these managers should not be equal in their share of cost savings due to the different opportunities available to them. All this led to the failure of the Shapley method to fulfill the requirements of internal bargaining among the departments, which led to its distributions to lack of objectivity and realism, which is what the researcher has previously shown when discussing negotiation theories between internal operating departments. Table No (1) provides a brief critical study of the three previous methods.

**Table (1).** A critical study of traditional cost allocation methods

Method	Selection	The basis of allocation
Moriarity	Neglecting the negotiations that take place between the internal departments affected by the privatization process, which leads to a distance from justice and objectivity in the allocation.	Allocating cost savings based on the independent cost of each department, which is taken as the basis for cost allocation among the beneficiary departments, and that the share of each center from the allocation does not exceed the amount of its independent cost.
Gangolly	The same criticisms depicted in the Moriaretti model, as bargaining between the beneficiary centers and the side effects of divisional alliances were not allowed.	Equal distribution of the surplus resulting from the allocation process, which is based on the centers' shares of the independent cost, thus achieving relative equality between similar departments.
Shapley	The effect of alliances was not demonstrated, which did not lead to the use of relative weights to outweigh the shares of cost savings.	Equal distribution of cost savings between different departments assuming equal operating capabilities of these departments.

Perhaps what has been explained above shows the importance of the theories of alliances among internal departments in the project in the point of cost allocation process. It is noticed that most of the accounting methods for cost allocation depend mainly on one or more bases in the allocation process, for example there are those who recognize the basis of ability to bear, others that take aside the cause and effect. But the question that comes to mind is whether these foundations can be used in isolation from studying the impact of internal alliances and the resulting bargains between the different departments that arise from it, beyond a reasonable doubt, on what is allocated to each internal center. The previous accounting principles, of course, aim to reach objectivity and fairness of allocation, but is it possible to achieve this without limiting the impact of clusters or alliances among the various operating departments? It may be expected that taking into account the theories of alliances, which implicitly govern the work of the different agents within the project, will reveal to the senior management, the most appropriate possible alliance, and indicate other alternatives available to these internal departments, which will help in obtaining relative weights. It helps in the process of internal cost allocation and its impact in modifying the use of the Shaply's values function, in terms of limiting the effect of internal bargaining and adding its effect, in addition to the traditional foundations of causation, impact or bearing capacity. By amending this, the accounting principle that governs the special process becomes "the ability to bear in light of the alternative conditions available for operation, which will result in taking into account the opportunity cost in front of each division, which must be taken as an effective and influential element in the allocation process, and at the same time as an influential factor in the power. The proportion of each alliance (division), which is undoubtedly considered a better investigation of the principle of fairness of allocation at the same time, with this logic, any adverse or moral hazards, can be detected, among the coalition parties, which is what the agency theory tries to address, and is considered one of the adverse effects on the objective allocation of cost, which the researcher will of course pay attention to during the remainder of this research.

Determining or predicting the most appropriate form of the alliance in a more precise sense using a method of one of the previous alliance theories presented, will reveal the best alliance believed to exist in favor of the project, and the best way to allocate the cost savings. Of course, the use of the Shapley relationship, which aims to optimize the allocation of costs in order to reach a group of score mutually satisfaction, is important, but how can this be achieved without taking into account the impact of bargaining and negotiations between the various internal departments. Which in turn affect the level of resource exploitation and thus the cost allocation, which must be done in parallel with the application of the Shapley values function. Hence, a series of weights must be deduced, Which in turn, approximates real life and results in an approximate distribution of values. Asymptotic values through which it is possible to achieve a better degree of satisfaction than not resorting to this method, which was not mentioned by those who used the Shapley method in the past. In the meantime, this in turn requires the researcher to further delve into the analysis in terms of how to formulate the applied method for it, which is what the field needs.

The accounting use of game theory in the assignment process has essentially been devoid of recognition of the effect of interactions among internal agents. The researcher discussed previously the theoretical aspect of this effect, perhaps in normal circumstances in which the goal of those in charge of the work is the goal of maximizing the benefit of the project in general and which results in maximizing the benefit of these agents. But is this always the case?. Of course there are many cases that come under the name of moral hazards, and the adverse selection and, as we have already discussed some of them in the case of the sole

agent, they also can prevail in the case of multiple agents, and perhaps the previous problems can be formulated under the so-called collusion between agents.

In order to complete the critical study of the Shapley method to reveal its deficiencies and to try to benefit from it in the cost allocation process, after making the necessary development on it to arrive at a proposed quantitative model, the researcher will first present the traditional mathematical model for this method, then it will follow by explaining its deficiencies and finally how to benefit from it after development to arrive at the proposed model.

