Multi-stage scale of the incentive system for distributors of an electrical company

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Abstract. The model presented in the article expands the applied nature of the measurement theory and eliminates the gap in the application of measurements in the "agent theory" (the economic theory of incentives). Distribution channel management is one of the key issues for the vast majority of manufacturers. This channel is the widest, and therefore determines both the production plans and the marketing policy of the manufacturer. The current practice of setting discounts has become extremely sophisticated, and the variety of discounts is impressive: currently, about 20 different types of discounts are used in international trade practice. This article proposes a new model for stimulating distributors – a multi-stage scale that matches the distributor's score with the percentage level of discount for regional coverage and specialization. The list of indicators for calculating the discount for specialization and regional coverage includes a group of indicators to increase the motivation of the distributor to improve the quality of their work and a group of indicators to increase the motivation of the distributor to expand the scope of action. Using the method of index grouping of expert estimates, the weight values of each indicator were found using the method of index grouping of expert estimates. The problem of calculating the score of distribution activity results was set as a multi-criteria problem, in which the method of additive optimization was used for the procedure of folding private criteria, which was preceded by checking all private criteria for additive independence. As a result of the calculations (using the processing of expert opinions by the method of index grouping of expert assessments), a five-step scale of discounts was obtained. The data of the international electrotechnical company Schneider Electric in Russia became the empirical basis for the implementation of the tasks set. The developed incentive model can be adapted for any commercial enterprise that is interested in promoting its product through regional coatings, as well as in supporting the image of the product, which, of course, helps to stimulate demand and increase sales.

1. Introduction
Modeling measurement systems and processes is a broad and fairly diverse topic, due to the wide variety of physical principles used, the complex nature of many devices, and the interdisciplinary approach usually required to evaluate their actual behavior. A mathematical model is the key to extracting information from a measurement system and the quality of the information obtained directly depends on the quality of the model [1, 2].
Measurement is the most important tool of modern thinking. This is the means by which we describe the world. Its application has been extended from the physical Sciences and technologies in which it originated to other fields of knowledge, such as social Sciences, behavioral Sciences, and decision science [2, 3]. The human effort spent on research, development and application of measurements is enormous. The research has theoretical and practical significance. The model presented in the article expands the applied nature of the measurement theory and eliminates the gap in the application of measurements in the "agent theory " (the economic theory of incentives).

Distribution sales, in comparison with direct sales, provide a higher percentage of sales of industrial products [4]. Distributors remain a practical way to enter new markets [5], provide geographical coverage of the market, provide market information, establish contacts with customers, and provide advice and technical support [6, 7, 8].

Manufacturers selling through distribution use a variety of different management mechanisms, such as incentive programs, monitoring processes, and forced contracts [9, 10] to increase sales as well as the number of new customers. Of the many available mechanisms, the most likely incentive for specific distributor actions is usually the incentive channel [11]. Sales promotion is a set of methods and techniques used throughout the product's life cycle. A wide range of sales promotion methods has a multi-purpose orientation, and the choice of the goal depends on the object of the upcoming impact [12].

The literature on distribution channels focuses on the dyadic nature of individual relationships between producers and distributors [13, 14], in reality, producers usually involve many intermediaries [15, 16]. This makes it difficult for the manufacturer to analyze the performance of each distributor and develop an incentive program that satisfies all intermediaries. A study of business and marketing literature has revealed that the popular literature deals mainly with incentive mechanisms on a case-by-case basis [17], which has allowed us to identify the gap of references to the unique General model that we are trying to eliminate.

Despite scant empirical attention to the problem of motivating distributors, some elements of the incentive system can play an important role in forming a conceptual platform for those elements of incentives that are most relevant to the subject area of this study.

Given the importance of channel incentive programs, this article offers a theoretically based four-step method for developing a distribution channel incentive system, as shown in the figure 1. The purpose of this article is to create a flexible differentiated system of incentives for distributors for practical implementation in production companies. The model is a system that can be used to quantify the value of the measured value and the specific nature of this information.

![Figure 1. Stages of building a new incentive system for distributors.](image)

The implementation of this idea is linked with the construction of a multi-stage reduction scheme, which puts in conformity recruited distributor on performance number of points (scoring distributor) the level of discount expressed in percent, is presented in section 2. Section 3 describes the methods and results of the analysis, and discusses the contribution and implications of the research in section 4.

