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Modelling of consignment process by using axiomatic design

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Abstract

Effective supply chain planning increases both competitiveness and profitability of companies. The present study re-designs consignment order management for a medical company by using axiomatic design principles. The proposed design enables a newly-hired employee to manage the structure from pickup to delivery between the supplier and the customer and effectively complete the process without any difficulty. The role of training in this process is very important. However, the study results also reveal the need for certain other activities for the development of strategic coherence and strategic planning in supply chain management.

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1. Introduction

French origin word *consigne* means order, depository, directive, bespoke and instruction (Gürsoy, 2012). Consignment sale is defined as the sale whereby a seller pays the cost of the goods to another seller, broker or distributor after the goods are sold (TDK). It emerged as a marketing model for small businesses, especially those with a certain customer portfolio and which do not have the necessary capital to purchase any product. The consignment process involving the entire sales process can be defined as a process that brings together all elements of the supply

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chain. The success of a supply chain depends on the business process structure, the use of information systems and the partnerships with supply chain members. Muckstadt, Murray, Rappold and Collins (2001) have argued that there are five guiding principles to be followed in order to achieve perfection in supply chain with the aim of gaining competitive advantage. The principles are as follows: knowing the customers; establishing a supply chain organization that eliminates waste, instability and uncertainty; building tightly-connected information infrastructures; initiating well-integrated business processes and creating interconnected decision support systems. Drawing on the complicated structure of supply chain, the present study aims to model the consignment process, a part of supply chain, using axiomatic design principles to contribute to the effective fulfillment of the process.

2. Consignment And Sales Consignment

Consignment is a process in which an enterprise sends goods to another enterprise to be sold on predetermined rates or the conditions of the day. The trader or the enterprise that sends the goods is called consignor and the trader or the enterprise that receives the goods to sell is called consignee. In the consignment process delivery of goods is not a sale but an entrustment as the consignor has the ownership of the goods until the consignee sells them. The role of the consignee in the process is to mediate the sale of goods (Tolu, 2015). Consignment can also be defined as the delivery of goods to a buyer without transferring the ownership of the goods and to be sold only through introduction. Firm sale is achieved when the buyer accepts and purchases the goods. This sales and payment method is implemented in both domestic and international sales. Consignment also expresses an international sales and payment method in which the importing (buyer) company is introduced the goods, uses and purchases them through the mediation of the consignor after the goods are sent abroad especially by exporting companies. It also covers the sales, payment and export procedures for selling in foreign markets new products which need introduction. Thus, there is a supply chain in the process from consignor to end buyer. In this chain, the consignee is obliged to deliver goods to the consignee at the right time while the consignor is obliged to supply enough product. The consignor and the consignee are required to coordinate and meet the end customer's needs just-in-time.

The properties of consignment sales can be listed as follows (Kaya and Turguttopbaş, 2012):

1. This method depends entirely on trust.
2. The sales are risky as there is no certainty in the sales despite the visibility of the exporter in the foreign market. Waiting time expenses are incurred by the exporter. However, the goods can be sent back to the seller any time until the firm sale regardless of the costs of the sales and receivables. The goods of the exporters is open to the risks that might arise from climate and foreign exchange restrictions due to foreign political reasons beyond their control. The seller has no bill of exchange and no guarantee to cover the losses which may occur due to the fault of the buyer.
3. Open account and consignment sales have the same features in terms of the problems arising due to the delivery of the price and form of sales.
4. "Joint account" refers to a new form of sales suggested for partial guaranteeing of consignment sale considering the risks involved in this type of sales. In such a case of export consignment, the consignor guarantees a minimum sales price for the exporter and the difference between the sales price and the guaranteed price is shared between the exporter and consignor (buyer) after the expenses are deducted.
5. The said type of export often applies to goods that enter a market for the first time, sent for the purpose of introduction, might be spoiled and perished and sold within a long period of time.
6. The export demand in question is made together with the exporter. The duration of the permit issued for export consignment is determined to be 90 days. Consignment goods must be sold within one year starting from their actual dates of issue.