Traditional Shapley model:

Here, the game supposedly doing to be a cooperative game located within the proposed solution using Shapley and assuming there are three sections A1 ... A3 which is characterized by the lack of comparative advantage to any of them. No opportunity alternative available to the department, Consequently, it is more appropriate for the different centers to form a collective alliance, or perhaps even less collective alliances . Alliances may take the following binary or triple form:

$$(A1, A2)$$

or

$$(A1, A2, A3)$$

The general relationship of the collective alliance, as stated in Shapley's first formula, resulted on the following assumptions:

- (A) Assuming that the number of departments that can benefit from a particular service or a specific joint cost is denoted by the symbol ( m ) where m = 1,2,3.....,m .
- (B) Assuming that some departments have allied themselves to form an alliance( P ) and that the expected return of these departments together in the event of their alliance can be expressed in the form of a function F( P ). Perhaps it is better to consider that the departments in their expectation of a certain return, it can be assumed this expected return of the expected benefit from the common cost can be expressed in the form of return to scale, this additional necessary concern is for easy solution as the alliance between divisions must be created by the side concessions between the allies basically to reach a compromise, and that these concessions represent what can be likened to a value driven system seen, reaching an agreement acceptable in order to achieve full and mutual consent between all allies mutually satisfactory .Here, the value of the game from the point of view of Shaplys for a coalition to be sections in the following image:

$$v(P) = \frac{(P-1)! (M-P)!}{(P-1)! (M-P)!} \cdot \frac{M!}{M!} \quad (12)$$

Since the value of the operating Shaplys of the net return of the section( m<sub>1</sub> ) as a result of entering the alliance ( P).

( P<sub>i</sub> ) is the number of divisions that entered into the alliance ( P ) ( M ) Total number of centers or agents.

Here , the burden to be loaded ( v )<sub>1</sub> on the center(m ), the difference between the total return section ( h )<sub>1</sub> , less the value of Shaply's specified value ( c )<sub>1</sub>

The researcher notes that the most important assumption on which the Shapley value function is based in its previous form depends mainly on the fact that all sections can

accumulate the expected marginal contribution to reach the value of the game, in the event that all the expected alliances between the departments are equal probabilities. In the sense no difference between the coalition  $(a_1, a_2)$  alliance  $(a_1, a_3)$  or  $(a_2, a_3)$  in a family of three sections of the game, and that all sections have an equal share in the game return, which is incompatible with a large part of the fact that different alternatives exist for different departments.

Here, the probabilities of side alliances are equal and expressed in the form of a decimal fraction, and as long as the probabilities of joining the alliance by each division are equal, and that there is no comparative advantage for any alliance over the rest of the alliances, the value of Shapley can simply be expressed as an average, mathematically, the total return for the match as a whole. Of course, all of this is due to the fact that alliances or any new member joining the coalition are random. Here there is  $(P-1)(4-P)$  an arrangement to the internal side of alliances between divisions, as the section  $P_1$  will come after all other sections Allied  $(P)$  and before any other section has yet to join this alliance. Here, the marginal contribution of section  $(P)$  can be a statement to the relationship:

$$F(P) - F(P - [m])$$

The marginal contribution of allied  $(m)$ , will represent the sum of the marginal contribution of each inside alliance, resulted from the basic alliance multiplied by the relative rate of each individual allied in the whole coalition in the game.

We can criticize the previous assumptions for several reasons, which can be summarized as follows:

- (A) It is not logical to assume that the probabilities of joining any of the coalition parties are equal, because there are many reasons that may lead to the opposite of the above, including the self-interest of the one in charge of managing the department, cases of internal competition among the different departments, and the operational capacity of each Section.
- (B) The axioms developed by Shapley as a tool for cost allocation have already been criticized in several references<sup>[47]</sup>.
- (C) The previous relationship and the interpretation that follows it does not necessarily lead to achieving the objectives of satisfactory cost allocation in terms of fairness<sup>[46]</sup>.
- (D) It neglected the side effects resulting from the managers of these departments and their earnest pursuit of maximizing their self-benefit or self-utility. Besides the benefit of the department and the project as a whole, which leads to an additional constraint that must be recognized within the constraints of solving the problem
- (E) There is an implicit assumption in the previous case, which is related to the availability of internal balance conditions among the different departments of the project, which means equal opportunities and alternatives available to the different departments, and it means that there are no sections of relative weight, and therefore the status of acceptance of the current situation is from alliances. This assumption is difficult to accept in light of the prevalence of internal competition conditions that cannot be ignored among the various departments. To modify this assumption, we should take into account the circumstances of the permanent relations between the sections list, and the consequent need to recognize the weight of each section on bargaining rules and the individual incentive from the alliance as a whole, which can not be ignored if the form of suggested model is to be applicable in practice.

- (F) Perhaps taking into account these side bargains will lead to a state of neutrality and fair allocation, which is identical to the accounting purposes referred to in the cost allocation.
- (G) There are many factors that encourage the emergence and control of the idea of bargaining before the formation of the existing alliances and the determination of the outcome of the game, and among these factors the desire to develop, which is difficult to consider a constant element, and the consequent change in the size of the revenue allocated to the parties to the game, for example the electricity service that can be changed, which changes in total according to the change in the volume of demand for it from the benefiting departments, here the volume of the demand is a function of the current operating conditions of the department, as well as the expectations of changing the general demand for the products of the intermediate section, which often transforms to form a non-linear function. If changes are taken into account and the unforeseen effects of the demand on intermediate products for this department, which is to be joined to a larger alliance of the beneficiary sections, in addition to the actions that do not fall within the framework of the general interest of the project, especially those that represent a temporary benefit to the department and not the project, which is related to collusion between departments.
- (H) The assumption of separating the marginal contribution of each section and adding it to the different sections to obtain the total return of the match is considered an assumption of mathematical and practical ease only, and of course, the brother will continue with this assumption in the rest of the analysis during this study due to the difficulty of switching from it, but for the scientific honesty, this assumption, is considered a lot of exaggeration and difficult to be accepted, given that there are many returns difficult to be measured in one unit of measurement, if not impossible to be measured at all, and some of them are achieved without the possibility of being noticed at the end of the operation and not directly after the alliance, which may transfer its impact to another alliance or To another stage of operation.
- (I) According to all the foregoing, the assumption of impartiality in the satisfactory allocation of the cost may be important, but it should only be by the person in charge of the allocation process, and not of course by the agents in charge of the different departments due to the subjective considerations of these agents, which were explained previously. Therefore, realistic prospective behavior by these agents may be characterized by caution and averse or, to take risk-seeker. These are all considerations that must be taken into account when measuring the expected marginal contribution from each department on the one hand, and as an influence in the bargaining process among the different departments.

