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Supplier Integration. A Proposed Practical Approach through a Matrix Comparing ABC Classification and Vendor Rating

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ABSTRACT

In the supplier evaluation process, companies focus on comparing performances. The literature offers various analysis methods, although the matrices used are often subjective and difficult to implement in practice. This article aims to develop an easily implementable model, aimed at meeting the company's need to identify suitable suppliers for integration projects. Integration involves establishing close collaboration and cooperation between suppliers and customers with the goal of reduced inventory levels, shorter delivery times, and improved customer service. Thanks to the collaboration of a sample of companies, a new model is proposed. Our research is structured in three phases: identification of parameters for supplier evaluation; creation of the matrix; evaluation of the satisfaction level reported by the companies that have used the model. A comparison matrix between ABC classes and a multi-criteria supplier evaluation index allow the company to define a set of suppliers with a high probability of integration. This practical approach has been implemented in approximately 23 companies, and the level of satisfaction reported is high because it demonstrates greater rationality in supplier evaluation.

1. Supply Chain Management

Since 1990, the field of Supply Chain Management (SCM) has become highly popular. Mentzer et al. (2001) attempted to propose a comprehensive definition, not limited to a specific discipline and adequately reflecting the breadth of issues generally addressed under this term. This article uses the definition that states that supply chain management is defined as the systematic and strategic coordination of traditional and tactical business functions and the systematic and strategic coordination among companies within the supply chain, with the aim of improving the long-term performance of individual companies and the entire supply chain (Mentzer et al., 2001, p. 18).

Purchasing plays a fundamental role for companies in finding the best materials and services, thereby enhancing their ability to meet the needs of their customers. One of the biggest challenges that procurement managers face is the selection of strategic suppliers who will

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provide them with products, components, and materials in a timely and effective manner, in order to maintain competitive advantages. The strategic approach varies and depends on the type of procurement, as presented by Kraljic (1983), using variables such as the impact on profit and supply risk as analysis factors. Therefore, supplier selection based on the right procurement strategy is essential for the entire supply chain. Procurement of items is considered complex when supplier availability and the number of suppliers are limited, as it involves a high supply risk. Furthermore, supply complexity can also be assessed in terms of competitive demand; supplier selection is one of the most critical procurement activities, as the performance and competitive advantages of companies depend on collaboration with high-performing suppliers (Wagner, 2006). Suppliers contribute to the four major competitive priorities: quality, delivery, flexibility, and cost (Prajogo and Olhager, 2012). Selecting appropriate suppliers and engaging in collaborative and shared activities can reduce material costs and the time required for new product development by 20%, while simultaneously improving material quality by 20% (Monczka et al., 2016). It is evident that supplier selection is crucial for overall company performance. Choosing the right suppliers is not always an easy process. It is based not only on selection but also on preceding steps, including problem definition and identification of selection criteria (de'Boer et al., 2001). The supplier selection process typically involves evaluating various alternatives based on multiple criteria (e.g., cost, quality, delivery, and flexibility). Based on multiple criteria, supplier selection requires accurate decision-making, often of a complex nature. In practice, multi-criteria supplier evaluation is usually based on decision maker judgment, representing a highly subjective approach. Efforts can be made to redesign supplier selection processes. For example, the adoption of risk factors in selection criteria (Wasthi et al., 2018; Igoulalene et al., 2015; Rajesh and Ravi, 2015) and multi-sourcing (Haleh and Hamidi, 2011), as well as integration with inventory management (Firouz et al., 2017; Keskin et al., 2010), become the main focus for risk mitigation in procurement-related areas.

2. Customer and Supplier Relationships Evaluation

The lack of integration between suppliers and customers can lead to various issues in the supply chain, with the most famous being known as the bullwhip effect. This effect is an example of a typical outcome in supply chain management resulting from dynamically complex circumstances and was first highlighted by Forrester (1958). According to Chen et al. (2000), this phenomenon states that the variability of a product or component increases as one moves along the supply chain away from the end customer. In other words, the extent of material and order variations seen in upstream stages of a supply chain is wider than what occurs in downstream stages.

