

Suppliers Classification Process at Civil Aviation Company

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Abstract—The basic methods of suppliers classification are considered. The classifier of the suppliers for the civil aviation company was developed. The suppliers classification process in the concept of an automated system of suppliers quality evaluation is described.

Keywords—suppliers classification, automated supplier evaluation system, suppliers management strategy.

I. INTRODUCTION

Since the second half of 20th century, the international production integration takes place due to the international division of labor and international production cooperation [1]. At this time the role of suppliers, especially in the production of high technology products, increases dramatically.

Depending on the percent of purchased products, there are up to a half of problems associated with quality of manufactured goods and services may arise through the fault of suppliers. The process of building the mutually beneficial relationships with suppliers [10] starts with deciding which suppliers are planned to cooperate with in the future; how to build the relationships with suppliers; what kind of requirements are applicable to different categories of suppliers and which risks rate is acceptable.

As the result, there is an increasing demand for the development of an effective mechanism for suppliers management, control and evaluation. For this task, the algorithm for the automated supplier evaluation system development was proposed in [9].

On the other hand, one of the primary tasks of this system development is the suppliers classification. This is the basis for the consideration of a methodology (strategy) for the suppliers selection, assessment and development and contract requirements definition.

This paper considers the suppliers classification for the field of civil aviation. It was developed in order to specify contractual requirements for different supplier types and appoint methods and amount of their inspection, development and evaluation.

II. KEY CRITERIA FOR SUPPLIERS CLASSIFICATION

The suppliers classification can be performed using one or several parameters, depending on the classification purposes. As mentioned above, the classification parameters can be divided into: simple (single-criterial) and complex (multicriterial).

Single-criterial - classification based on one qualitative characteristic and does not require additional calculations.

Multicriterial (calculated) – supplier classification using combination of several criteria (using mathematical tools), mainly based on the supplier rating (analysis of supplier performance) [2, 6, 8], or based on the criticality of supplier and shipped products or risk evaluation [3, 4, 7].

The basic list of classification parameters and supplier categories is shown in Table 1.

TABLE I. CLASSIFICATION PARAMETERS

Classification parameters	Categories
<i>Single-criterial parameters</i>	
On the supplier competence	Developer (technological competence); Manufacturer (manufacturing competence); Intermediary (wholesale companies)
On the delivery subject	Supplier of standard parts; Supplier of materials; Component source; Supplier of assembly units; functional groups etc. Systems provider; Supplier of equipment; Service provider; Others
On the supplier location	Domestic; Foreign; Intraregional; Out-of-regional
On the certificates availability	Having a QMS certificate Not having a QMS certificate
On belonging to a particular economic system	Intra-system (belonging to the same system as customers); Non-system (all others)
On the form of property	Government suppliers; Municipal suppliers; Private companies; Cooperative suppliers; Suppliers of other forms of ownership.
On the work experience with the enterprise	Experienced with the customer; New suppliers.
<i>Multicriterial parameters</i>	
On the strategic value of the supplier	Strategic partner Preferred supplier Qualified supplier Supplier
On acceptance categories	Preference contract; Contract is possible; Contract only by special permission; Contract impossible
On the criticality of the supplied products)	Strategic materials; Problem materials; Basic materials; Non-critical materials
On the just-in-time deliveries	Just-in-time delivery at hourly intervals. Just-in-time delivery at daily intervals Weekly demand controlled by the program Periodic deliveries

This list of classification parameters may include other parameters, such as: technology, quality, logistics, price level and volume of supplies, etc. The set of parameters depends on the objectives of the classification, the specifics of the organization work and its strategic purpose.

The number of classification parameters should be optimized in order to reduce unreasonable costs for suppliers evaluation at the expense because of the costs for data collecting and processing.

III. SUPPLIERS CLASSIFICATION IN CIVIL AVIATION

There is proposed a supplier classification for civil aviation company. It is recommended to use it for:

- guiding the suppliers initial evaluation, selection and approval of suppliers;
- guiding the suppliers QMS audit (hereinafter audit) type, qualification and re-qualification;
- guiding the Contracts structure and content according to the type of the supplier;
- guiding the supplier monitoring;
- guiding the supplier evaluation, analysis of supplied products quality.

A special feature of civil aviation field is that there is certification of quality system by Aviation authorities. They issue a Certificate of Production Organization Approval (POA) or a Certificate of Design Organization Approval etc. The classification presented in this paper fulfils the requirements of Russian aviation authorities and EASA.

Thus, the suppliers involved in the aircraft production can be divided into the following categories:

1) *Production Approval Holder* - supplier, manufacturer of Purchased System Components, Details and Structural parts, designed by their customer or by them on the basis of the customer Technical Specification. They are EASA or/and Russian Aviation Authority POA Certificate Holder for the production of the supplied parts.

