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Stuff Scheduling in Capillary Marketing and Analysis of its Impact on the Company's Financial Issues

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A B S T R A C T

In today's competitive business environment, supply chain performance is one of the most critical issues in the various industries; there is much argumentation about the fact that supply chain performance is the basis of the supply chain management efficiency. In this regard, the distribution sector is the most important part of the supply chain. Dud to the pulse of a company is in the hands of its sales and distribution department. This article proposes a new mixed integrated linear programming model MILP for scheduling distribution channel membership based on capillary marketing by considering staffs experiences at Pak's pasteurized dairy in one month. The purpose of this study is to reduce the costs of the company along with the increase in sales. Constraints affecting target functions such as minimum sales per employee and maximum overtime days are also considered. The computational experiment by GAMS software demonstrates the effectiveness of the model in reaching its objectives.

Keywords: Scheduling, Capillary marketing, Experience, Manpower, MILP, GAMS.

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1. Introduction

Increasing international competition indicated that organizations must pay attention to proper reaction to changing environment and emphasis on flexibility in their external environment. Today's organizations in the national and international arena to gain a decent place and maintaining it requires the use of an appropriate model, such as supply chain management in order to realize the competitive advantage and expectations of customers [1]. In today's competitive business environment, the supply chain performance is one of the most critical issues

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in various industries. It is argued that supply chain performance measurement is fundamental to efficient supply chain management [2]. Supply Chain (SC) is an integrated production process in which raw materials are converted into processed products and then delivered to the customer. There are two basic processes in an SC: (1) production planning and inventory control, (2) distribution planning and support. Production planning and inventory control process describes managing the complete process of designing and manufacturing of production and storage devices also the raw material maintenance methods, materials in the production process, and the final product. The process of distribution and support is also how to retrieve products, transferring them from the distribution centers to customers, and providing after-sales services to them [3]. A supply chain provides internal linkage of organizations, the resources, and processes that deliver products and services to the final customer [4]. Researchers and writers of the supply chain usually consist of three main layers:

- Upstream layer: Includes a supply of materials and services from suppliers.
- Processes (internal processing): Include in-house activities for the final product.
- Downstream: Includes distribution and distribution activities for customers (retailers or consumers).

In the other words, the supply chain is referred to as an integrated system that is coordinated in a series of related business processes [5]. As the definition implies, distribution is one of the members of the supply chain; there are various definitions for it and it also includes a variety of different types, each of which is applicable to the type of industry and product. Distribution is one of the marketing mixes that in its simplest form transfers the production from the factory to the market. In the other word, the most important task of the distribution channel is to deliver the goods to potential customers at the right time and right place [6]. Organizing distribution systems are defined as a vital part of the economy [7]. Because production and service distribution is a part of Growth Domestic Product (GDP), hence an efficient distribution system can help countries' sustainable economic development and decline consumers' costs [8]. Therefore, the organization of this sector requires the identification and implementation of new distribution tools and methods, the reform of the rules of the guild system and the principled policy [7]. In the distribution of companies, three options are as follows:

- Exclusive distribution: In this way, an intermediary is selected as an exclusive agent in each region. In this strategy, the number of intermediaries is much lower than other types of distribution and is used more specifically for special products such as cars and special clothing.
- Selection distribution: Retailers were selected to offer some productions. The number of mediations is less than mass distribution and more than exclusive distributions. These strategies are for accessories [9].
- Mass distribution (capillary broadcasting): This strategy, which includes the distribution of products in a large number of retailers, is most commonly used in the field of consumables and everyday consumer goods. This is the most appropriate way to distribute consumer products [10].