The consequences of this effect include excessive inventories, low levels of customer service, inaccurate and delayed capacity planning, income loss, increased transportation costs, and ineffective production planning (Lee et al., 1997). Lee also states that access to information is crucial for minimizing this type of variation. Innovative companies in various industries have discovered that they can control the bullwhip effect and improve their supply chain performance by coordinating information and planning along the supply chain.

Effective supply chain integration requires effective implementation. Supplier integration is achieved through practices involving a combination of internal procurement-production initiatives and external supplier-related initiatives. Purchasing provides a critical link between production and the supply base, interpreting and communicating product plans and production needs to suppliers while simultaneously providing a channel for updating production on supplier technologies, capabilities, and limitations. However, while there are numerous

recommendations on an integrated supply chain, the recommendations in the papers are mostly general in nature and do not provide operators with specific information on how to implement a real integration.

For many companies the process represents a great challenge because it is a multi-criteria decision-making problem that leads to inevitable compromises. The literature presents numerous criteria and methods for the process. Some methods have been suggested to facilitate the supplier evaluation and selection process. However, the challenge is which criteria and methods are most suitable, in particular for small and medium enterprises. Among the models present in the literature, two categories can be identified: positioning on a matrix and identification of the partner through mathematical models.

Some well-known visualization models such as the one presented by Parasuraman (1980) belong to the first group. He was one of the first researchers to introduce the concept of supplier segmentation. His main idea was to identify distinguishable segments of potential suppliers for each item to be purchased by an industrial company, based on characteristics closely related to the company's key customer segment characteristics. For this purpose, he proposed a gradual procedure:

- Step 1: Identify key characteristics of customer segments.
- Step 2: Identify critical supplier characteristics.
- Step 3: Select relevant variables for supplier segmentation.
- Step 4: Identify supplier segments.

Parasuraman's approach is a process that does not specify segmentation variables (step 3) but describes how to find them and then form the segments. In contrast, other approaches specify segmentation variables.

The Kraljic Portfolio Matrix (KPM), initially proposed by Kraljic (1983), provides a way to strategically manage purchasing. The matrix focuses on developing purchasing strategies for different commodities based on their potential value and supply risk. Sometimes this classification is not easy because it is difficult to uniquely interpret the characteristics of a single supplier. The result is the difficulty in understanding which suppliers to involve in a supply chain management (SCM) strategy. Gelderman (2005) argues that it is not clear why Kraljic selected the variables used.

Building on Kraljic, Olsen and Ellram (1997) proposed a new model. They renamed the vertical and horizontal axes as "strategic importance of the purchase" and "difficulty of the procurement situation." In this new version, there is little change in meaning. They assess strategic importance through three factors internal to the company: competence, economics, and image. The difficulty of managing the procurement situation is assessed through three factors external to the company: product, supply market, and environmental characteristics (Ellram and Hendrick, 1995).

Regarding the mathematical models, Ordoobadi and Wang (2011) have listed various mathematical models for supplier selection, such as the method of weighted linear average, the cost ratio method, supplier profile analysis, AHP-based supplier evaluation, dimensional analysis, data envelopment analysis, cluster analysis, along with other hybrid methods. Özfirat et al. (2014) categorize methods into five groups: multiple attribute decision-making methods, mathematical programming approaches, statistical/probabilistic approaches, intelligent approaches, and hybrid approaches.