Empirical test results based on data from the electrical engineering company Schneider Electric (SE) Russia. The focus group involved in the study included the company's experts: specialists of the commercial control Department, marketing Department analyst, managers for working with distributors, regional managers for working with distributors.
2. Model

Proper use of the incentive system allows you to build long-term relationships with distributors and significantly increase sales. Manufacturers usually use different strategies, creating a whole pricing system that reflects differences in demand and costs by geography, the requirements of specific market segments, the distribution of purchases by time, order volumes, delivery schedules, guarantees, and service contracts. This requires various types of distributor support in the form of channel incentives. Globalization and high levels of competition force producers to make more and more concessions to consumers and intermediaries in the sale of their products. The discount system is an extremely useful, popular and flexible tool for stimulating sales [12, 18, 19]. The current practice of setting discounts has become extremely abundant, and the variety of discounts is impressive: currently, more than 20 different types of discounts are used in international trade practice.

The amount of discounts depends on the nature of the transaction, the terms of delivery and payment, and the market conditions at the time of the transaction [11].

Distributors can be divided into two groups: distributors who focus on expansion or regional coverage and those who focus on specialization [20]. The discount for regional coverage supports companies that seek to expand their sales area in other regions and cities. The second group includes distributors who do not have a developed regional network, and want to focus their sales exclusively in their city and develop their retail outlet by attracting more customers. There are also companies that are engaged in a certain intermediate position.

2.1 Creating a list of indicators that affect the distribution discount

During research interviews, two groups of indicators were identified as potential incentives: (1) to increase the motivation of the distributor to improve the quality of their work, and (2) to increase the motivation of the distributor to expand geographical coverage (increase the number and improve the quality of outlets). The first group of indicators includes: the number of qualified employees at the point of sale \( (X_1) \); the number of qualified merchants working outside the office to attract customers \( (X_2) \); the number of seminars held to train customers on the manufacturer's products \( (X_3) \). Indicators and requirements are shown in the table 1.

| Indicators | Requirements |
|------------|--------------|
| the number of qualified employees at the point of sale who meet at least two requirements \( (X_1) \) | The employee has a deep knowledge of the technical features of the manufacturer's equipment; the employee has more than one year of experience working with the manufacturer's products; the employee knows the technical and commercial advantages of the manufacturer's products and is able to reasonably convince the company's customers of this; the employee is able to find the optimal solution to the client's problem using the best aspects of the manufacturer's products. |
| the number of qualified merchants working outside the office to attract customers who meet the requirements \( (X_2) \) | The merchant has basic knowledge of the manufacturer's products; the merchant knows in depth where the manufacturer's equipment can be used; |
number of seminars held to train customers on products ($X_3$)  

The second group of indicators includes:
- ($X_4$) the number of necessary inventory for the design of a retail outlet (showroom with stands; catalogs, posters);
- ($X_5$) product volume in price lists;
- ($X_6$) advertising costs for the manufacturer's products.

Thus, taking into account these factors, each distributor may eventually receive an additional discount for regional coverage and/or a discount for specialization. However, it is incorrect to assume that each factor has an equal influence on the final score. It is clear that a quantitative increase in some of the above indicators is more important for increasing motivation, and some – less.

There is no doubt that in order to make informed decisions, it is necessary to rely on the experience and knowledge of the focus group experts. To solve this problem, we will find weight values (which determine in quantitative form the degree of preference of the j-th criterion in comparison with other criteria, and the sum of the weights should be equal to one) for each indicator using methods of processing expert estimates [21].

The reliability and reliability of decisions based on the judgments of the expert group depends to a large extent on the organization of the procedure for collecting, analyzing and statistical processing of these judgments. In the traditional (group) discussion of problems at meetings of commissions or councils, the resulting assessment is obtained from the entire group as a whole. However, the opinion of the most authoritative and the emotional impact of the most "assertive" participants often have a significant impact on the judgment of others. In addition, members of the Commission who are in the minority feel insecure and therefore often join the majority opinion. Therefore, in order to reduce the psychological influence of experts on each other and obtain more reliable estimates, direct discussions should be replaced with programs for coordinating individual opinions. The simplest way to use a group is to use it individually. The method is that each expert gives an estimate independently of the others, and then these estimates are processed and generalized into one general one.