2) *Production Organization Approval and Design Data Holder* - manufacturer of Purchased System Components, Details and Structural parts, in accordance with TSO / ETSO / PMA / TC / STC, the Holder of Production Organization Approval Certificate, issued by the National Aviation Authorities.

3) *Subcontractor* - supplier, manufacturer of Purchased System Components, Details and Structural parts, according to the customer Design Data. They are not EASA or/and Russian Aviation Authority POA Certificate Holder.

4) *Subcontractor and Design Developer* - supplier, manufacturer of Purchased System Components, Details and Structural parts, designed by them on the basis of their customer Technical Specification, for which customer is anyway the Approved design data Holder and that are not a POA Certificate Holder for the supplied parts.

5) *Vendor / Dealer* - supplier of Purchased System Components and products, manufactured according to standard conditions (fasteners, standard parts, materials, etc.). They do not manufacture the delivered products.

6) *Manufacturer* - supplier, manufacturer of products, manufactured according to standard conditions (fasteners, standard parts, materials, etc.).

7) *Approved Service Provider* - Service provider in support of Aftersales Support. The supplier is Holder of Approved Maintenance Organization (AMO) Certificate, issued by Aviation Authorities.

8) *Service provider* working during the A/C Production process in accordance with customer DD.

For the ease of integrating the supplier classifier into the automated supplier evaluation system, it is recommended to assign a digital code to each type. At the same time, it is proposed to divide the suppliers types into groups according to one or several characteristics and assign a digital or letter designation to these groups:

P – production organization - the Holder of Production Organization Approval Certificate issued by Aviation Authority;

S - subcontractor - production organization that is not the Holder of Production Organization Approval Certificate issued by Aviation Authority;

VM – supplier, manufacturer or vendor, delivering standard parts and materials, as well as the vendor, delivering System Components;

SP - Service Provider

After that, the code of each supplier type will consist of two identifiers: group designation and suppliers type designation. For example: P1, P2; S1, S2; VM1; VM2; SP1, SP2.

The proposed classification was developed based on the following parameters with relevant criteria (see Table 2):

TABLE II. CLASSIFICATION PARAMETERS USED FOR SUPPLIERS CLASSIFICATION IN CIVIL AVIATION ORGANIZATION

Classification parameters	Criteria
Delivery subject	Purchased system components Parts and Assembly Units / Structural parts Manufacture using TSO, ETSO, PMA, TC, STC Standard parts Materials Service
Supplier competence	Developer (technological competence); Manufacturer (manufacturing competence); Intermediary (wholesale companies)
Aviation Authority approval	Production Organization Approval Approved Maintenance Organization

The percentage of suppliers of different types, involved in aircraft production is shown at Figure 1:

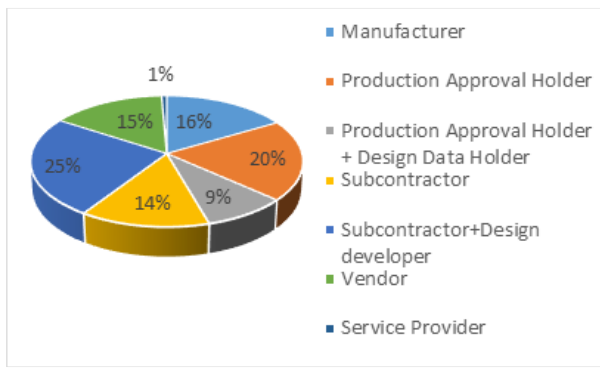


Fig. 1. Percentage of suppliers of different types in civil aviation organization

Within the framework of the proposed suppliers classification, the most amount of inspection should be established for subcontractors and service providers working on the customer's Design Data or specification. These suppliers manufacture products / provide services under the customer quality management system (QMS) or Production Organization Approval. For their qualification (requalification) it is necessary to perform an on-site audit of their Quality System, transferring to them all the requirements assigned by Aviation Authority to the customer. In addition, it is recommended to establish specific requirements for their periodic performance evaluation.

As about the suppliers strategic values, the strategic partnership is preferred to be established with Production Approval Holders, Subcontractors, Subcontractors+Design Developers, Service Providers, as they provide specific products developed for the customer, using customer design data or developed in accordance with customer technical specification. It follows that the two parties are working together on the product design and its installation to the final product, and it requires close cooperation at all the product lifecycle stages. And it causes more problems to change the supplier of one of these types and requires heavy spendings.