Most of these methods are rather complex and require sophisticated data collection and processing systems for implementation in a company. In Italy over 99% are SMEs, as presented

by ISTAT in the last report (2021), with a share of employed people equal to 81.4% of the total. Both the technical skills necessary for data analysis and adequate information management systems are often not present in medium-sized and small companies. Consequently, the adoption of sophisticated mathematical models is often not applied (Bianchini and Michalkova, 2019)

Among the models present in the literature to be cited, Garfamy's (2006) work can be presented; he applied Data Envelopment Analysis (DEA) to minimize total cost of ownership (TCO) and proposed the application of DEA in evaluating the supplier performance based on TCO. Ross et al. (2006) identified the DEA methodology as the basis for an iterative analytical and broader framework - namely action research (AR). The proposed methodology fused both buyer and supplier performance attributes and was found capable of delivering measurable and actionable outputs. Data Envelopment Analysis is characterized by the ability to determine the relative efficiency of similar decision-making units - DMU (where 'similar' refers to DMUs that use the same inputs to produce the same outputs under identical production conditions). What makes the DEA method flexible and easily applicable to various production situations is the fact that efficiency measures can be carried out even in the absence of a detailed description of the production process, unlike parametric techniques.

Talluri and Narasimhan (2003) are the first group of researchers who focused on the importance and implications of performance variability in evaluating different suppliers. The researchers saw the process as a system in which the main objective was to minimize the input items such as cost and to maximize the outputs such as quality, delivery performance, etc. The researchers proposed two linear programming (LP) models so that groups of homogenous suppliers can be easily identified, which provides discriminate choices in final selection.

Chan and Chan (2010) proposed an Analytic Hierarchy Process (AHP) to solve the supplier evaluation and selection problem taking the example of fashion industry. Kumar and Roy (2011) proposed a rule based model with the application of AHP to aid the decision makers in vendor evaluation and selection taking the power transmission industry. Barla (2003) proposed the Simple Multi-Attribute Rating Technique (SMART), where seven evaluating criteria of reliability, capability, quality organization, geographic location, financial condition, service level and price were considered. Huang and Keska (2007) presented an integration mechanism to form a comprehensive and configurable metrics arranged hierarchically, which considers product type, original equipment manufacturer (OEM)/supplier and the level of supplier integration. The researchers presented a total of one hundred and one metrics for supplier selection.

Our work was to evaluate among the various models the simplest and most easily usable one in a medium or small-sized company. For example, an AHP analysis can be difficult to perform especially if the company has relationships with 200-300 suppliers. The method developed in this paper aims to be simple enough for regular use and, where possible, integrable into existing information systems.

3. The Study

As presented above, the two main categories of models have weaknesses respectively. Mathematical models were considered difficult to apply, often due to a lack of sufficient and reliable data as well as the expertise of the company's internal staff. Matrix-based models are more easily implemented in medium and small businesses, but come with a high level of subjectivity. Starting from the main weaknesses of previous models, we aimed to develop a model that could be easier to implement and objective. Objectivity is interpreted as "having a reality independent of individual minds" (Roy, 1993), so different individuals could describe

the same situation differently since they are not uniquely determinable in matrices like Kraljic's. Our target is to increase objectivity through a set of parameters that can be uniquely determined.

Supply chain integration has been described by Clancy as an attempt to elevate the links within each component of the chain (to facilitate) better decision-making and to make all parts of the chain interact more efficiently, thus creating visibility in the supply chain and identifying bottlenecks (Putzger, 1998). The basis of integration can be characterized by cooperation, collaboration, information sharing, trust, partnership, shared technology (Akkermans et al., 1999). The theme of cooperation is further supported by other authors (Fernie, 1995; Lawrence, 1997; Morton, 1997) and is essentially expressed by Parnell (1998) when stating that supply chain integration truly occurs when customers and suppliers establish close partnerships aimed at reducing inventories, lead times, and increasing customer service. The selection and determination of subjects to be involved in integration processes should not be a procedure governed by chance or people's experience; instead, it should be a clear and shared procedure leading to the identification of those subjects (suppliers) that have characteristics that can lead to relationships based on cooperation, collaboration, information sharing, trust, partnership, and shared technology.

The study was divided into three phases:

1) Define a set of KPIs.
2) Propose the set of KPIs to a sample of companies and receive their evaluations.
3) Create a necessary model to identify which suppliers can be involved in integration processes. Monitor the validity of this model with a sample of companies.

