Journal of International Trade, Logistics and Law, Vol. 3, Num. 1, 2017, 11-21

PERFORMANCE-BASED TASK APPOINTMENT MODEL IN URBAN PUBLIC TRANSPORTATION: THE CASE OF IETT

Ahmet Fuat Taşdemir, (MSc)

Istanbul Commerce University, Turkey

İsmail Ekmekçi, (Prof.)

Istanbul Commerce University, Turkey

Received: Jan. 14, 2017 Accepted: Jan. 23, 2017 Published: June 1, 2017

Abstract:
Provision of quality services in urban public transportation has become a significant field of research to be analysed separately, particularly for metropolitan cities where population and other components of traffic are rapidly increasing. Quality of public transportation operators can be figured out with the help of various parameters. Among those, human resources undoubtedly have a significant role. Fulfilment of operators' strategic aims and targets is in direct proportion to performance and satisfaction of employees.

With an innovative approach, this study aims to suppose a new, performance-based task assignment model that grounds on the target to achieve a fair work distribution by analysing General Directorate of IETT's current "task assignment process for drivers", which manages urban public transportation of Istanbul Metropolitan City. This model identifies specific performance indicators and gives points to the drivers according to competency. New software has been developed with an algorithm to allow drivers to choose the routes they will work on, depending on their competency points. With 184 drivers, 22 routes and 135 buses, IETT Sarigazi Bus Terminal has been chosen as the pilot area of this new idea of "self-appointment".

Keywords:
IETT, Urban Public Transportation, Motivation, Rewarding, Performance Evaluation, Staff Scheduling, Preference

1. Introduction

As the most crowded city of Europe, Istanbul is one of the most significant centers of trade and thus transportation, with an approximate population of 15 million and a ridership of 28 million. Provision of quality services in urban public transportation has become a significant field of research to be analysed separately as the living areas within the city has expanded towards the outer sides and the current urban transportation system has fallen behind the developments. Quality of services is a significant fact for public transportation operators and this fact is composed of various parameters. Among these parameters, human resources and management undoubtedly have significant roles.

The concept of human resources management has evolved to a different level within the last years. Organizations has been aware of the fact that an efficient management of human resources is a key factor to succeed, to survive and even step forward within the modern competitive market. Organizations can be carried to success by the achievements and performances of people (employees). Today a number of organizations are allocating great amounts of budgets to ensure employees' satisfaction. The reason is the idea that an increase in satisfaction will lead to better motivation, efficiency and loyalty.

Satisfaction and performances of employees can only be obtained in a peaceful working environment. Providing such an environment requires challenging processes and high performance of management. Modern and innovative organizations apply performance-based management systems to increase employees' satisfaction and performance. Performance based management systems develop a competitive but fair environment, enable self-evaluation of

employees and take necessary steps to make up deficiencies. On the other hand, performance based management systems also reward employees with high performances in various ways, following an evaluation process. These rewards are generally given as premiums in addition to wages.

This study brings a different perspective to rewarding and creates a new model called as "self-appointment" that enables employees to choose the routes they will work on, according to monthly performance values. Within the scope of this performance-based task assignment model that grounds on the target to achieve a fair work distribution by analysing General Directorate of IETT's current "task assignment process for drivers", IETT Sarigazi Bus Terminal have been chosen as the pilot area of this new idea of "self-appointment", with its 184 drivers, 22 routes and 135 busses.

2. Staff Scheduling

Staff scheduling is one of the key components of planning processes for both public and private organizations. Besides the budgetary aspects, this process should also be considered with its emotional side as it directly related with humans. Due to the advances in technology, today's work force scheduling has been concentrated upon the minimization of costs and this fact has led to a number of new research studies.

Staff scheduling does not only consist of creating schedules of shifts and daily tasks, but also aims to preserve quality of services, provide satisfaction for both customers and employees. Organizational and legal amendments, competency and preferences of employees, labor demand and many other factors complicate the staff scheduling process. The optimum staff scheduling should be as effective as possible in task appointment. In this way costs will decrease while employees and customers become more satisfied.

Today, organizations need auxiliary tools within decision-making processes to ensure high levels of employee satisfaction, for the true employees and in true periods of time, with a true cost as well. This auxiliary system would typically include various components such as electronic tables and database tools created with mathematical models and algorithms.

A large number of commercial software packages are available to help organizations in this context. Particularly in our field, which is the field of transportation, a Canadian company (Hastus) provides staff scheduling, operation management and reporting services while a Germany-based software (IVU) brings all scheduling and appointment functions together for the staff and vehicles in a single system that is widely used in all Europe. South American countries, on the other hand, frequently use a Spanish software (Goal System). This software, as all the others do, provides an optimum bus and driver optimization.