3. Consignment Process And Its Problems

Payment process through consignment sale can be explained as follows (Millî Eğitim Bakanlığı, 2011):

- The consignor i.e. the broker and the importer company make a contract,
- The goods are shipped to the brokerage company that mediates the consignment sale,
- The consignor company protects the goods on sale (merchandise) until a buyer is found (While the goods are consigned to the consignor company, the exporting company has the ownership of the goods),
- The consignor company finds a buyer for the goods and provides the exporting company with detailed information on the sale to be made to the buyer,

- The exporter company prepares the bill on the amount of sales made and forwards it to the brokerage company,
- Since the consignor company has the obligation to pay the cost of the goods as from the date of bill, the company has to make payment within the legal period arranged in the exchange regulations, in accordance with the terms in the contract,
- The brokerage company prepares a bill also for the brokerage determined according to the contract and collects it.

While this sales and payment method is highly risky for exporting firms, it is an attractive form of importing and payment and poses no risk for the importing company.

Consignment process is quite risky for the seller. Risk can be minimized only to a certain extent by a contract drawn up in accordance with the law and in a way to define the whole relationship between the seller and the buyer. For the importer, sale is not leaving the goods on consignment. The sale is considered to be executed only when the product reaches the end buyer. The importer is liable for all the inventory costs in the process. Considering that the bill for the consignor is added to the inventory cost, the need for proper management of the process for making profit becomes obvious.

The exporter takes full responsibility of the goods during storage process. Physically, the goods are consigned to the consignor. If the importer does not protect the goods consigned with contracts and fail to make audits at certain times, problems that would occur during the process might lead to serious financial loss.

It is also important that the importer should be accurately informed about the consignor's sales. When not informed properly and timely, the importer is negatively affected. Because in such a case, the bill is not prepared timely for the consignor even though the product is sold and the sold products become physically lost products for the exporter.

All these disadvantages are advantageous for the consignor since working on consignment is based on trust and the accuracy of the process is entirely under the initiative of the consignor. As the consignor considers the case as an advantage, it is an attractive incentive for the importer to work on consignment method since it enables the importer to gain competitive advantage over its competitors in the supply chain.

4. Designing Consignment Process With The Axiomatic Design Principles

The present study aims to re-design the consignment process by using Axiomatic Design (AD) principles in order to solve the current problems and to create a more efficient process.

4.1 Axiomatic Design

The concept of axiomatic design introduced by Suh (1990) refers to a set of scientific principles. AD helps the formulation of design goals to be carried out in a hierarchical structure covering all the required information. This approach can be seen in several different areas ranging from product design and improvement to the process design and improvement (Kabadurmuş and Durmuşoğlu, 2007). Although the first AD implementations are related to the product design (Suh, 1990), today it is also used in areas related to systems design.

In this approach, all designs refer to the constant processing of the information in and between each of the following four areas: CA, FR, DP and PV. Customer requirements are created in the customer area (CA) and then formulated in the functional area. It is known that the designer first determines the set of independent functional requirements (FR) which should be met and which will be used in the solution. Afterwards, the designer starts to work on design parameters (DP) for the creation of physical structure needed in order to implement these. At this point, if it is impossible to implement the DP set without specifying it more clearly although the FR set is created, the designer returns to the FR area again and obtains a FR set at one level lower. Until the solutions for the problems occurring at low levels become known, "decomposition" and "zigzagging" will continue to occur (Suh, 1990). The design parameters are related to the process variables (PV) in the process area. At this point, transitions to the question "how" with the question "what" is defined as "mapping". It is also possible to state that this approach aims to put forward a method which can make search in a systematic manner in the design area. This way it will be possible to minimize the role of chances in the process and alternative solutions will be found much more easily.

4.2 Modelling of the Consignment Process

Majority of the companies working on consignment basis often have problems related to running an efficient consignment process and the emergence of the losses. These problems occur when the staff in most of the companies working on consignment basis lack the relevant knowledge, there are frequent turnovers, the job is not defined

properly, contract drafts and price policies are not in place, contracts are not made properly, relationships with customers are not adequately established, and controls are not performed in a timely and accurate manner. With the aim of providing a guide for the managers of the companies working on consignment basis, the present study proposes an effective model for consignment process created by applying the AD principles. According to the model presented in Figure 1, the functional requirement and its design parameter are determined as follows:

F₀: Improve the Consignment Process

D₀: Effective Process Design

The process from the assessment of the request to the approval of the sale and the collection of the payment is designed as the sub-functions of the F1/D1 function. However, the existence of other sub-functions of this design is obvious. In addition, the role of training is also very important in the process. In this sense, the training process (F2/D2) and its sub-functions have also been detailed.