3.1. First Phase

The study began with a literature analysis aimed at determining which parameters can be considered valid in the analysis and selection of a supplier. We proposed to a sample of companies a set of about one hundred parameters suggested by Huang and Keska (2007) for supplier selection. From this initial collection, we created a questionnaire that was sent to enterprises. The goal was to identify which were considered most useful and significant. Our questionnaire suggested avoiding common mistakes:

- Measuring the wrong things.
- Measuring too many things and losing sight of the goal (our goal is to define a set of 5-7 indicators).
- Considering parameters expressed by subjective (non-numeric) evaluations.
- Outputs not leading to adequate actions that need to be taken.
- Parameters difficult to understand and/or interpret.
- Parameters difficult to export through a common Enterprise Resource Planning (ERP) (a lengthy or complicated process for capturing a parameter can be an ineffective method).
- Sanctions after measurement; the supplier seeks to defend themselves from contributing.

According to O'Brien (2014), there are six areas that are useful to examine and from which key performance indicators (KPIs) can be found (Van Weele, 2004; De Araújo et al., 2017; Kumar et al., 2005). These areas are:

- Financial performance.
- Product safety.

- Product quality.
- Delivery performance.
- Relationships and services.
- Certifications.

3.2. Second Phase

Thanks to national industry association's databases, we sent a questionnaire to approximately 300 companies belonging to various manufacturing industries located in the northeastern region of Italy. In the questionnaire, we asked which parameters could be most significant for them in the case of supplier selection and evaluation. Our target was to define a set of KPI with the following characteristics:

- Meaningfulness: They provide useful indications for determining a strategy.
- Ease of retrieval: The data is present in the management system and is easy to export.
- Uniqueness: The parameters can be expressed in numbers, making the evaluation more objective.
- Unambiguity: easiness of interpreting the parameter and understanding its meaning. Ambiguity is a noun that refers to the quality of being open to more than one interpretation than it can create inexactness.

The majority of the research sample (65 respondents) selected only a few KPIs and proposed a model composed of 6 parameters. Usually companies with over 20 key performance indicators are characterized with lack of focus, lack of alignment, and underachievement (Parmenter, 2010). The parameters that received the highest number of selections from the companies belonging to the sample were selected. Moreover, as each question was accompanied by a Likert scale, those with a Cronbach's Alpha value greater than 0.7 were chosen, which are generally considered acceptable (George & Mallery, 2003). The KPIs chosen were:

- On-time deliveries: For each supplier, the ratio of on-time deliveries to total deliveries. The unit of measurement is in percentage.
- Quality: The ratio of the quantity of problem-free products to the total products received from the supplier. The unit of measurement is in percentage.
- Complete delivery: The ability to receive the order in a single shipment. The unit of measurement is in percentage.
- Distance: The kilometers from the supplier to the customer's company. The unit of measurement is in kilometers, and the parameter is defined by a set of ranges (e.g., less than 200 km is rated as 5 on a Likert scale from 1 to 5, while more than 3000 km is the worst case rated as 1).
- Certifications: The presence of CSR or accreditation to international standards. In this case, the evaluation is not expressed in different ranges but only by the presence. In particular, the 5 levels represent the presence of a series of certifications, starting from the one considered most common to those of more recent generation as reported by the International Standard Organization (ISO) The proposal model gives the following options: 5 on the Likert scale represents the presence of all main certifications (ISO 50001 – 14001 – 18001 – 9001), while 1 represents the absence of any certifications.
- Payment terms offered: The fewer days it takes to pay the supplier, the worse the situation for the customer. The unit of measurement is the number of days, and the parameter is defined by a set of ranges (e.g., more than 60 days is rated as 5, while prepayment or payment within less than 10 days is the worst case rated as 1).