Capillary distribution is the delivery of products to the latest vendor. The capillary distribution is inspired by the circulatory system in the body of living beings. Thus, according to the anatomy of the human body, the circulation begins in the body from the heart and then through the arteries, the arteries flow through the capillaries in all parts of the body. The remarkable thing is that flow and stream from the heart begin as a continuous and always active center, and this is a key point in the distribution of the capillary of goods and services. That is, by simulating the body's circulatory system, a stream of fresh and hot blood at all times of the day and for many years, by arteries, are being continuously sent from the jaw to the smallest capillaries of the body, and of course some of it is returned by the vein. It can be argued that capillary distribution is a way to start a distribution of goods and services from a center that can be either a company or any of its dealers, and begin a continuous, permanent, and uninterrupted stream. All distribution channels raised from the manufacturing company to retail, and kiosks all form a physical distribution system that start from the heart and ends up capillaries. Therefore, it can be stated that the capillary distribution is a method that must be developed from a center that can be either a company or any of its agents to distribute goods or services and start a continuous and uninterrupted stream, which is pointed out by Antonio and Roberto [11]. In order to achieve this goal, it is necessary to pay attention to many points and factors that one of the most important factors is attention to the human resources in the capillary distribution channel. In capillary distribution, companies, like many other sectors, have an important and inevitable focus on human resources and the proper use of this resource. Therefore, to have a capable organization, having a sufficient number of employees at the right time, is a very important factor in meeting the needs of customers. Human resource planning is an interdisciplinary activity and it requires a combination of statistical, economic, psychological, social, and scientific knowledge of managers and planners for efficient management. This activity is indeed an essential mechanism for effective management because the first job in human resource planning, is determining the number and type of people needed by the organization for the moment and prediction it for the future [12]. Because one of the most important tasks that constantly puts a heavy burden on human resources is to maintain optimal human resources [13]. Moreover, workforce planning is a sensitive issue in production and service environments in order to provide suitable working hours for employees, in accordance with employer's goals and employee preferences, as much as possible [14].

2. Literature Review

In this regard, the review of the research background in the distribution of companies indicates that the attention to the importance of the role of human resource planning has not yet been taken into account, and despite the significant role that distribution activists have in increasing liquidity and reducing the risk of customer losing and impacting their plans, their scheduling and timing have been neglected. Optimized staff schedules can provide enormous benefits, but require carefully implemented decision support systems if an organization is to meet customer demands in a cost-effective manner while satisfying requirements such as flexible workplace agreements,

shift equity, staff preferences, and part-time work. In addition, each industry sector has its own set of issues and must be viewed in its own right [15]. Manpower scheduling is a challenging problem in production and service environments. The ultimate purpose of manpower scheduling is equitable allocation of working hours/shifts to employees considering work regulations, legal constraints employers' objectives, and employees' preferences. A proper schedule leads to efficiency increase, maximum utilization of resources' capacity, decrease of time required to finish the works, and profitability increase in each organization [14]. The origin of manpower planning and scheduling is traced back to the Edie [16] work on traffic delays at toll booths. Afterwards, manpower scheduling methods have been used in different application areas. Generally, the optimal employee/shift scheduling problem arises in some situations with a variety of service delivery settings, such as telephone companies, airlines, hospitals, banks, police departments, transportation companies, fire departments, etc. [17]. Hertz [18] proposed a multiple-shift workforce planning under annualized hours in a Switzerland's company. The model takes into account laws and collective agreements that impose constraints on overtime and holidays. Computational experiments on a real-life problem demonstrate annualizing working hours is a good economical way of adjusting productive capacity to seasonal demands and obtaining flexibility in the distribution of annual working hours. A multi-objective manpower scheduling model regarding the lack of clarity on the target values of employers' objectives and employees' preferences was proposed by Shahnazari [13]. The problem of manpower scheduling in break times for employees working in Mixed Model Assembly Lines (MMALs) has investigated by Hasani-Goodarzi et al. [19]. Amin-tahmasbi and Mohseni [20] studied a multi-objective scheduling problem of traffic police. The results indicated that the rotary multiple shift system is more efficient than fixed shift system and total cost decreased about 20 percent. Asgari [21] proposed innovative genetic algorithms model to solve the problem of the professors' educational planning considering students' opinions. Modeling the nurse scheduling in different shifts in order to decrease the overtime of each nurse and increase the efficiency proposed by Nasrollahi [22]. Pak Seresht et al. [23] studied a fuzzy modeling airline crew scheduling problem and solving by particle swarm optimization. The results concluded by Lingo software showed the efficiency of scheduling model assigning staff to predetermined missions. In Adem and Dagdervuren [24] study, the tour scheduling was taken into account that consists of shift and days off. The proposed approach is the modeled 0-1 mixed integer programming. To solve this problem, optimization software tool called GAMS was used. An Integer Programming (IP) formulation for the staff scheduling problem encountered an Emergency Medical Services (EMS) system proposed by Vermuyten et al. [25]. Using a two-phase fuzzy multi-objective linear programing for selecting supplier and order allocation problem proposed by Nazari-Shirkouhi et al. [26]. The staff scheduling in job rotation environments considering ergonomic aspects and preservation of qualification was presented by Hochdorffer et al. [27]. Finally, Leggate et al. [28] proposed modeling crew scheduling in offshore supply vessels. As a result of the study, staff scheduling which considers employee health and safety in context of ergonomics and keeps labor cost as low as possible was obtained. Literature view indicates that staff scheduling in distribution