4.2.1. The Process from the Assessment of the Request to Collecting Payment

This process is divided into 10 functions designed as follows:

4.2.1.1. Assessment of the Request

The sub-functions are defined within the specified time period. Accordingly, the first function and its design are as follows:

F₁₁: Create a Work Request

D₁₁: Searching for New Customers and Analyzing Customer Characteristics

It expands into the followed sub-functions and parameters:

F₁₁₁: Search for new customers

D₁₁₁: Identifying the customers who are not worked with previously

F₁₁₂: Gather preliminary information about the customers who are not worked with previously

D₁₁₂: Making preliminary research of the market and communication organs

F₁₁₃: Contact the new customer

D₁₁₃: Meeting persons or units to be contacted when the work will start

F₁₁₄: Determine the customer's eligibility

D₁₁₄: Performing work on customer suitability in the light of the data obtained during the correspondences

Knowledge of the sales team of the field is very important. Work request can be received from the consignee; however, it must be mostly created by the team. Each request should be assessed separately as it is a serious decision to work with a new customer and a serious investigation is a must for making such decision. The received requests can be assessed by contacting with the unit making the request and obtaining the necessary information, but request creation is a more difficult process, so the employees should know well how to create and evaluate the request. It is important that the team comprises of people knowledgeable on the issue and is supported with constant training since the team collects the working customer data and makes meaningful reports for the company and these reports directly affect the decisions of the management. The customers suitable for the company structure who can adapt the consignment system and do not cause payment problems should be carefully assessed and selected. Before meeting the customers, the company's operating units that can be contacted depending on the working method of the company should be identified and each of these units should be contacted separately to collect the necessary data. The staff members of the management body and purchasing department, doctors, nurses, warehouse attendant are also among those who should be contacted. A new customer form should be created for each customer with the data obtained during these interviews and recorded in the company database. The data transformed into meaningful reports should be shared with the management team and evaluated and the management team should make a decision about working,

and thus, the team should consist of the members who are competent to decide and adopt the corporate culture of the company.

4.2.1.2. Making the Contract

The second function, its design and sub-functions are as follows:

F₁₂: Make a Contract

D₁₂: Reaching an Agreement through Mutual Correspondence

F₁₂₁: Create draft contract

D₁₂₁: Creating the draft non-customer specific contract with attorney and other consultants

F₁₂₂: Prepare contract and quote

D₁₂₂: Adapting the draft to the customer and preparing the quote through correspondence

F₁₂₃: Acceptance of the contract/revision

D₁₂₃: Carrying out correspondence

Companies should seriously protect their rights in the countries where they operate in order to survive. To protect their rights, companies sign written contracts with their business partners and base all their rights on laws. Especially foreign-based companies have contracts which are prepared in a common framework in accordance with both the laws of the countries in which they invest and the laws of their own countries. Contracts are drafted after long-term work and the mutual agreement period is the most important and painful process for business partnerships. Smooth progress of the process is in a proportional relationship with the successful performance of the first function as both parties want maximum protection of their own interests due to the high risk in such working methods, especially consignment.

During the customization of the contracts for customers, the guidelines of the contract are often not changed and the parties are concerned more about agreeing on price offer. In this regard, a startup where the parties put forward their requests openly improves efficiency in the process. The attitude and competence of employees during the interviews are very important. Employees should also constantly be supported with trainings during this period. The contracts based on laws and protecting mutual interests should be signed after a thorough evaluation and stored during the business partnership.