The research utilizes Multi-Criteria Decision Making (MCDM), one of well-known modelling and methodological tools for studying multifaceted problems (Kahraman, 2008). It focuses on decision problems due to the presence of various decision criteria and interacting design constraints. MCDM is defined as decision making under the presence of multiple, conflicting criteria for judging the alternatives and the need for making compromises or trade-offs regarding the outcomes of alternate courses of action (Masud and Ravindran, 2009; Ehrgott et al., 2010). The MCDM can offer numerous advantages. Here are some of the main reasons why it is recommended to use MCDM in this context:

- Objectivity: By using MCDM, organizations can reduce subjectivity in decisions and rely on a systematic and quantitative evaluation (Ho et al., 2010).
- Transparency: This approach provides a clear and structured framework of the decisions made, making the decision-making process transparent for all parties involved (Dotoli et al., 2020).
- Flexibility: MCDM can be adapted to take into account the specific priorities and weights assigned to each criterion by a particular organization (Alshamsi et al., 2023).
- Efficiency: It provides a systematic and methodical way to evaluate a large number of suppliers based on various criteria, making the decision-making process more efficient (Raut at al., 2012).
- Improvement of Communication: It offers a common platform for discussion and analysis, facilitating communication between the different business functions involved in supplier selection (Taherdoost & Madanchian, 2023).
- Continuous Improvement: By using MCDM as a standardized evaluation tool, companies can monitor supplier performance over time and identify areas for improvement (Wang at al., 2020).

In summary, the MCDM provides a robust and flexible framework for evaluating suppliers in a complex and constantly evolving environment, ensuring well-thought-out decisions aligned with the needs and priorities of the organization.

Model considers the following elements:

- m is number decision criteria
- n is number of alternatives
- C_1,.,C_m are m decision criteria
- A_1,..,A_n are n finite alternatives
- a_{ij} is scored performance of the alternative Ai (i=1…n) against criterion Cj (j=1…m)
- w_1,...,w_m are normalized weight assigned to the criteria
- x_1,...,x_n are values associated with the alternatives after
- evaluating with m criteria

The total "score" Xi for each decision alternative is:

$$X_i = \sum w_j a_{ij} \quad (1)$$

Multi-Criteria Decision Making Models are an effective tool used to solve complex selection issues including multiple criteria and options.

These parameters were subsequently weighted by each company to provide a level of importance. Some companies adopted Analytic Hierarchic Process (AHP) to define the weight for every criteria. The level of importance attributed by each company to the individual parameter varies widely and depends not only on the industry it belongs to but also on who responded to the questionnaire. For example, a quality manager tends to give greater

importance to quality parameters, while a logistics manager tends to prefer punctuality and order completeness. At this point, the supplier evaluation is ready to be used.

3.3. Third Phase

The final part of the research involved presenting the companies that participated in the survey with an analysis model. The purpose was to ask them if this model could be useful in identifying which suppliers to integrate into supply chain management processes. Every company had to conduct the ABC analysis on its suppliers and correlate the three classes with the rating value calculated from appropriately weighted parameters. The ABC analysis was based on the expenditure made towards suppliers in the past 12 months. Regarding the supplier assessment, reference tables were suggested in which a value from 1 (not very important) to 5 (very important) is assigned to each parameter, as shown in the following table. Companies could adopt the provided references or customize them. The following image presents the suggested tables for the sample of companies for each parameter. In particular, the six parameters most frequently chosen by the companies belonging to the analysis sample are presented. For each parameter, bands corresponding to a value of evaluation are suggested, where the value 5 represents the most advantageous situation, while the value 1 represents the least advantageous choice. For example, the quality index (QI), a quality rate higher than 99% corresponds to the value 5, while a value below 85% represents the most disadvantageous situation and is suggested to be rated as 1. The ranges were suggested to the companies following some direct interviews at various companies in discussion sessions held with the recipients of the questionnaires. Not all companies decided to adopt the proposed values; in most cases, each company chose to customize the ranges.