A large number of studies have been conducted on staff scheduling methods since 1950s. For this reason, there is also a large quantity of resources in this field, available within the literature. The first study was conducted by Edie (1954) on sufficient numbers of cabinet operators to meet various service requirements during different times of the day. Dantzig (1954) focuses on linear programming to create time schedules for vehicle cabinet operators and has conducted many other research studies to apply this approach to larger-scaled problems. Aggarwal (1982) explains staff planning processes, specific restrictions and solutions in the field of service industries. Another research compares workforce scheduling programs with intuitive methods and linear programming methods (Bechtold, 1991). Al-Tabtabai and Alex (1997) discuss how a construction company dealing with multiple projects could apply genetic algorithm methods to appoint workforce for a specific problem. Aickelin (1999) analyses problem-specific knowledge to develop a genetic algorithm approach for a problem in appointing nurses. Main theme of this study is balancing feasibility features and the cost of solutions. Typical genetic algorithms may yield negative results. In order to prevent these negative results, problem-specific information should be introduced to the problem in different ways. The most effective variant of the algorithm supposed in this study revealed a possibility over %99 of producing an optimum solution (Aickelin, 1999).

3. Performance Evaluation and Rewarding

Performance evaluation is a system that manages organizational performance evaluation processes including measuring employees according to the criteria determined within the light of aims and competencies, having feedbacks and conducting reporting procedures. Performance Evaluation System is a tool that is used by organizations to measure individual performances and to help employees deliver outstanding performances.

Fındıkçı, İ. (1999) states that "performance evaluation aims to evaluate individuals as a whole, considering all relevant aspects, to reward successful ones and to give opportunity to make up deficiencies". The main principle of performance evaluation is not to punish individuals due to failures but to reward them after achievements.

Performance evaluation is also a procedure to collect organizational data relevant to the level of performance delivered by an employee during work hours (Waxin and Bateman, 2009). It is also a process that is used to value and thus contribute to task performances of individuals. Performance evaluation is a part of performance management systems that depends on the targets determined together with employees. Performance evaluation is described as a system of periodical controls that evaluates employees' performance levels in specific tasks and creates an opportunity for an early response (Jordan, 2009).

3.1. Performance rewarding

Rewarding is a significant motivator that should be emphasized when individual performances are discussed. Rewarding includes appreciations for hard works, growth and development. In other words, rewards are acquisitions of an employee as a result of delivering a better performance than expected in a specific task. According to Lundy and Cowling (1996), the concept of reward includes both direct labor wages and indirect acquisitions of employees. These rewards are the wages given for the efforts and capabilities of employees in line with the contract signed between employer and employees and described as external rewards. On the other hand, organizational rewards include internal rewards such as status, admiration, company membership, safety, career, development, sense of appreciation and success.

Rewarding is not only based on material values. This system is related with both internal and external motivation that includes monetary and non-monetary rewards. A research study conducted in United Kingdom regards the connection between wages and performances as a significant and indispensable concept for the employer and professional staff (Armstrong, 1993).

4. A Different Perspective in Rewarding: Performance-Based Task Appointment Model

With an innovative approach, the supposed model aims to create a new, performance-based task assignment model that grounds on the target to achieve a fair work distribution by analyzing General Directorate of IETT's current "task assignment process for drivers", which manages urban public transportation of Istanbul city.

This model identifies specific performance indicators and competency points that will be given to the drivers according to the data of task completion during the operation period. New software has been developed with an algorithm to allow drivers to choose the routes they will work on, depending on their competency points. With 184 drivers, 22 routes and 135 buses, IETT Sarigazi Bus Terminal has been chosen as the pilot area of this new idea of "self-appointment".

Aims of the suggested system are as follows;

- To systematize task writing,
- To ensure "a fair distribution of work",
- To create a "transparent" structure,
- To "increase competitiveness" with the point scoring system,
- To obtain better "labor efficiency" by increasing performances,
- To increase motivation, satisfaction and knowledge of employees,
- To ensure the "peace in working environments",

- To increase "customer satisfaction",
- To improve quality of services.

4.1. Determining and weighting performance criteria

Strategic aims and targets of the organization, potential improvements in quality of services and labor efficiency as well as potential contribution to employees' skills and development were the factors considered during the determination process. As a result, seven staff performance criteria that can be called shortly as SMART (Specific, Measurable, Acceptable, Realistic, Temporal) were identified. All of these criteria are numerically measurable.