4.2.1.3. Examining the Consignment Order

The third function and the design of its sub-functions are as follows:

F₁₃: Examine the Consignment Order

D₁₃: Identifying Customer Capacity

F₁₃₁: Identify the capacity

D₁₃₁: Obtaining data on current and previous sales data

F₁₃₂: Report to the customer and company management

D₁₃₂: Forecasting the quantity of the products to be used and conducting research on existing competitors

F₁₃₃: Determine the suitability of the order

D₁₃₃: Comparing the order with the obtained data

Examining the consignment order is another important issue. Because leaving a high amount of products on consignment with the customer creates a serious inventory cost for the company and the company can start the payment term only after billing and not when the product is left with the customer. In other words, a required amount of the product should be left with a customer who has the capacity to use it. An important point to be considered when determining the amount of the product required by the customer is the existence of competitors. Existence of a competitor that contains products which are the substitutes for the products of the firm might cause a certain number of customers to prefer those substitutes. In such a case consignment goods are translated into sale more slowly and this can result in the decision to consign a lesser amount of goods. Inventory control belongs to the customer as long as the

products remain with the customer. However it should be considered that the consignor might not act with due diligence in issues such as the use of the products according to the expiration dates, the storage of the products under proper conditions and the reporting of the uses in a correct manner. This is a big risk for the company and the risk is reduced when the company ships the right amount of product to the customer. In other words, losses are minimized. In addition, shipment of the right amount of product facilitates the work of the employee whose duty is to control it and the employee can recognize the loss faster. Viewed from a different angle, undershipment of products reduces accessibility. Operation costs and interest in the competitor might increase in cases of urgency.