According to the foregoing, it becomes clear to the researcher, the extent of the influence of the agent in charge of managing each department in forming and participating in the various alliances, and the implications of that previously explained on the cost allocation process. But the question that comes to mind is, do all managers (agents) have the same quality of expected behavior?

To answer this question, it depends on the many behaviors that he had previously shown Magee[5]. In some detail, as well as the degree and willingness of the manager or agent to make uncertain decisions. In other words, what is the behavioral readiness of the manager to face the risks of taking certain decisions? Perhaps this depends on the degree and area of authority delegated to the director, which we assumed through our analysis, as there is a large amount of powers delegated to him and practical necessities required the

need to follow the decentralization of the decision, and the other issue is the extent of his willingness to face risks. Here, the researcher can arrive at three possible cases for the behavior of the agents towards facing risks, as the manager may be neutral or indifferent as a result of the decision he makes. The agent may be cautious or avoid facing risks, and finally he may be risky or gambler. Perhaps the effect of this on choosing the form of the alliance, and the degree of compromise that will take place, will vary according to the different personal nature of each manager, and the effects that this will have on the final allocation of cost, which calls for the need to study each case independently from others.

The researcher notes that the state of caution may not be suitable here because it violates the concept of accountability, just as the case of unlimited adventure. Here, also does not represent the attribute of the agent, as it represents the role of the principal, so as the accounting convention settled on it. We will focus on the state of neutrality. Or what we called indifference risk-neutral in the light of which the analysis of this research will be completed.

Here, the agent will not be interested in any game and any additional alliance, or enter into more negotiations after it appears to him that what he expects from further negotiation, is equivalent to what is available to him without entering into this negotiation. For example, if it is in front of a manager's either participating in the coalition (P - 1) or participating in the coalition (P - 2) and that it may take (v) the possibility of participation in the alliance and thus match revenue takes the value as, t he probability (1 - t) to participate in a game whose return takes the value (L) according to the state of indifference in the face of risk. The agent will not care that he is not sure of the return of any of the two games he will enter and achieve the previous return.

So the expected agent utility function according to the expected personal benefit theory takes the following form:

$$F(a_n) = v k + L (1-v)$$

Or in other words, the different alliances of the agent are in the following form:

$$V(a, q - 1), (1 t) (a, F1), (1, v)(a, F2)$$

Here, there is one of two alternate options before the agent:

- (A) Wait until the end of uncertainty, and is available in front of the agent greater knowledge here can participate in the coalition (P - ), probability (t), and the subsequent entry of the match in 1 or enter the match in 2 discretion in front of the benefit.
- (B) on the other side of indifference to the situation of uncertainty and enter any alliance that will result in a benefit or expected return in the form of:  $v K + (1 - t)L$ .

In addition to the above, during the case study of the indifferent manager, he becomes in a situation in which he does not care, or there are no differences in front of him between whether he bargains with a group of other agents to join him in side alliances, and therefore this alliance return will become uncertain, or he is convinced of a certain amount of return if he does not enter into bargaining with them here. It is necessary to assume that there is no additional cost as a result of the previous bargaining process, otherwise its presence is an additional factor affecting the decision-making and may also affect the degree of indifference or neutrality. This agent, and perhaps this assumption is important because it does not contain any express only afford the cost but also bear will not contain any difference between any concessions by any of the agents.

Accordingly, the case of the researcher's assumption that all agents are in an equal position in their bargaining power, which is what we have previously studied, as it is a condition for the success and formation of a sound alliance that no one of the agents has inherent power surpasses other agents, and perhaps this matter also brings us closer to negotiation theories. Traditionally, accepted in previous social psychology presented in the previous parts, especially equal-excess model, the importance of the previous assumption is evident in that the value of the assignment game that will be produced in this case will be the same as the value of the previous Shably function, indicating its importance in cost allocation.

Confirming the foregoing, the manager who will or will not participate in the game must be expected to obtain an average benefit and, since this game will not give him any additional return as a result of his negotiation, it is therefore a cooperative game from similar parties, none of whom has any influence over the others. Here, to summarize, the value that is expected to be borne by the cost of participating in this negotiation with the aforementioned specifications is exactly equivalent to the value of Shapley that will be borne by it in a case that meets the conditions of indifference and the above-mentioned specifications.

Therefore, the expected benefit from entering the game in the previous way can be shown in the following relationship

$$D(a_n) = \sum_{p \in S} p [f(p) - f(p - a_1)] \quad (13)$$

$$D(P) = \sum_{h \ni p} (-1)^{h-p} \left[ \begin{matrix} m-p \\ h-p \end{matrix} \right]^{-1/4}$$

Perhaps the foregoing gives the same value derived from the Shapley function, which means that in the event of indifference and equal opportunities available to the different agents, the Shapley value remains valid and representative of the outcome of the negotiation between the different agents and that, accordingly, the Shapley value function is an appropriate tool for making the allocation and highlighting the effect of negotiations among the agents.