section which has an important effect on other sections of companies has been ignored. So, this study tries to propose a new bi-objective mixed integer linear programming model for scheduling capillary marketing channel's members of Guilan province's Pak dairy company in one month base on their experience. Minimizing the firm's costs and maximizing its sell in this sector as aims are pursued. In the final step, the presented model is solved by GAMS software and the results is analyzed.

3. Problem Statement and Mathematical Modeling

Flexibility for correct use of human resources is one of the most important issues which today's organizations face with; particularly, in advanced economies, the workforce flexibility is one of the best ways to respond to fluctuations in demand [29]. Staff scheduling is a process for designing an efficient and possible work timetable for employees by considering staff and organization's condition and work regulations to response the organization's work demand. Providing the best table which often is a part of discrete optimization needs an effective and efficient approach [30]. On the other hand, scheduling the distribution staff creates an opportunity for the management to use the employees in an optimal way and manage costs as well. Moreover, in concept, the equations are designed in a way that provide more possibility to connect with customers' network, so create an opportunity to making management aware of their necessities in order to provide their satisfaction. Thus, in this paper, a Mixed Integer Linear Programming model (MILP) for scheduling Pak's pasteurized dairy staff based on their experience in one month is proposed. The objective functions of the proposed mathematical model are trying to minimize labor costs and increase sale. Firms costs are divided into 3 parts: Fixed costs (salary), variable costs (overtime works, lunch and commuting costs), and insurance that consists of fixed and variable costs. Marketers are grouped in tow: Experienced (3 people) and non-experienced (17 people). Because the experienced staff at the time of receiving and processing the same order quantity is better than less experienced, and their currency volume of sale (sale's value) is better than others, it's important to note that the amount of sale that is independent of the number of factors but it depends on the number inserted in the invoice. Also, the issue's assumptions are as follows: Receiving and processing each order every day should be answered in a working time equal to or less than the time it is considered per employee per day. Any worker faces with an overtime day limitation. The company also needs a certain amount of stuff every day that the number of people cannot exceed the maximum amount per day at the same time, the minimum number of people on ordinary days, and overtime should always be considered as a constraint. The total amount of sales of each employee during each month should not be less than the target amount set for each employee. Because selling on an overtime day is not like a normal day, it is not possible to use all employees on an overtime work day for the company because the overhead costs are imposed on the company. Ordinary working days cannot be lower than the minimum for each employee. Indexes, parameters and variables are defined as follows: (I) indicates employee index ($I=1, 2\ldots N$). ($I1$ & $I2$) are defined as experienced and non-experienced employee index, respectively. (P) is days of month index which is divided into three categories.