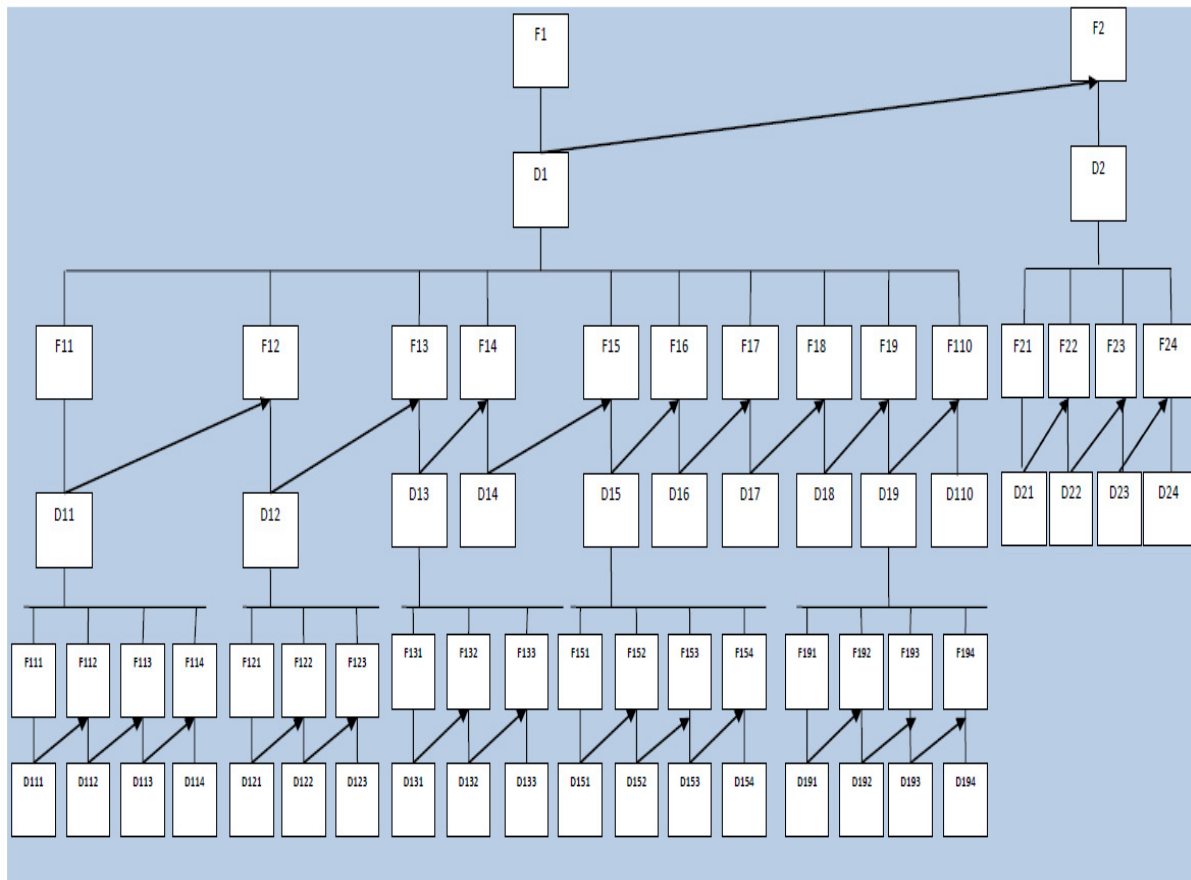


Fig. 1. An efficient consignment process design

4.2.1.4. Confirming the Order

The design process related to the fourth function is not divided into sub-functions and the function is as follows:

F14: Confirm the Order

D14: Reaching Mutual Agreement on the Consignment Quantity

Several parameters should be considered simultaneously at the stage of order confirmation. It is a better start for the parties to mutually decide on the amount of the goods to be consigned rather than acting individually. Thus, both parties positively contribute to the process with their experience and the data they have. Knowledge of the sales team of the field is also very important. A sales representative who is able to well analyze customers, take quick action by anticipating changes, support and lead the management to make the right decision with her/his reports plays an active

role in the correct determination of the number of the consignment. Completion of the previous steps (identification of customer capacity, conducting competitor research, etc.) of the process correctly and completely is important for the initiation and progress of the process.

The point that needs to be taken into consideration is that the greater quantity of the consigned product the greater the risk is. However it should also be underlined that consigning a less amount of goods might reduce accessibility or increase the amount of the goods to be urgently shipped and thus might increase operation costs or negatively affect the consignor's confidence in the company.

As consignment process is a living process, consigned amounts can be changed depending on the amount of use, increase and decrease in the capacity of the customer and the changes in the activities of competitors etc. At that point, it is important to consider whether the company has enough inventory of the product to be consigned, so it is vital for the realization of the import to forecast the consigned products to be billed and to be put in place of them.

4.2.1.5. Shipping the Goods

The design process related to the fifth function is as follows:

F₁₅: Ship the Goods

D₁₅: Taking the Order and Forwarding it to the Shipment Company

After the determination of the order quantity, the order should be forwarded between the partners through a proper channel and method. The sub-functions are defined as follows:

F₁₅₁: Take the order

D₁₅₁: Providing the communication of order between the company and the customer

F₁₅₂: Evaluate the order

D₁₅₂: Having the required confirmation/information in the order from the customer

F₁₅₃: Enter the order by using software

D₁₅₃: Processing of the order by the Customer Relations Department

F₁₅₄: Load the product

D₁₅₄: Preparing/loading/shipping the products

The party that sends the order should forward it after receiving the required approvals and informing the required units. The said party should also forward the order to the correct unit. The party that receives the order should process the order after checking its accuracy. It is important to question whether the order is binding, whether it has been sent in accordance with the contracts and whether the incoming information is correct. For example in case of the delivery of a shipment without the consignment order form, the warehouse attendant might not want to take responsibility for receiving the delivery of these products. Such a situation would mean the wasting of the labor spent on the creation of the shipment, the cost of the shipment and many other parameters. The Customer Relations Department that receives the order should be effective in this regard and should be supported with continuous training.

Working with the logistics company in harmony through all processes is also very important. In order that a company controls the outputs and shipments in a correct manner the company and the logistics company it works with should use a software that performs the reporting process appropriately. The logistics company should deliver the documents showing that the delivery is performed in an accurate and timely manner to the company. Employees should be trained on this issue and technological solutions should be effectively used.

4.2.1.6. Data Warehousing

The design process related to the sixth function is not divided into sub-functions and the function is as follows:

F₁₆: Store the Data

D₁₆: Monitoring the Physical Exits on the System

If a company quickly accesses the desired information, the work becomes effective to that extent. Determining which information will be needed and which software system will be used in order to quickly respond is a crucial issue for a company. Systems that allow companies to enter all data and receive meaningful reports when desired provide great benefits to companies today. A great amount of data can be reported with one single touch thanks to those systems. Systems that report product outputs in detail are important in terms of monitoring consignment products.