But assuming the previous available opportunities are equal, it is considered rare, that addition to the fact that the adventurous state can be characterized by the agent here stems mainly from the need to submit negotiation initiatives, the main reason for which is the existence of relative differences between departments at least in the level of energy available to each of them. Therefore, the model to be followed should not be limited to the fact that the negotiating match has close parties, but rather it must be shifted from that towards the case of disagreeing of the parties. With reference to the field of accounting, and the field of operations research in particular, we find that there is a general scientific urgency towards the necessity of developing models suitable for solving the previous problem, and this is what the researcher will try in the next part of the proposed model.

**7/3 Suggested Model:**

In this part, we will try to present some proposals and special treatments to confront the criticisms previously directed to the values of Shably (the Shapley game), which are basically not suitable in treating or confronting the negotiation problem that is supposed to exist in the case of multiple departments with different operational capacity used for the

services provided by the services departments , and which must be allocated in a satisfactory manner to the beneficiary departments.

To build the proposed model, the researcher presents the following considerations and determinants needed to form the model.

- (A) Every department or agent(i) has a certain capacity for operation, and he can follow several levels of operation or alternative exploitation of this capacity that can be called a mixture of exploitation bundle of usage, which can give the department a level of return or utility that can be represented by the function (V).
- (B) There are a number of departments that can form together a collation (M) and that this number represents part of the various centers updated for cost (N) in the firm, with the need to predetermine the operational capacity of each of the previous centers, with an abundance and exchange of information between the departments regarding the amount of capacity available to each of them, which in turn reflects the potential need for each of the previous centers of the services available through the service departments ( which are considered relatively limited ).
- (C) When negotiation takes place between two centers J & I, here, this negotiation does not result in a specific alliance, as a result of which a distribution of the level of benefit from the services of the available service centers, and the consequent occurrence of side concessions between the two previous sections, but it is possible to reach from that to an alliance that can take the following form: {i, J} To confirm that the negotiation has a positive ending.
- (D) In each financial period "T" a number of sections meet (n) In random ( so as to achieve a global model ), here is the confluence of random occurrence is assumed in the interests between the two centers J, i. The probability is determined by the following relationship:

$$2 \frac{1}{n_t(n_t - 1)}$$

It results from this encounter, which is equally likely to occur equality likely (50/50 for each of them ) return  $r_t$ , whereas  $r_t \in IR$ . This means that each agent gets a return from this meeting  $r_t$  Which represents part of the total revenue allocated to the departments . Of course, what happened in this period  $t_n$ , it may recur in the next period  $t_1$ , with the need to emphasize the principle of the independence of the possibility of their alliance during the period  $t_i$ . For the occurrence or non-occurrence of a meeting and alliance between them in the previous period  $t_n$ , first, with the passage of time, alliance may occur in successive periods as long as both centers are still in operation.

Here, by formulating the state of potential alliances between agents with the succession of periods and with the necessity of an assumption of small periods of negotiation between the potential parties to form alliances, each division achieves from behind this in exploiting its available capacity, a certain type of return (presumably similar to the allied centers) ,which can take The following relationship:

$$(1 - \delta) v(M)$$

In view of the succession of periods it has been used discount rate  $\delta$  , to find the current value in the period t, for future periods . In general terms, the net return achieved for the division can be expressed

$$S(N) = \sum_{M \subset N} \frac{(|M|-1)!(|N|-|M|!V(M)-V(M/i))}{|N|!} \tag{14}$$

here(i). For example, after achieving some concessions to the other sections as a result of the alliance process, which can be represented by a certain cost charged to the department  $r$ , and during the successive periods of the previous relationship:

where as  $M_t^i$ , is the capacity available to the department in the period  $t$ , and surely  $M$ , is a portion of the total capacity of all centers of the project  $N$ , which can be expressed as follows:

$$M_t^i \subset N$$

The researcher notes that the additional feature of this model is the introduction of the time component in the calculation, which necessitated the use of the discount rate.

In addition to the foregoing, the different centers that are presented in the game act according to the logic of collective awareness in the core, and it has all the necessary information to discover the different strategies of others. So the assumption is that, the abundance of information is the same for everyone information sovereignty, it must be applied here, which is also considered necessary for the application of the Shapley's method to come into effect.

$$S(M,q) = \sum_{A \subset q} \frac{(u(A)-1)!(U(N)-U(A)[V^-(A)-V^-(A/m)]}{U(N)!} \tag{15}$$

Perhaps it should be noted that the shorter the time interval between each meeting and the next, which leads to that the burden borne by each coalition that enters the coalition after negotiations, is equal to Shably's values, and that in relation to the expected return of the

$$V^-(X) = V(U_\alpha \in X^\alpha) \tag{16}$$

$$X \in q$$

$$M \in q$$

agent in the event of continuation and who has operational capacity  $M$ . In the case  $q$  It can be obtained with the previous Shapley relationship: whereas  $u(A)$ , a statement about the number of elements and relationships that fall on "q" And also:

$$(17)$$

From the above, the researcher can arrive at the modified Shapley values after taking into account the impact of the potential negotiations as follows:

Here ,the  $|N|$  ,  $|M|$  It is the measured quantitative values, expressed digitally or measured for groups N, M respectively.