(P_d) shows the ordinary day index, (P_e) indicates overtime day index, and (P_h) is holiday index (Friday). Finally, J demonstrates different conditions index like the holiday (J_h), ordinary day (J_d), and overtime index (J_e). Holiday is Friday that sales equal to zero. Overtime day is a day that is a holiday based on the calendar but due to some customers such as supermarkets and hypermarkets' demand goods, the firm should work on those days. The company does not employ all employees on overtime day because as mentioned, the mas of selling is not the same as ordinary days and they have to pay overtime these days, therefore, it is not economical that all employee work at overtime days.

In following parameters are defined: The fixed cost of assigning an employee per day is denoted by (F_c) and the variable cost of assigning an employee on day (*P*) with *(J*) status is defined by (V_{ijp}). (M_{i1jp} & M_{i2jp}) demonstrate experience employee sales on (*P*) day with (*J*) status and non-experience employee sales on (*P*) day with (*J*) status, respectively. (N_{i1jp}) is defined as order quantity (invoice issued), an experienced employee on day (*P*) with status (*J*) while order quantity (invoice issued), a non-experienced employee on day (*P*) with status (*J)* is shown by (N_{i2jp}). (*Li*) is minimum sales per employee per month. (*C*) shows percentage of the sale and (*E*) is the percentage that firms pay for insurance. (B_i) represents the upper bound for the maximum days of overtime for each employee per month. (a_{i1} & a_{i2}) denote the amount of time required to process each order by an experienced employee and the amount of time required to process each order by a non-experienced employee. The minimum number of people required for ordinary and overtime day is shown by (Q_P) also (G_P) is defined as the minimum number of people required for the ordinary day. (O_P) is the maximum number of people who can work on an extra day. (W_P) represents the minimum ordinary working days for each employee during the month. Therefore, the maximum work time per employee per ordinary day is (R_{ip_d}) and the maximum work time per employee per overtime day is (R_{ip_e}). In this modeling, five decision variables are defined as follows:

(X_{i1jp}, X_{i2jp}) are the binary variables, so if employee i_1 on day *p* is in position *j* is equal to 1 and otherwise 0, and if employee i_2 on day p is in position j is equal to 1 and otherwise 0. (K_{i1pd}, K_{i1pe}, K_{i2pd} & K_{i2pe}) are time to receive orders on the market by an experienced employee on an ordinary day, time to receive orders on the market by an experienced employee on an overtime day, time to receive orders on the market by a in-experienced employee on an ordinary day, and time to receive orders on the market by a non-experienced employee on an overtime day, respectively.

This model consists of two main functions, the first objective (Equation 1) attempts to minimize company's costs in the distribution sector. It includes four sections: The first section tries to minimum sales costs for two groups of marketing (experienced and non-experienced) which is calculated based on the percentage of sales to sales; in the second part of the function, the fixed costs assigned to each customer (monthly salary) are minimized; in the third part, the variable cost of each employee, including (overtime, lunch) will be minimal; and in the fourth and final

part, the insurance cost of each employee, which is a percentage of the fixed cost combination and sales reward, will be minimized. The second goal (Equation 2) is trying to maximize the number of sales. Function of the two purposes is different. One of them is about cost and the other one is about number of sale. Moreover, we have proposed second objective function because we follow a goal more than maximizing the sale. By presenting second function we want to improve the distribution channel's relationship with customers and increase the customers' network.