4.2.1.7. Counting

F₇ has been designed as follows but the sub-functions has not been defined.

F₁₇: Count

D₁₇: Controlling the Physical and Systemic Coherence at Certain Intervals

As mentioned previously, consignment process is risky and therefore requires to be seriously monitored. The company is responsible for monitoring the consignment products. The difference between the outputs and the amounts of the billed products should be physically present in the consignor and this can be controlled only through counting to be performed periodically. Missing products can be identified through counting and necessary actions can be taken to make up these shortages that would be identified within a short period of time. Whether products are outdated or not can be controlled by the said counting process and thus losses can be minimized.

4.2.1.8. Monitoring the Products Used

The design process related to the eighth function is not divided into its sub-functions. The function is as follows:

F₁₈: Monitor the Use of Products

D₁₈: Controlling the Creation and Complete Transfer of the Forms Expressing Use

For the company, sales is realized only when the product left on consignment is used. As long as the products remain on consignment, they create inventory cost for the company. Therefore, information on the use of the products should be transmitted to the company within the shortest time possible so that the company can start the billing process. For the company that will receive payment only at the due date in the contract after billing, managing this cycle without loss in financial terms is quite difficult. But if the process is accurately defined and the defined process is perfectly performed, profitability is not impossible; on the contrary, it is likely in high volume sales.

There many types of the said forms that express firm order for billing and these forms can be forwarded to the company by several methods. Specifying these types and methods in the contract would prevent mutual misunderstandings and later conflicts. One other challenge the company might face in this specific part of the process is the failure of the consignor to fill the form and inform the company for the sold product. Since the preparation of the form is under the responsibility of the consignor, this process should be carefully monitored. The creation of this form requires careful monitoring since it is the responsibility of the consignor. Performing periodic counting and paying visits are among the most effective ways of monitoring the said process.

4.2.1.9. Submitting the Bill

The design process related to the ninth function is as follows:

F₁₉: Submit the Bill to the Customer

D₁₉: Sales Support

Sub-functions are defined as below:

F₁₉₁: Receive/evaluate the firm order

D₁₉₁: Managing customer relations

F₁₉₂: Enter/Bill the order in the company system

D₁₉₂: Using technology and software system

F₁₉₃: Submit the bill

D₁₉₃: Making delivery/agreement to/with the related unit by signature

F₁₉₄: Measure satisfaction after the sale

D₁₉₄: Measuring/reporting needs and satisfaction through questionnaires

This function starts with the evaluation and acceptance of the form on the use of the consigned product by the Customer Relations. Evaluation of the form is important in terms of preventing the return of the bill and any damage to trade relations. In another aspect, continuous billing cancellation is a serious problem for the company in terms of internal and external audits. Customer Relationship Department prepares the bill for the order received through the proper channel in accordance with the quote in the contract. In this process, the system preferred by the company is very important. Using a system with minimum error rate that can transmit accurate and various data and provide an efficient use of time and monitoring is advantageous for the company. Shipment that follows the creation of the bill and the agreements are as important as the said process. The bill should be submitted to the customer on time. In order to avoid problems in agreements, documents/signatures showing the receipt of the bill should be taken from the authorized staff. In the following phases, financial agreements and monitoring should be made on time and in accordance with the laws.

After the contract is signed sales support units become even more important. Because this unit directly communicates with the customer most of the time and is responsible for a large part of the company prestige in the eyes of the customers. Achieving a long-term trade relation with the customer i.e. the consignor is closely related to after sales support. Hiring qualified people to work the said departments and supporting them with continuous training will provide a great return to the company.

4.2.1.10. *Collecting Payments*

The sub-functions of the 10th function are not presented and the tenth function is defined as below:

F₁₁₀: Receive the Payment

D₁₁₀: Collecting Payments at the End of the Term Determined in the Contract

Following the completion of the billing process in accordance with the dates specified in the contracts and submitting the bills to the consignor, the necessity to make agreements at certain times is determined in the laws. Tracking and timely collecting the payments of the bills on the number, amount and date of which there is agreement is the most important factor for the existence of the company. In cases where the collection cannot be made, the sanctions specified in the contract should be implemented and legal action should be taken.