To clarify the foregoing, the researcher assumes the following example, which contains three production centers 1,2 and 3, assuming that:

$$G = (V, N) \quad N = 1,2,3,\dots$$

It is a descriptive game function, which can be called a joint solidarity game( partnership game), and that:

$$P(\delta), \delta \in (0,1)$$

In the period  $t$  , a random convergence of sections 1 and 2 with a probability of  $1/3$  encounter .Here, in the case of assuming a meeting of 1 and 2, it follows that their agreement or disagreement is expected with a probability of 50:50 .If, for example, the meeting takes place and the assignment from 1 to 2 represents the value  $\alpha$  then,  $\alpha \in (0,1)$  .If he accepts 2 concessions 1, then this means that both of them have agreed to form an alliance between them according to which they will follow a certain level of performance or activity. Which in turn will result in the consumption of a certain level of service provided by the service centers, and the allocation is made based on this consumer level agreed upon in advance by both.

So Division (1) will get a value benefit  $(1-\alpha)$  He will get a benefit worth  $(\alpha)$ , and thus are two values that can be used depending on the concept of Moriarity , as a measure of the amount of benefit or as an expressing basis for the ability to bear, in order to allocate the cost after the end of the previous meeting, and with the agreement of the parties (1, 2) and by assuming their meeting with center(3) with a 33 % probability of agreement among themselves, and assuming that the assignment or the value that center (3) will bear the result of his agreement with (1, 2), is expressed in  $B \in (0,1)$  .Here if there is the recent agreement between the previous three sections, and before each of the (1, 2) his(3) of the concession, the value of the negotiating benefit of bargaining utility value Assigned among them as follows:

$$\alpha(1-\alpha)BV(N)+(1-\delta)(1-\alpha)V(\{1,2\})\&BV(N)+(1-\delta)V(\{1,2\}) \quad (18)$$

and

$$(1-B)V(N).$$

To compose the summed utility function for all sections of the alliance, we assume that  $E(\delta)$  represents the collective benefit function of

the alliance [1,2,3] Here it is:

Assuming that

$$\text{Lim } U^i(\delta) = \frac{1}{3} V(N) + \frac{1}{9} \sum_{J \in N} (V(N/\{J\}) - 2V(J)) + \frac{4}{9} V(i) - \frac{2}{9} V(N/\{i\}) - \frac{2}{9} V(N/\{i\}) \quad (19)$$

From the above, the researcher reaches: To complete this descriptive function, this integral must be used

$$\int_{\delta \in E} E^-(\delta)$$

$$V^- : 2^N \quad IR+$$



Where:

$$V(M) = \frac{V(N) - V(N)/M}{M \in N} \tag{20}$$

$$H(M) = \frac{|M|}{|N|} V^-(M) + \frac{|N| - |M|}{|N|}$$

He has risen Charnes et al <sup>[49]</sup> introducing a

standard value of proportionality in the previous value relationship  $2^N IR$ , We can call it the proportional function homomolifier as follows:

whereas  $|M|$  represents the portion measured or expressed in quantitative form, and I have indicated Gul[48] to me  $\lim U^1 \delta(\delta - 1)$  The mixed value statement between the Shapley values function and the proportional values previously arrived at by Charnes et al [49], As the limits of the utilities limits of the equilibrium for cross-game joint case  $N = (1,2,3)$ , that is, three divisions, pertaining to the value specified by the Shapley scale interfering with the proportional function homomolifier in cooperative matches. The proportional value serves to introduce and explain the effect of containing or introducing the size of the alliance or the effect of the relative differences between the different departments on the allocation process, when formulating the descriptive characteristic function used in allocation (the same has been demonstrated mathematically in the case of competitive and non-cooperative matches).

To confirm the effectiveness of the proposed model, the researcher, in the research appendix, prepared a computer program and applied it to a hypothetical case, from which the results shown in table 2 were reached at:

**Table (2)** allocation of general industrial costs

On production centers according to the proposed model

Divisional concessions as a result of the alliance (6)	Customization by production center ((5)	Energy Available to Alliance (4)	Potential alliances (3)	Level of demand for service center services( 2)	Center Production (1)
115	325	950	([Mi, M2, M3])	440	M1
95	275	850	([Mi, M2, M3])	370	M2
85	250	800	([Mi, M2, M3])	335	M3
50	150	550	([Mi, M2, M3])	200	M4

The researcher notes on the previous allocation plan that it has resulted in the amount to be allocated in full, thus achieving the goal of full utilization of the available capacity for the service center, while fulfilling one of the necessary conditions for the objective allocation of costs, as well as achieving the developmental goal of the privatization process. Perhaps the foregoing is in addition to what some have indicated that allocating to the previous plan will lead to achieving internal balance and that it falls within the scope of collective maturity for alliances rationality. Given that each center is not charged with more than the independent cost that it would have incurred had it not entered the consortium, it confirms the effectiveness and efficiency of the proposed model in making the objective allocation of costs.