On the other hand, relationships with other suppliers, such as manufacturers, vendors and sometimes Production Approval Holders+Design Data Holders can be opportunistic [5]. In case of low performance of suppliers of this types it can be more preferable to change the supplier as it is easier to find the alternative without heavy additional spendings.

In any case an additional suppliers evaluation should be performed prior to the decision making.

IV. CLASSIFIER INTEGRATION INTO SUPPLIER QUALITY MANAGEMENT PROCESS

An example of the supplier classification process in the concept of the automated supplier quality evaluation system development is shown in Fig. 2

The appropriate supplier management strategy should be defined and documented within the organization as a part of the automated supplier evaluation system development process. It should distinguish the supplier base management and the suppliers relationships management.

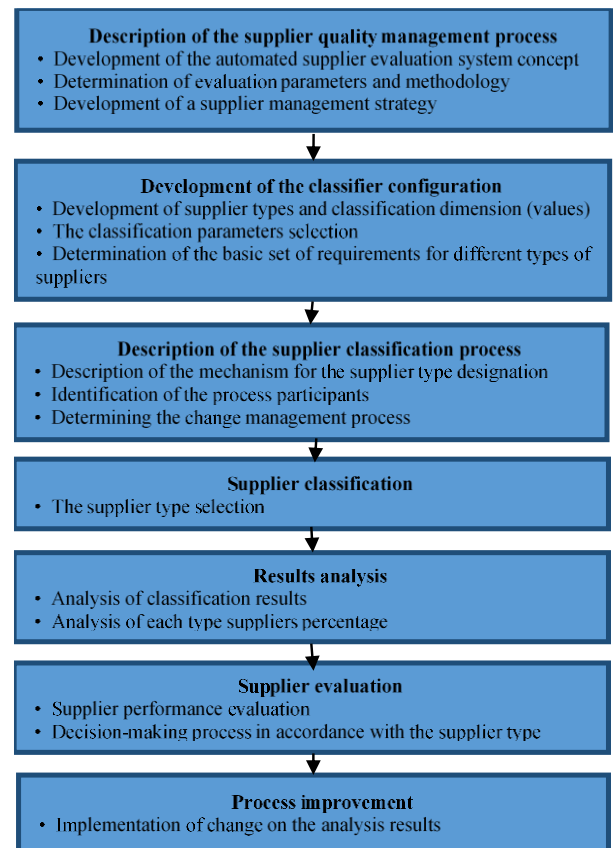


Fig. 2. Algorithm of the supplier classification process in the automated supplier evaluation system

It is recommended to organize a working group on this matter in order to involve all stakeholders and take into consideration all the internal consumers interests.

It is necessary to perform a periodic monitoring of the supplier management strategy implementation and control the related baseline data inside the organization and at the suppliers.

The supplier management strategy actualization and changes implementation process should be determined.

The amount of suppliers inspection should be determined depending on the supplier type. The main focus should be made on the key suppliers evaluation and relationships building with. This allows to reduce spendings.

As it was mentioned above, it is recommended to develop a specific set of contractual requirements for each supplier type. After analyzing these contractual requirements fulfillment rate and taking into consideration the supplier type, the decision on further cooperation feasibility can be taken. The decision can be following:

- to change the supplier;
- to influence the supplier (supplier stimulation and development or cultivating competition between suppliers of the same products);
- to start cooperation with a potential supplier;
- to acquire the supplier organization.

The classifier described in this paper can be supplemented by including additional classification parameters. It is

recommended to combine the use of this classifier with a multicriteria evaluation (classification), in order to assess the suppliers criticality in terms of spendings, impact on the final product, risk evaluation, etc.

The set of criteria for such evaluation is determined in accordance with the organization specifics. Development of the criteria system necessary and sufficient for effective suppliers management in application to civil aviation is the subject for independent research.

V. CONCLUSION

Suppliers classification is one of basic elements of the supplier management process. In some cases, the suppliers classification is performed according to qualitative characteristics (single-criterial parameters). In other cases, suppliers classification can be performed using mathematical tools and quantitative estimates (multicriterial parameters). In this case, the suppliers classification is the result of complex evaluation based on suppliers performance (rating methods), criticality (supplied products criticality, supply volumes and / or total costs).

This paper provides the detailed suppliers classification using several qualitative parameters and taking into consideration the field of civil aviation. After the classifier was developed it is necessary to assign its place in the suppliers quality management process. For this purpose, the algorithm of the classifier incorporation into the automated supplier quality evaluation system was developed and some recommendations for developing a supplier management strategy were given.

The following step should be the supplier evaluation. For this purpose, it is suggested to develop a multicriterial evaluation system and define methodology to perform the accounts.

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