4.2.2. Training Process

The model refers to the importance of training in several functions. The training function can have different qualities for each issue, but in general it can be designed as below:

F₂: Carry out the Training Required for Each Function
D₂: Efficient Training Process

Its division into sub-functions is as follows:

F₂₁: Determine the aim of the training including orientation

D₂₁: Investigating the deficiencies that require training

F₂₂: Select the training

D₂₂: Identifying the training suitable for the aim among the existing ones

F₂₃: Carry out the training

D₂₃: Carrying out the training by identifying the attenders

F₂₄: Report

D₂₄: Measuring the training efficiency and evaluating the results

For the company, increasing its profitability is proportional to reducing the costs. Human is the most important cost for the company. Even if a newly hired employee is experienced, familiarizing him/her with the corporate culture requires training. Rightly selected employees must be constantly supported with training.

Businesses are not closed systems. For companies, keeping up with the changing and developing world is only possible by continuously renewing themselves and especially their employees. It is obvious that training is vital in this respect. The design of the training function is becoming more and more important for these reasons. Human Resources Departments should accurately identify the needs of the company and carry out training activities that would help employees develop themselves in their work life.

The prestige of a company depends on the employees who represent the company. No matter how good the products and services are, misbehaviors of the employees, their lack of knowledge and skills might destroy the prestige of a company. Therefore, employees must be constantly observed, their shortcomings must be identified and should be eliminated through training. Training right employee with the right training is the most important point. Sales strategies training cannot be offered to an employee responsible from operations or interview techniques training cannot be offered to an employee responsible from marketing. Training should be designed for specific needs and given to the right person. The effectiveness of the training should be constantly measured.

4. Conclusion

The present study creates a model for consignment process by using the Axiomatic Design principles and draws conclusions on the gains to be obtained by the implementation of the model in a medical company having problems in its consignment process. As another positive contribution, it is predicted that with the new design a newly-hired employee can manage the structure from pickup to delivery between the supplier and the customer and effectively complete the process without any difficulty. The consignment process performed following the design with axioms will reduce the costs of the company and increase its profitability. Similarly, it is believed that both customer satisfaction and employee satisfaction are likely to dramatically increase in the long term. This situation will increase the company's competitiveness and at the same time will ensure profitability by strengthening customer loyalty. However, the importance of staff training is obvious in re-planning the consignment process and obtaining the said advantages. Indeed, the role of training in the process is quite big. In this sense, companies should pay attention to the necessary training and development activities, identify the needs of employees and should continuously control training results. However, according to the study results it is obvious that for developing the strategic cohesion and strategic planning areas of supply chain management, the following activities should be carried out:

- Relevant strategies should be defined depending on the main competitive advantage,
- Activities that do not generate added value should be reduced and efforts should be made to strengthen activities that generate added value.

Following activities should be carried out for the development of general processes and the technologies started to be used:

- Main and required activities should be regularly reviewed,
- Overall efficiency should be increased by modernizing and harmonizing activities.

Administrative and organizational factors should also be considered from a different angle. Some points identified in relation to this aim are as follows:

- To integrate the supply chain model in a better way,
- To reduce excessive stock levels,
- To increase capacity utilization rate.

Cooperation is an important factor in supply management and the following development attempts are recommended to be made about it: to determine the main partners and to increase efficiency in the sales order management.

The whole system should be observed and necessary performance measurements should be performed accordingly. Some of the methods that can be applied to achieve this aim are as follows:

- Carrying out reporting processes depending on specific business objectives,
- Reducing time spent for performance analysis by using appropriate criteria,
- Making efforts to create better inventory and data demand.

As a result of the said practice, the following suggestions have been made:

- The areas to be developed in the study can be completed,
- Big process design can be made by controlling the interactions among the processes and defining the sub-functions of all functions,
- The accuracy of the predicted gains can be investigated via the application in the model company,
- The effectiveness of the design can be measured more efficiently by applying the design by using numerical data.

It is obvious that following the suggestions brought forward in the present study will help the evaluation and implementation of a more stable and a detailed supply chain management system.

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