Table 1.
The proposed ranges of six identified parameters

QUALITY INDEX (QI)		IN FULL INDEX (IFI)		PAYMENT INDEX (PI)	
Greater than 99%	5	Greater than 99%	5	Greater than 90 days	5
95% < QI < = 99%	4	97% < IFI < = 99%	4	60 days < PI < = 90 days	4
90% < QI < = 95%	3	95% < IFI < = 97%	3	30 days < PI < = 60 days	3
85% < QI < = 90%	2	90% < IFI < = 95%	2	5 days < PI < = 30 days	2
Less than 85%	1	Less than 90%	1	Less than 5 days or in adv	1

ON TIME INDEX (OTI)		DISTANCE INDEX (DI)		CERTIFICATION INDEX (CI)	
Greater than 99%	5	Less than 2 days	5	Previous and 50001	5
97% < OTI < = 99%	4	2 days < DI < = 10 days	4	Previous and 14001	4
95% < OTI < = 97%	3	10 days < DI < = 20 days	3	Previous and 18001	3
90% < OTI < = 95%	2	20 days < DI < = 40 days	2	9001	2
Less than 90%	1	More than 40 days	1	No one	1

4. The Proposed Model

The proposed model creates a matrix that takes into account a categorization of spending levels (ABC analysis) towards suppliers and the quality of the supplier, estimated by the previously developed assessment model. ABC analysis is a well-known method known as the Pareto principle. This principle is stated as follows (Ultsch, 2002): "In many projects, 20% of the total effort produces 80% of the total result." In our study, the Pareto principle can be explained through the following situation: 80% of the total expenses are made with 20% of the suppliers.

One of the strengths of this representation is the comparison between spending levels (ABC) and objective supplier performance. ABC analysis is unambiguous, simple to perform, and its

value has been demonstrated in the literature. The use of a multicriteria evaluation leads to determining a rating value obtained through the weighting of the presented parameters. The final data (rating) is unique and the result of a determination based on shared tables among different company functions. The result of the analysis is the creation of a table that allows for cross-referencing the classes related to the spending level with the rating value. This result is better explained through the presentation of one of the cases relating to a company belonging to the sample.

The company is medium-sized with about 150 employees, belongs to the metalworking industry, and makes machinery for woodworking. The rows represent the three classes according to the Pareto distribution related to the spending level (A = 80% of total expenditure; B = 15%; C = 5%). Specifically, there are 99 suppliers belonging to class A, 124 suppliers belonging to class B, and 629 that belong to class C. The expenditure recorded in a year with the top supplier from class A is about 1 million Euros, while with the last supplier on the list, the purchase value was 35.00 Euros. The determined rating has led to dividing the values into 5 ranges: a rating below 1.5 is considered very low; low if the calculated value is between 1.5 and 2.5; medium if between 2.5 and 3.5, high with a value between 3.5 and 4.5; very high if the rating is over 4.5. The range determination was made after a meeting with the company's main managers. The result highlights a large number of suppliers with a very low rating. There are only about 48 that have scored a high or very high rating and belong to A class. The final interpretation of the proposed model suggests to the company that suppliers with whom integration projects can be started are classified with a high expenditure level (A class) and with a high or very high rating. The selected suppliers are deemed important since the company has a very significant expenditure and they have performance parameters considered to be very good (timeliness, quality, etc.). Thanks to this positioning, the company has started an integration project. With some suppliers belonging to class A and with high or very high ratings, company has made a project of integration among the management systems for the creation of a continuous replenishment.

Table 2.
Example of matrix related to a company

	RATING					
	VERY LOW	**LOW**	**MEDIUM**	**HIGH**	**VERY HIGH**	**SUM**
LEVEL OF	<=1,5	1,5<Rating<=2,5	2,5<Rating<=3,5	3,5<Rating<=4,5	Rating>4,5	
A	27	7	17	40	8	99
B	91	4	8	16	5	124
C	621	1	4	3		629
SUM	739	12	29	59	13	852

The positioning matrix can therefore be summarized in the following figure.