In addition to the foregoing, the point of rationality in conduct that results from alliances ( $M^i$ ), it will result in rationalizing the utilization of the available capacity of the service center, as well as the value of ( $v$ ). It does not depend only on the nature of the game between the parties of the alliance<sup>[48]</sup>, but also on the negotiating ability of the parties to the game, which is a function of the operational capacity of those centers. Therefore, the effectiveness of the model can match parties, which is a function of the operational capacity of those centers. So it will enhance the effectiveness and efficiency of the proposed model in achieving the rational allocation of costs. This argument can be summarized in the following:

- The model has contributed to highlighting the unseen non-pecuniary, the special process, which are mainly represented in the actions of agents to achieve the maximum self-benefit for their departments, by entering into side alliances, which gives these alliances a relative influence on the specialized process.
- Contributing to achieving the general objective of the project, and this is evident from the disclosure of possible alliances and the statement of the optimal alliance that achieves the best use of the available resources, thus contributing to the achievement of the developmental dimension of the specialized process, which the researcher referred to at the start of this research.
- Achieving justice in the allocation, which is a necessary condition to reach objectivity and full satisfaction mutually satisfactory About privatization, which is the requirement that he previously mentioned Thomas, As the primary objective of the objective allocation of costs. This is evidenced by a comparison of the savings allocated to the parties to the alliance, which can be inferred by dividing the data in column 6 by the data in column 2. Here it should be noted that the abundance was not distributed evenly between the allied sections, as is the case in the Shapley values function, but the distribution of the saving here is considered more fair, as it came in a form proportional to the energy of each division, which directly indicates its negotiating ability, which brings the model closer To achieve the main goal of the research and also to make it more objective and close to practical reality.
- The allocation of cost according to the proposed model took into account a basic condition in the objectivity of the allocation, which is the ability to bear and benefit. The demand for the services of the service center was not used as a means to make the allocation, but rather was used as an indirect indicator expressing the operational capacity of the production centers, which in itself is considered a tool for negotiation between the various productive departments, and evidence of the ability of these centers to benefit and endure.

From all this, it is arrived at the conclusion that the previous model has greatly contributed to achieving the basic dimensions and requirements of the specialized process, which indicates to its effectiveness and applicability.

However, despite the previous effectiveness aspects of the proposed model, there are still some points that represent obstacles to practical application, especially those related to the abundance of data necessary for the application and the flow of information and its credibility between the different agents and the top management, as well as the mathematical difficulties resulting from the application in the case of facing real practical problems. It contains many production and service centers, which made the researcher limit the application of the model to a hypothetical case, and for one period of time, hoping in the near future that he will be able to fully implement the model on some firms and during a longer period of time.

What increases optimism towards achieving the previous goal is the emergence of large technology in electronic information systems and also the presence of fast electronic computers, with low operating costs, which enable overcoming previous obstacles. In addition to the foregoing, the technological renaissance and the accompanying emergence of decision support systems and especially, the systems of experience, which led to the ease and ease of making custom decisions based on the effective use of more complex and complex quantitative methods, to represent evidence of the sincerity of the our approach.

From, all the foregoing, it becomes clear to us that it becomes possible to develop the theory of game with regard to the application of fairness for the values of Shably, taking into account the impact of alliances and side negotiations, and by that in this model, we have been able to benefit from the values of Shably specialization without neglecting the impact of negotiations, and also helps to create a game between the value derived from the application of the mathematical model and the theoretical requirements for satisfactory cost allocation. This finding will help to achieve the main goal of this research, which in the end will lead to reaching at an allocation of the cost of public services more acceptable between centers. This will lead to making cost appropriation decisions more realistic in terms of taking into account the internal operational conditions and the interlocking interests of the agents, and the resulting side cooperatives and occupies the thinking of everyone who occurs in the impact of the agency theory, especially related to internal performance evaluation and cost allocation. It also helps to create a game between the value derived from the application of the mathematical model and the theoretical requirements for the fair allocation of cost, which is the main goal of this research and which also helps to achieve the ultimate goal of the project.

As a final point, it is the apparent difficulty of the contents of the mathematical model, but this model has proven its validity in other similar aspects that are similar, for example its used in the distribution of costs of public benefits among members of society, and also the suggestion of using it in the tax field to determine the tax capacity of individuals taking into account considerations of income and wealth. The researcher here has adapted and developed its use to suit the subject in question, which gave it a new dimension. It was not used previously in the field of accounting, and it also helped to provide logical solutions to many problems that were previously raised in many places, whether in this research or in other similar research related to negotiation and distribution of the outcome of the game, and taking into account the forms of alliance between the different centers with different operational capacities.

#### 4/4 Developed features of the proposed model:

According to the previously formulated model of cost allocation, which in fact represents a reformulation and modification of Shapley's allocation method, after taking into account the effect of internal negotiations among the different agents, taking into account the influencing power of each agent, the researcher can refer to the following characteristics and results that represent the scientific addition to the proposed model which can be summarized as follows:

- 1- This model helped out of the silence that characterizes the Shapley method, and turned into a dynamic model, which changes according to the change in the negotiating power of each new section that enters the alliance, and it also allows for multiple periods of application and not shortcomings on one period .
- 2- This model helps to achieve the objectives and the necessary conditions for allocation, in terms of fair loading, bearing capacity, causation ... etc., and this is due to the departure of the model from the case of assuming the equal relative power of each cost center, to the case of the difference of this capacity, taking into account the difference employment opportunities and alternatives available to each department, and the resulting difference in the bargaining power of that department.
- 3- The proposed model during the research helped to take into account all parties to privatization. Instead of the previous models that considered the privatization process as a central process, it was recognized that the privatization process here should take into account the overlapping of common interests of the actual implementers ( agents ) and the consequence of that. An investigation of loading fairness, and a means to motivate agents to improve aspects of climate utilization of resources, in addition to recognizing the shape and size of the alliance as an influential element in the cost allocation process.
- 4- According to the proposed model, which helps prediction of precedent ex-ante with potential alliances, and members of the prospective alliance, which in turn will help assume a prior allocation of resources, which would work to achieve the temporal, planning and control dimension, as well as the structural dimension of the allocation .
- 5- The developmental dimension of the privatization process is available in this model, given that the allocation takes place before the start of operation, which in turn helps to predict aspects of misuse of resources, and any undesirable violations between some departments, which in turn helps to raise the productivity of utilizing available resources.
- 6- The value ( $\delta$ ) which has already been identified in the proposed model, as a measure of crossing for the amount of actual benefit, will help determine what should be allocated in a tribal on each section of the cost of a fair and effective, so that the allocation as much benefit and also depending on the ability of endurance.
- 7- The use of the proportional function in the Shapley's amendment enabled the access to relative weights that helped shift from the hypothesis of equal return in the game to the hypothesis of difference in shares according to the difference in capacity and operational energy.

#### 5- Conclusion and recommendations:

During this research, we attempted to present a set of recommendations and proposals related to the cost allocation process, by formulating a proposed quantitative model for conducting the allocation process . In the formulation of the model, it was taken into account to include the behavioral aspects of the internal agents in the project who represent the

different cost centers, while negotiating the determination of the degree of their exploitation of the common services available to them, and this research went in parts of it towards the development of some studies that were done in this Field of cost allocation and the theory of costing.

It is noticed that the most important difficulties faced by the decision maker when undertaking the cost allocation process, especially, when the cost centers are multiple, is the problem of internal conflict of interests of the agents<sup>[56]</sup>, and the consequent problem of uncertainty resulting from concealing some information by agents to achieve some self-benefit for them or in order to carry out actions in their favor and against the benefit of the project as a whole.

The study of the allocation of general industrial costs in light of the agency theory is considered one of the matters necessary for project management, so that the extent of the conflict between the self-interest of the different departments and the interest of the project as a whole becomes clear. Perhaps it previously important as it helps them in a statement the degree of exploitation of own resources for those departments and the requirements of the services provided by the service departments " who will be reflected , of course , those decisions centers, which may conflict often with some of the decisions of the higher levels of the project ." Also, considering the aspect of privatization and the resulting study of the degree of utilization of available resources to represent one of the tools that contribute to the effective evaluation of the performance of the agent and a means to help in formulating the incentive function granted to him. It is also considered an important means in extracting the large amount of information needed by senior management at the level of the performance of these centers.

The opinions in favor of adopting a system for allocating costs in light of agency theory - as a complementary system to the basic cost system in the project - are based on the fact that the allocation process is a tool for evaluating the performance of the agent, in line with the principle of liability accountability and also the relative autonomy granted to some departments, which aims to minimize the conflict between the interests of the subjectivity of the agents and the public interest of the project . Some have indicated that there are real and clear influences on the cost allocation process stemming from the influence of agents on the degree of use and exploitation of services available from service centers, and also in influencing the degree of expected exploitation of those services in the long term, and that allocation decisions can be used as an incentive tool for agents. They are in the process of directing the centers' internal performance to be in the best interest of the project . Accordingly, the relationship between cost allocation and agency theory is characterized as an indirect relationship that stems mainly when creating the agent's incentive function, where the degree of utilization of available resources is one of the variables for determining the incentive for the agent, and in addition to using it as a motivational tool for agents to develop their performance in favor of the project. It is also considered a means to extract more information that supports top management decisions regarding cost allocation and internal performance evaluation.

It is noticed during the evaluation of the traditional allocation models used in the accounting field that they were characterized by a set of features that led to the emergence of this research problem, and the researcher can summarize it as follows:

- (1) It contained many unrealistic assumptions, which made it inappropriate for practical reality.

- (2) As a result, the allocation process provides results that are far from the objectives of fairness, causation and affordability, which are the desired goals in satisfactory cost allocation.
- (3) With regard to the Shapley function in particular, which found a great deal of acceptance among those interested in the field of cost allocation, it was based on the assumption that the revenue allocated to the parties to the game would be equal, which did not take into account the difference between the previous parties in the operational capacity of each of them. The ability of each of them to negotiate is what prompted the researcher to try to formulate his proposed model to avoid previous problems .

Perhaps the study and the development of the proposed model in the manner that was carried out during the research has worked to take into account the dimensions and requirements necessary for the objective and fair allocation of the cost, first by trying to make the allocation as much as the expected exploitation of each department, which is determined in its quantity and amount based on the negotiations, and secondly that it took into account that the agents are not always working to take into account the interest of work only, but they are during their work, trying to achieve their own goals related to motivation and stay ... etc . Therefore, the model assumed the state of the agent who has some degree of participation in the project risks, in contrast to what the accounting approach followed, in that ,the agent is a cautious person trying to avoid project risks . Perhaps this consideration will help in the more accurate application of the concept of liability accounting, as well as the scientific principles and practical considerations for evaluating the internal performance of the various project departments.