These performance criteria were weighted by thirteen experts within the relevant field, with the use of AHP (Analytic Hierarchy Process). As a result, competency points were obtained for each employee. Employees have an access to their competency points and can make objections about the points through the "e-şoför" (e-driver) system. This transparent approach facilitates participation of the staff and creates an opportunity for a timely response in cases of mistaken data entered into the system.

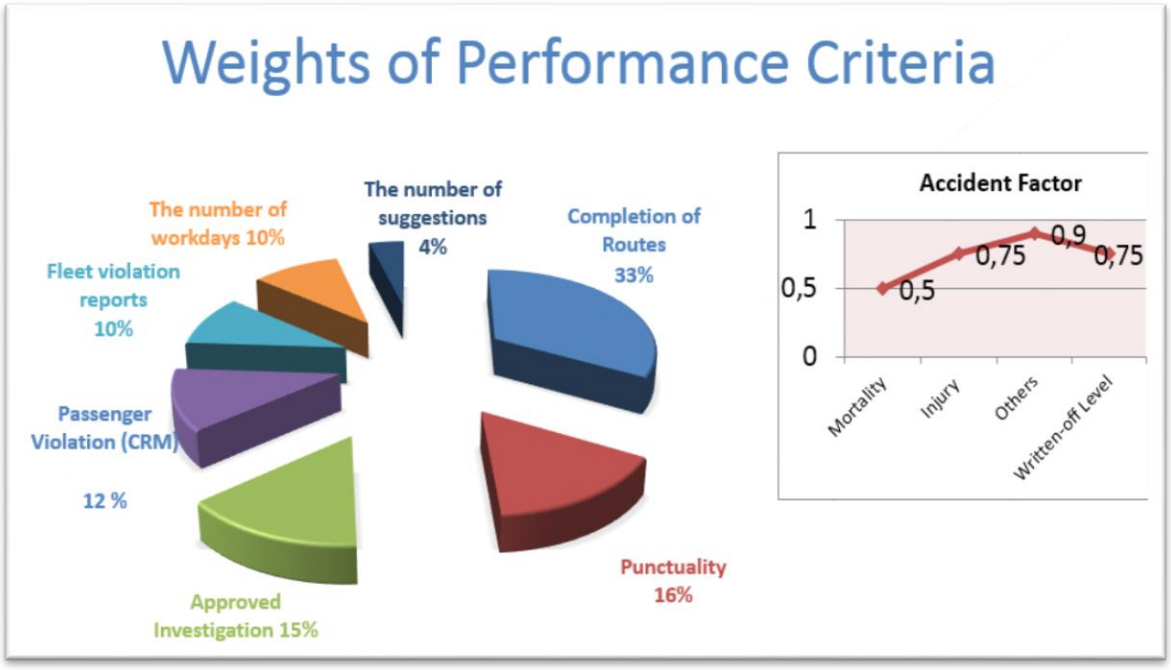


Figure 1 Weights of performance criteria

Route completion: Route-km completion has the largest weight (%33) among all the criteria. This term describes the rate of completed services, excluding the lost operational kilometres (completed km/planned km).
Punctuality: This term explains completion of services in time. This rate is obtained through the AKYOLBIL system managed by Fleet Managers that controls the punctuality of vehicles (-1, +3 minutes) and conformity with the scheduled durations between source and destination points.
Approved investigation reports: This term describes the reports about violations that impair the quality of public transportation.
Passengers' satisfaction (CRM): This data is obtained through passengers' complaints about drivers' violations during the operation of public transportation services.
Fleet violation reports: These reports are prepared by the Fleet Management Center about violations conducted by the drivers within the period between beginning and end of services.

The number of workdays: This is the number of days when drivers are expected to work during a month. For this model, the number of workdays that might affect employees' performances was determined as 22, excluding weekends and off-days. Exceptions about the staff were not considered within the scope of this measurement.
The number of suggestions: These are suggestions related with significant points identified by drivers during the operation of public transportation services and aim to improve the quality of services. Each employee is supposed to report at least one suggestion.

The accidents, which are highly critical for operators, were included as a general factor (multiplier) within the study. In addition, seniority years were not considered within the study but occasionally used to differentiate employees with same points and preferences.

4.2. Software development (SIS)

SIS application was developed using asp.net on Microsoft .Net platform. C# was used as the software language and the front interface was created using various techniques including JavaScript, html (Hyper Text Mark-up Language), Ajax (Asynchronous JavaScript and XML), css (Cascading Style Sheets), and query. The application was developed in a multi-layered structure and consists of three different layers, namely data layer, business process layer and presentation layer.

Data layer of the application operates on the MS SQL Server. Database object models were designed during the development process of the data model, using the Sybase Power Designer tool. The project was hosted by Windows Server 2012 on the ISS (Internet Information Services) and opened to public access after necessary penetration tests were conducted.