$$\begin{aligned} minZ1 = [\ & (\sum_{i1\epsilon I}\sum_{j\epsilon Je\cup Jd}\sum_{p\epsilon P} x_{i1jp} * M_{i1jp} * C) + (\sum_{i2\epsilon I}\sum_{j\epsilon Je\cup Jd}\sum_{p\epsilon P} M_{i2jp} * \\ & C) + (\sum_{i\epsilon I}\sum_{j\epsilon J}\sum_{p\epsilon P} x_{ijp} * F_c) + (\sum_{i\epsilon I}\sum_{j\epsilon Je\cup Jd\cup Jh}\sum_{p\epsilon P} x_{ijp} * V_{ijp}) + \\ & (((\sum_{i1\epsilon I}\sum_{j\epsilon Je\cup Jd}\sum_{p\epsilon P} x_{i1jp} * M_{i1jp} * C) + (\sum_{i1\epsilon I}\sum_{j\epsilon J}\sum_{p\epsilon P} x_{i1jp} * F_c)) * e) + \\ & (((\sum_{i2\epsilon I}\sum_{j\epsilon Je\cup Jd}\sum_{p\epsilon P} x_{i2jp} * M_{i2jp} * C) + (\sum_{i2\epsilon I}\sum_{j\epsilon J}\sum_{p\epsilon P} x_{i2jp} * F_c)) * e)] \end{aligned} \quad (1)$$

$$\text{maxZ2} = \sum_{i1\epsilon I}\sum_{j\epsilon Je\cup Jd}\sum_{p\epsilon P} x_{i1jp} * M_{i1jp} + \sum_{i2\epsilon I}\sum_{j\epsilon Je\cup Jd}\sum_{p\epsilon P} x_{i2jp} * M_{i2jp} \quad (2)$$

s.t.

$$\sum_{j\epsilon Jd} a_{i1} * N_{i1jp+} k_{i1jp} \leq R_{ip} \qquad \forall i_1, p\ و\ j\epsilon Jd \quad (3)$$

$$\sum_{j\epsilon Je} a_{i1} * N_{i1jp+} k_{i1jp} \leq R_{ip} \qquad \forall i_1, p\ \ j\epsilon Je \quad (4)$$

$$\sum_{j\epsilon Jd} a_{i2} * N_{i2jp+} k_{i2jp} \leq R_{ip} \qquad \forall i_2, p\ و\ j\epsilon Jd \quad (5)$$

$$\sum_{j\epsilon Je} a_{i2} * N_{i2jp+} k_{i2jp} \leq R_{ip} \qquad \forall i_2, p\ و\ j\epsilon Je \quad (6)$$

$$\sum_{j\epsilon Je\cup Jd}\sum_{i\epsilon I} x_{ijp} \geq Q_p \qquad \forall p \quad (7)$$

$$\sum_{j\epsilon Jd}\sum_{i\epsilon I} x_{ijp} \leq G_p \qquad \forall p \quad (8)$$

$$\sum_{i\epsilon I}\sum_{j\epsilon Je} x_{ijp} \leq O_p \qquad \forall p \quad (9)$$

$$\sum_{j\epsilon Jd}\sum_{p\epsilon p} x_{ijp} \geq w_p \qquad \forall i \quad (10)$$

$$\sum_{p\epsilon P}\sum_{j\epsilon Je} x_{ijp} \leq b_i \qquad \forall i \quad (11)$$

$$\sum_{j\epsilon J}\sum_{p\epsilon P} M_{ijp} * x_{ijp} \geq L_i \qquad \forall i \quad (12)$$

$$X_{ijp}\epsilon \{0،1\} \qquad \forall i, j, p \quad (13)$$

$$k_{i1pd}، k_{i11pe}\ ،\ k_{i2pd} \text{ and } k_{i21pe} > 0 \quad (14)$$

Eqs. (3) to (6) state that the responsibility of each marketer, including the receipt and processing of orders, must end at least equal to or less than the hours worked per employee per day. The

remarkable thing is the amount of working time per day that is the same for both experienced and inexperienced worker groups. Constraint 7 appoints a lower bound to the requisite number of the employee for each ordinary and overtime day. Constraint 8 determines an upper bound to the requisite number of the employee on an ordinary day. Constraint 9 indicates that there is an upper bound to hire employees on an overtime day. Constraint 10 proposes a lower bound to minimum ordinary days for each employee. Constraint 11 appoints an upper bound to maximum overtime day for every employee during the month. Constraint 12 indicates that the total sales for each employee cannot be lower than the determined amount. Constraint 13 shows binary variables; for example, an employee with j condition on p day works, it is 1, otherwise, it is 0. Constraint 14 shows non-negative variables. Defining each of these constraints for creating a rational model is necessary because by eliminating any of them, the model will lose its logical and economic purpose.