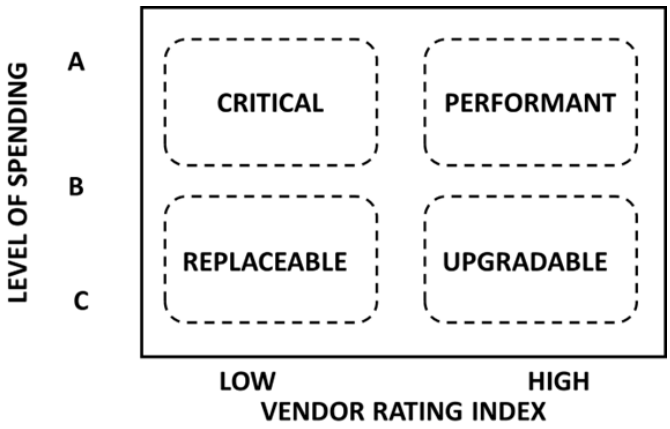

Figure 1. The proposed matrix and positioning
Note: The four sections result of the comparison between the ABC classification and the rank of vendor rating

Four sectors can be identified in the matrix:

- High spending level (Class A) and high evaluation value. Suppliers in this group are most suitable for initiating integration relationships, such as just-in-time, kanban, vendor-managed inventory, consignment inventory, etc. (Payaro & Papa, 2019). This combination allows for the identification of all suppliers that have a high rating, meaning they are punctual, have short lead times, and offer advantageous payment conditions, in addition to having numerous certifications. In other words, they demonstrate greater reliability. Added to this is the fact that the level of expenditure is high, thus increasing the customer's bargaining power towards the supplier. With this additional condition, the supplier might recognize in the customer a good opportunity to develop a partnership strategy. We have called the suppliers in this set "Performant."
- Low spending level (B,C) and high evaluation value. Strategically, it is possible to increase the spending level due to high quality (Upgradable). The good rating of the supplier indicates to the customer the possibility of increasing the level of expenditure by shifting some purchases from suppliers with lower ratings. For this reason, this set has been named "upgradable"
- High spending level and low evaluation value. These are critical suppliers because their poor performance could be a problem. They are likely difficult to replace, but the company will need to consider the possibility of changing them (Critical). In this situation, the supplier's performance is not considered to be sufficient, but the levels of expenditure are high. This could be the case where the supplier is a market leader, may have a monopoly in the market, or has exclusive materials or components. In such a situation, it would be advisable to look for a valid alternative.
- Low spending level (B, C) and low evaluation value. Non-strategic suppliers that are easily replaceable (Replaceable). Usually, this set contains the largest number of suppliers. Strategically, it does not seem to be particularly critical, although the indication is to try to replace the less performing suppliers with others that have higher values.

The 23 companies that have used the model have recognized that the result is appealing and helps identify those suppliers who can be involved in integration projects. Belonging to class A allows the customer to increase decision-making power. Currently, 23 companies are using the model and declare satisfaction because it represents a practical, easy-to-implement, and maintainable model.

The analysis of the matrix allows for the precise identification of suppliers with which there is a greater probability of initiating integration projects. The same matrix also highlights critical suppliers. Two sample companies have included the model in their ERP system to constantly monitor the supplier situation.

Among the weaknesses of the system, there is certainly the determination of the weights (importance) of the supplier evaluation parameters and the ability to identify the "customer's power," as presented by the AT Kearney model. As defined earlier, the level of importance attributed by each company to the individual parameter varies widely and depends not only on the industry it belongs to but also on who responded to the questionnaire.

5. Conclusions

The aim of the study was to propose a tool suitable for companies to identify suppliers with whom to initiate integration processes. The proposed model is objective, defined by numerical parameters, easily exportable from the management system, and easily updatable.

The first result of our survey is that most companies agree that only a limited number of parameters can be used for objective analysis. The weight of importance attributed by each company to the individual parameter varies widely and depends on the industry and the questionnaire respondent. The selected parameters were on-time deliveries, quality, complete delivery, distance, certifications, and offered payment terms.

The second result of this study is the proposal of a new matrix. The model takes into account both the spending level (ABC analysis) and the supplier's quality, estimated by an objective evaluation model.

Participating companies have highlighted that the proposed model allows the identification of a group of suppliers suitable for integration. The number of companies involved is limited, and the research lacks statistical significance. Additionally, it does not consider a representative sample. Future studies can expand the sample and evaluate the results one year after implementation.

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