In our case, to determine the weight values of parameters (particular criteria), it is convenient to use the index grouping method to determine the weight values of the above indicators that affect the distributor discount for "regional coverage and/or specialization" [21].

Seven people from the focus group act as experts. Data from the expert survey is presented in the table 2.

| Indicators | Expert 1 | Expert 2 | Expert 3 | Expert 4 | Expert 5 | Expert 6 | Expert 7 |
|------------|---------|---------|---------|---------|---------|---------|---------|
| $X_1$      | 0.30    | 0.20    | 0.15    | 0.20    | 0.15    | 0.20    | 0.15    |
| $X_2$      | 0.20    | 0.25    | 0.20    | 0.25    | 0.30    | 0.31    | 0.26    |
| $X_3$      | 0.15    | 0.15    | 0.10    | 0.15    | 0.10    | 0.05    | 0.02    |
| $X_4$      | 0.10    | 0.10    | 0.05    | 0.05    | 0.15    | 0.05    | 0.08    |
| $X_5$      | 0.05    | 0.10    | 0.20    | 0.10    | 0.15    | 0.23    | 0.34    |
| $X_6$      | 0.20    | 0.20    | 0.30    | 0.25    | 0.15    | 0.16    | 0.15    |

The method of index grouping expert ratings is performed in several steps.
Step 1 – the establishment of a secondary parameter estimates ($A'$): 

$$A' = \frac{a_{\min} + a_{\max}}{2}, \quad a_{\min} = \min_{n=1}^N \{a_n\}, \quad a_{\max} = \max_{n=1}^N \{a_n\}. \quad (1)$$
Step 2 – The calculation of the deviation of expert estimates from the estimated average values \(d_n\), the formation of sets \(P\) and \(M\) (\(P\) – the set of expert assessments, which formed a positive deviation from the average, \(M\) – a lot of expert assessments that formed negative deviations from the average) and counting the number of elements of these sets (\(m\) – number of elements in the set \(M\); \(p\) – number of elements in the set \(P\)):

\[
d_n = a_n - A, \text{ if } d_n < 0 \quad n \in M; \quad d_n > 0 \quad n \in P
\]  

(2)

Step 3 – determining the sum of negative and positive deviations:

\[
S^+ = \sum_{n \in P} d_n, \quad S^- = \sum_{n \in M} d_n
\]  

(3)

Step 4 – setting index values \(k_1\) and \(k_2\):

\[
\begin{align*}
S^+ \geq |S^-|, \text{ then } k_1 &= \frac{S^+}{|S^-|}, \quad k_2 = 1; \\
S^+ < |S^-|, \text{ then } k_1 &= 1, \quad k_2 = \frac{|S^-|}{S^+}
\end{align*}
\]  

(4)

Step 5 – calculation of generalized expert estimates:

\[
\lambda_i = \frac{k_1 \sum_{n \in P} a_n + k_2 \sum_{n \in M} a_n}{k_1 p + k_2 m}.
\]  

(5)

Thus, using the method of index grouping of expert assessments, the coefficients of significance of particular criteria were established, which is presented in the table 3.

Table 3. Established coefficients of significance of particular criteria.

| Indicators | \(\lambda_i\) |
|------------|-------------|
| \(X_1\)    | 0.02        |
| \(X_2\)    | 0.26        |
| \(X_3\)    | 0.13        |
| \(X_4\)    | 0.08        |
| \(X_5\)    | 0.14        |
| \(X_6\)    | 0.20        |

The obtained coefficients must be normalized as in equation (6).

\[
\lambda_i'' = \frac{\lambda_i}{\sum \lambda_i}
\]  

(6)

Table 4. Final estimates of the importance of parameters.

| Indicators | \(\lambda_i''\) |
|------------|-----------------|
| \(X_1\)    | 0.024           |
| \(X_2\)    | 0.313           |
| \(X_3\)    | 0.157           |
| \(X_4\)    | 0.096           |
| \(X_5\)    | 0.169           |
| \(X_6\)    | 0.241           |
Thus, the table 4 shows the final estimates of the significance of particular criteria, as a result of using the method of index grouping of expert opinions.