4. Solving Mathematical Model

Workforce scheduling aims to find employee shift arrangements to match a time-varying customer demand for service while keeps costs under control and satisfies all applicable regulations (e.g. shift lengths and spacing of breaks). In this regard, it is important to note that the company is a dairy company. Accordingly, depending on the type of service and its customers, the scheduling of employees is different from that of manufacturing companies or organizations that operate 24 hours a day. The problem is a mixed integrated linear programming model MILP solved by GAMS. The reason for choosing this software is that GAMS software is designed in the general mathematical modelling system and specifically used for modelling and solving linear, nonlinear, complex, and other types of optimization problems. The special application of this software is to solve complex models, especially in large scale. Although the models solved by this software have high data volumes, the time spent on processing them is negligible. In addition, making the next necessary changes, or converting a model to another, is done with this software simply. The GAMS software is a powerful and comprehensive tool for solving even large-scale mathematical that plays a bigger role in engineering. That is, wherever we need to make optimal decision-making with time, cost, and resource constraints, the mathematical modelling should be used. The GAMS is a very effective tool for solving these types of models. Due to the capabilities of this software and the features of the issue, GAMS has been chosen as a tool for solving the model. In the following, based on company's policy and states of determined month, every employees has to be present at his job except days p_5, p_{12}, p_{19}, p_{26} which are Fridays. Table 1 shows the staff attendance status during the month after solving by GAMS software.

Table 1. Optimum mode of attendance or absence of staff during the months of the month.

Days	Attendance Status	Employees
p_5, p_{12}, p_{19}, p_{26}	0	For all
p_1-p_4, p_6-p_7, p_9, p_{11}, p_{13}-p_{14},p_{16}-p_{18},p_{20}-p_{22},p_{24}-p_{25},p_{27}-p_{30}	1	For all
p_8	0	For a_2,a_4,a_5,a_6,a_{10},a_{15},a_{16}, a_{19}
	1	For others
p_{10}	0	For a_1,a_9,a_{13},a_{14},a_{15},a_{16},a_{18}, a_{20}
	1	For others
p_{23}	0	For a_2,a_3,a_7,a_8,a_{11},a_{12},a_{17}, a_{20}
	1	For others

Table 2. Average time to receive orders on the market on an ordinary and overtime day for non-experienced and experienced employee.

	$\bar{k}_1$	$\bar{k}_2$	$\bar{k}_3$	$\bar{k}_4$
a_1			463	492
a_2			464	493
a_3			465	486
a_4			462	490
a_5	510	524		
a_6			465	489
a_7	507	528		
a_8			465	492
a_9			462	496
a_{10}			465	500
a_{11}			466	494
a_{12}			467	496
a_{13}			465	499
a_{14}			462	499
a_{15}			465	498
a_{16}			463	488
a_{17}			465	500
a_{18}	509	531		
a_{19}			465	487
a_{20}			463	489

Tables 1 and 2 represent the optimal mode after solving the MILP model problem using the GAMS software. The problem is modelled for two groups of experienced and non-experienced marketers. It is solved as optimal as possible by taking into account its objectives and constraints, so that, you can see a 10% increase in sales, in addition, the same percentage of costs was reduced. As stated earlier, the sales of these two groups of marketers are different from each