As for the formulation of the proposal , a gradual progression has been made from the direct case, which is the assumption of a model that contains a single cost center on the expressions that the cost allocation process may be affected indirectly during the determination of the incentive granted to the agent, to the more general and comprehensive case of multiple cost centers, and so on. The situation has side effects related to the ongoing negotiations between the various operating departments, with the aim of reaching the best utilization of the available public service capacity . Perhaps the formulation on which the proposed model was prepared , had been introduced by the mobility victory after the previous accounting models were characterized by the side of silence, and all this would help the administration in advance in predicting the aspects of the expected alliances, as well as the most appropriate plan to exploit the services of public service centers, which in turn would help to achieve the developmental dimension of cost allocation, and it also takes into account a new influencing factor on the cost allocation process, which is the form of alliance supposed to be established between the various project departments, and taking into account the alternative employment opportunities available to each of them, which are considered helpful elements of negotiation capacity.

But due to the novelty of the proposed model and its need for more effort and research to try to apply it, especially in the case of availability of data on real practical cases, so the validity of this model has been chosen from the theoretical side and in light of a limited hypothetical case that has proven its effectiveness, and the field remains open for many researchers to conduct more development and application to it, which we hope to see in future research in the near future, whether by the researcher or other workers in this field . In addition to the foregoing that the model reached, the researcher can work on its application to scope to other cost allocation , such as contributing to the decisions and determine conversion rates on the local and international level, which is a form of cost allocation.

Despite the need for more theoretical and applied research in the point in question, this research - from our point of view - has provided a good model for conducting the rational allocation of cost in light of the existence of negotiations between cost centers within the project, taking into account the different requirements for the allocation, which are causality, ability to bear, need and fairness, and he also added a new influence to it, which is the form of the existing alliance within the project.

Appendix (1)

The following is the computer program that was prepared to implement the proposed model:

```

10      INPUT N, MM
20      DIM M (N), V (N), VNI (N)
30      OPEN "I," I, FS
40      FOR I = 1 TO N
50      INPUTS (I), M (I), V (I), VNI (I)
60      NEXT I
70      FOR I = 1 TO N-1
80      L = INT (M) (I) - 1
90      GOSUB 330
100     MI = FAC
110     FOR J = 1 + 1 TO N-1
120     L = INT (M) (J) - 1
130     GOUSB 330
140     M2 = FAC
150     FOR K = J + 1 TO N
160     L = INT (M) (K) - 1
170     GOUSB 330
180     M3 = FAC
190     M4 = N - MM
200     GOUSB 330
210     M4 = FAC
212     NN = N
214     GOUSB 330
216     NN = FAC
220     S = ((MI * V (I) - VNI (I) - VNI (I) + M2 * V (J) - VNI (J) + M3 *
           V (K) - VNI (K)) * M4 / NN
240     PRINT
250     PRINT "S ="; S
260     PRINT
270     PRINT
280     NEXTK
290     NEXTJ
300     NEXTI
310     STOP
320
330     FAC = I: IFL = 0 THEN 370
340     FORR = 2 TO L
three   FAC = FAC * R
hundred NEXTR
fifty   RETURN

```

360  
370

Appendix (2 )

The application of the previous computer program resulted in a hypothetical case of four production centers  $M_1, \dots, M_4$  With operating capacity proportional to the respective demand function of the service center services, and whose available capacity is 1000 service units ) an hour, for example .( If it is known that the internal demand function for production centers, respectively, is 748 , 633 , 575 , 345 service units, and that these centers are integrated " as a prerequisite for a solidarity match between them".

The following alliances emerged after the implementation of the previous program:

The coalition

The amount of energy used by the service center

$V (\{M_1, M_2, M_3\})$	950
$V (\{M_1, M_2, M_4\})$	850
$V (\{M_1, M_3, M_4\})$	800
$V (\{M_1, M_2, M_3\})$	550
$V (\{M_1, M_2, M_3\})$	1000
$V (\{M_2, M_3, M_4\})$	500
$V (\{i, i\})$	Zero
$V (\{i\})$	
$i \neq j$	
$i \in N$	
$M \in N$	
$S (i, N)$	
$V \in 2^N \cap \mathbb{R}_+$	

In order to complete the solution to extract the value of the service energy that should be allocated to the various production centers, the method of linear ) indicative ( sequential programming was followed. sequential parametric linear programming Which is characterized by helping to reach the optimal solution in light of the random movements of production centers, which maximizes its own return from the match, and at the same time works to achieve the general benefit of the project as a whole in the end.

The previous programming model took the following form :  $\alpha$  mini Assuming that  $\alpha = (i, N^-)$ ,

(21)

Subject to :

$$\begin{aligned}
 M_1 + M_2 + M_3 + \alpha &= 950 \\
 M_1 + M_2 + \quad + M_4 + \alpha &= 850 \\
 M_1 + \quad M_3 + M_4 + \alpha &= 800 \\
 M_2 + M_3 + M_4 + \alpha &= 550 \\
 i + j + \alpha &= 500 \\
 i + \alpha &= 0 \\
 M_1 + M_2 + M_3 + M_4 &= 1000
 \end{aligned}$$

As a result of the solution sequence in the previous model A, the amount allocated to each production center was reached and appeared in the following figure:

$$V(M) = \{1325, 275, 250, 150\}$$

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