2.2. Checking the additive independence of indicators

The problem of calculating the score of distribution activity results is set by us as a multi-criteria problem, in which the method of additive optimization is used for the procedure of criteria folding.

To use this method, the identified indicators must be checked for additive independence. Testing the hypothesis of factor independence begins with identifying the utility independence of one of the factors \( X_2 \) from \( \{X_2, \ldots, X_n\} \). Then we check for independence by utility \( X_3 \) from \( \{X_1, X_3, \ldots, X_n\} \) and, if there is mutual independence, proceed to testing the hypothesis of additive independence of factors. This sequence of actions is related to the fact that unilateral independence is the weakest condition for independence, and additive independence is the strongest.

The establishment of independence in terms of utility occurs when an experiment is carried out, in which a decision-maker (DM) and an expert participate, where the DM is offered lotteries with equally probable outcomes. For each of these lotteries, it is necessary to determine a deterministic equivalent, that is, such a factor value for fixed values of the others that it is not important for the DM to choose a lottery or the proposed factor value [22].

The decision-makers were 2 employees from the focus group (commercial control specialist, expert Manager for working with distributors). The final set of factors (parameters) consists of the six indicators listed above \( \{X_1, X_2, X_3, X_4, X_5, X_6\} \).

Using the "fork" method, as in the figure 2, we will conduct a series of tests where the DM is presented with a certain lottery with equally probable outcomes \(<(Y_{\text{min}}, Z), (Y_{\text{max}}, Z)\>\). In our case, the \( y \) value corresponds to the value of the checked factor \( X_i \), and the \( Z \) – value corresponds to the fixed factors \( X_{i+1} \ldots X_n \). If the results show that the value of the deterministic equivalent fluctuated within reasonable limits (set by the DM), then this factor is considered independent of the others.

![Figure 2](image-url)

**Figure 2.** A graphical illustration of the method of the “fork”.

By examining different points from the segment \([Y_{\text{min}}, Y_{\text{max}}]\) (it is advisable to offer DM points located on different sides of the desired value, consistently approaching the center of the segment) with a fixed \( Z_i \), we look for a point \( Y \) which DM would be indifferent to the choice between it and the lottery being played. It will also be the deterministic equivalent of \( \hat{y} \).

The number of tests is set by the expert. Each new test is performed with a new \( Z \) value. In our example, the number of tests was three.

If the resulting values of the deterministic equivalent of \( \hat{y} \) in various tests are theoretically equal to each other, then there is independence of the utility of factor \( y \) from factor \( Z \). However, in practice, this
equality is usually not achievable. In this case, the DM defines the limits of the (reasonable) tolerance for $\hat{y}$. However, if the differences between deterministic equivalents in tests are significant, i.e. the values do not fall within a predetermined interval, then there is no independence in utility between the two factors.

As a result of research, it is established that the factors are independent. Then we investigated the factors for additive independence.

Два фактора $Y$ и $Z$ являются аддитивно независимыми, если лицо, принимающее решение, подтверждает эквивалентность лотерей с равновероятными исходами следующего типа:

$L_1 < (y_1, z_1)$ and $(y_2, z_2) >$  
$L_2 < (y_1, z_2)$ and $(y_2, z_1) >$,  
moreover, the outcome $(y_1, z_1)$ is not equal to any of the outcomes of the second lottery.

Thus, after conducting 15 studies, it was found that the assumption of additive independence of factors is proven.

Then, based on this, we used the additive optimization method for the criteria folding procedure, namely, for calculating the point ratings of distributors.

### 2.3. Determining distributor scores based on the additive optimization method

To determine the points, data analysis was performed based on empirical data from managers working with distributors from the focus group.

To solve this problem, we used the method of additive optimization [23].

$$F_i(a_{ij}) = \sum_{j=1}^{n} \lambda_j * a_{ij}$$

$$\sum_{j=1}^{n} \lambda_j = 1, \lambda_j \geq 0, j = 1, n.$$  

Equation (7) defines an additive optimality criterion. The values of $\lambda_i$ are weighting factors that determine in quantitative form the degree of preference of the $j$-th criterion in comparison with other criteria. In other words, the coefficients $\lambda_i$ determine the importance of the $j$-th optimality criterion. In this case, the more important criterion is assigned more weight, and the overall importance of all the criteria is equal to one, as in equation (8).