other, so that the experienced group gets better results than the other group. In this case, it can be concluded that experience and education play a key role in the company's profitability. Because if the profitability of all members is the same as each other and at a higher level while the second target is well covered, can be seen the effect of these results on the first objective function that considers the least costs. Conceptually, the results are that: With increasing sales, the first part of the first objective function that is trying to minimize sales revenues increases, but this is justified by the fact that the effect of fixed costs, the second part of the objective function is reduced by increasing sales and profitability. Meanwhile, the increase in the number of sales in the second objective function has largely gained the satisfaction of the company executives and reduced the effect of increasing the amount of sales reward. Table 1 summarizes the status of employee attendance on different days of the month before the settlement. As you can see, all employees have to be on the job every day except Fridays. Also, by examining Tables 1 and 2, which refer to the optimal summary of employee attendance in the various days of the month after the solving, and the average amount of time employees spend on order placement on the market, respectively, the effect of goals and constraints on numerical results is observable. To illustrate this, let's mention an example of each of the Tables 1 and 2. As stated earlier, Table 1 shows the optimal mode of employee attendance on different days of the month. Therefore, it is evident that all marketers must be present on all days, except Fridays and there are limitations to employ them in overtime work days, eighth, tenth, and twenty-eighth, which in Eqs. (7) and (9) state to the lower boundaries of the presence of employees on ordinary days and overtime days and the limit of their presence on an overtime day, respectively. Table 2 according to the second objective function, increasing the sales value, and the constraint 10 which corresponds to the minimum number of ordinary days that each employee has to attend during the month, and the minimum sales for each marketer mentioned in Eq. (12) took this shape. Because by eliminating any of these items model to minimize costs to the extent possible, it will plan for the absence of staff and in this way, the issue will have no economic and logical justification. Table 2 also shows the average amount of presence of each of the two groups of employees on an ordinary and overtime day to receive orders from the market, which was discussed in Eqs. (3) to (6). Considering the fact that the amount of time that experienced employees spend for processing each order is less than non-experienced employees, in the same way, the amount of order receipt time (K) will also be different. So that by issuing the same amount of invoice for both groups, the amount of processing time of the total issued invoices is different. For example, if an experienced employee and a non-experienced employee, both on an ordinary day, issue about twenty-two invoices considering the different values of a (processing time of each order). A total amount of processing times for an employee with experience of about eighty eight minutes and for a non-experienced employee will be about one hundred and thirty two minutes, which is due to the constant value of 600 minutes for R. The total times for receiving orders for an experienced employee is about five hundred and twelve minutes and for a non-experienced employee, it is about four hundred and forty-nine minutes. The closest numbers to these values are shown in Table 2.

5. Conclusions and Future Trend

The study was conducted to optimize the costs and sales volume of the capillary distribution division of Pakistani Dairy Company in Guilan province, and as the analysis of the results, the model was aimed at achieving the desired goals and constraints. This model examined only the data of a month in the company, but the stated problem was capable to generalize to other months of the year or other parts of the company, and even to various companies and industries, especially those operate in a single shift, for example, banks, insurance companies, and similar organizations. The only thing to note is that the upper or lower bounds of each constraint must be determined according to the calendar and conditions of each month as well as the individuals of each section. For example, for a month with fewer or more days off, or a section of the company with a different number of employees, the conditions will differ in other ways. As future research, the number of forces in the company now provides the necessary coverage for a large part of the province but this number of forces is not enough to cover the entire province, so finding the maximum number of people to complete the entire coverage of the province as a target can be investigated. The following constraints can also be added to work in future studies: Satisfaction limitation, some employees may not be satisfied with the division of the days to be used or not for any reason, hence this issue as a constraint should be considered in future research. It is possible to divide the employees of this division into five groups so that in each group one person is considered as a supervisor. In this way, there should be a limitation on this issue that in one day at the same time the supervisor of the group and a member of the group cannot go on leave, or if the conditions are inevitable, the company would have a solution for this position. Satisfaction constraint, perhaps some employees are not satisfied with this planning for working or not working on some days, therefore, for future modelling, this issue should be taken into account as a constraint. Employees can be divided into four groups contain four marketers and a supervisor. Therefore, applying an equal to stating this rule that supervisor and an employee are not permitted to have a day off together as a constraint is necessary, or if it is inevitable a solution can be presented.

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