The generalized goal function, as in equation (7), can be used to collapse partial optimality criteria if:

- particular criteria are quantitatively comparable in importance;
- particular criteria are homogeneous (have the same dimension).

In our model, the criteria are heterogeneous and have different units of measurement: (pieces, money, interest). Therefore, normalization of the criteria is required, as in equations (9) and (10). Criteria normalization refers to a sequence of procedures by which all criteria are reduced to a single, dimensionless measurement scale.

$$a_{ij}^+ = \max (a_{ij}), i = 1; m ; \ a_{ij}^- = \min (a_{ij}), i = 1; m$$

Then, in accordance with the principle of maximum efficiency, the normalizable criteria are determined by the equation (10):

$$\hat{a}_{ij} = \frac{a_{ij}}{a_{ij}^+}, j = 1; l ; \ \hat{a}_{ij} = 1 - \frac{a_{ij}}{a_{ij}^+}, j = l + 1; n$$

For our model, the optimal strategy will be the one that provides the maximum value of the goal function of equation (7), since the higher the values of the criteria, the greater the discount value should be.

As a result, the distribution of point ratings of distributors was obtained, on the basis of which a multi-stage scale of discounts was built using the processing of expert opinions.
2.4. Building a multi-stage scale of distribution discounts

The multi-stage discount scale was built in three stages:

- setting the number of scale steps;
- definition of the boundaries on the x-axis (scoring distributors);
- definition of the boundaries on the y-axis (level discounts, %).

The tasks of these stages were solved with the involvement of focus group experts and the method of index grouping of expert assessments described earlier.

This resulted in getting the discount level values depending on the distributors’ scores.

As a result of the calculations we get a five step scale of discounts which is shown in the table 5.

| Level | limit            | Discount (%) |
|-------|------------------|--------------|
| 1     | from 13 to 22    | 2            |
| 2     | from 23 to 32    | 3            |
| 3     | from 33 to 46    | 4            |
| 4     | from 47 to 63    | 7            |
| 5     | from 64 and higher | 10          |

So, the idea of calculation and discount calculation was implemented in the construction of multi-scale discounts that the distributor recruited according to the results of scoring the value of the discount in percent.

3. Implementation

The four-step process described here offers manufacturers a framework for developing an interval scale of compatible incentive packages with intermediaries, with the goal of encouraging more distributors by increasing regional purchasing volumes, as well as through specialization that helps maintain the product image and goodwill of the manufacturer.

The model is intended for:

- to motivate distributors to improve the quality of work in relation to their customers, improve the level of qualification of the distributor;
- for motivation to expand the scope, increase the number and quality of retail outlets;
- to encourage the distributor based on the results of annual sales.

To implement and implement the incentive system, the company must have powerful information resources. This issue can be implemented using a well-established reporting system.

The incentive model implemented in four stages is suitable for any production company, but if some parameters of the model are revised in accordance with other conditions, it is possible to adapt the system without any problems to solve similar problems at any commercial enterprise that is interested in promoting its product through regional coatings, as well as in supporting the image of products, which helps to stimulate demand and increase sales.

4. Conclusion

This article presents a model that extends the applied nature of measurement in agent theory. An approach is proposed that can measure the effectiveness of the distributor, which are measured in an interval scale.

The sales promotion program is an important tool for manufacturers and distributors that affects the effectiveness of their development strategies. The model turned out to be useful and convenient for conducting the process of monitoring distributors. Moreover, the proposed criteria give us a critical conclusion that all distributors have a transparent selection scheme. However, this model also has limitations and barriers.
Restrictions are related to investments in the automated monitoring process. In turn, the barriers are contained in the control system. Formalization and centralization have a corresponding positive and negative impact on exchange relations [24].

By linking the control characteristics of an incentive to the performance requirements of distributors, you can reduce the risks of distributor inefficiency.

The incentive program is an investment and has many potential advantages for manufacturers and distributors.

The four-step process described here offers manufacturers a framework for developing compatible incentive packages with intermediaries.

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