Through this application, drivers who work for the Regional Directorates of IETT may choose;

- Bus routes they demand to work on,
- Type of services (with rest breaks, direct, morning single, evening single),
- Off-days (rest days),
- Type of substitute driver (in normal services: a partner driver).

To summarize, drivers have a right to choose all preferences that do not negatively affect the services through this application.

4.3. Pilot Scheme

With 184 drivers, 22 routes and 135 buses, IETT Sarigazi Bus Terminal has been chosen as the pilot area of this new idea of "self-appointment". In order to properly test this new model, meetings were held to discuss current progress of the system and to exchange ideas with the significant shareholders of the General Directorate of IETT, labor unions.

Then, a training schedule for drivers was created. Training programs were designed to allow groups of ten participants in order to ensure better understanding of the topics. The participants were informed about the advantages of this system both for the staff and the organizations. On the other hand, training programs were used to break the resistance of the staff, particularly encountered during the periods of transition. Giving necessary information for the shareholders and completing the training programs, the process was furthered with the phase of preferences.

4.4. Test phase and measurement of service points

The process was divided in two phases as 1st and 2nd Terms of Preferences to be done according to performance points. If 75% of the staff is appointed in 1st Preference Term, 2nd Term will not be carried out.

As the preferences were considered for the first time with this model, which is based on monthly performance points, the placement process was carried out according to the average points of the last six months. Moreover, there was not any list of base points for the services as it was to be the first term for determining preferences.

After the necessary preparations for the software were completed, employees were asked to choose their preferences to test the model. As a result of the test phase of preferences, 60% of 184 employees working for Sarigazi Terminal were appointed to preferred tasks after the 1st and 2nd Preference Terms, while rest of the staff was randomly placed into remaining services.

Employees decided their preferences after analyzing the preference lists which contain all details about relevant services. In the 1st Preference Term, 51% of all employees were appointed to the services they preferred. However, a 2nd Term was carried out as the 75% condition had not been fulfilled. Appointment process was concluded after the 2nd Placement which was done randomly in line with certain restrictions and criteria. Analysis of the preference process is given in Table 1.

Table 1. Benchmark test results of worker placement test analysis

SARIGAZI TERMINAL PERFORMANCE-BASED PLACEMENT ANALYSIS						
Number of participants	Preferential Placement				Random Placement	Alternate
184	111				54	19
Order of Preference	1st Placement		2nd Placement			
	95		16			
	Normal	With Rest Breaks	Normal	With Rest Breaks		
	32	63	8	8		
1st Preference	10	16		5		
2nd Preference	8	8	4	1		
3rd Preference	4	8		1		
4th Preference		7		1		
5th Preference	2	4				
6th Preference		3				
7th Preference		3				
8th Preference	4					
9th Preference	2		2			
10th Preference		1				
11th Preference		2				
12th Preference		2				
13th Preference		4	2			
14th Preference	2	3				
15th Preference		2				
TOTAL	32	63	8	8		

Base points of services were also determined according to the results obtained through the test process (Table 2). These base points revealed most preferred types of services and thus contributed to the actual preference process.

Table 2. List of service points

Workday							
Route Number	Service Number	Service	Duration	Beginning of the Service	End of the service	Terminal	Point
11	761	11/761/With Rest Break	480	05:45	19:00	ALTUNİZADE	85,83333
11	770	11/770/Station Line	480	15:15	22:30	YENİDOĞAN	87,16667
11	769	11/769/Station Line	480	06:50	14:00	YENİDOĞAN	87,5
11	771	11/771/With Rest Break	480	07:10	20:10	YENİDOĞAN	89,83333
122D	6174	122D/6174/Station Line	440	16:00	22:30	SARIGAZİ GARAJI	61,83333
122D	6175	122D/6175/ With Rest Break	475	06:30	20:10	Ş.ŞAHİNBEY	86,83333
122M	6215	122M/6215/ With Rest Break	480	06:30	19:00	Ş.ŞAHİNBEY	77,33333
122M	6213	122M/6213/ With Rest Break	480	06:10	18:30	Ş.ŞAHİNBEY	85,33333

4.5. Actual preference process

Problems encountered during the test phase was analysed before the actual preference process. As a result of this analysis, frequent mistakes of employees were identified and necessary steps were planned to improve deficient sides. It was revealed that multiple parameters caused confusion for the employees during the preference process. Therefore, the necessary steps were taken as follows:

- The preferences were prepared as a package and a user-friendly interface was developed.
  Counselling Offices were established in order to facilitate the process and analyse possible complaints.
- Perception management meetings were held with the employees and representatives of labor unions in order to manage the transition period.

Work distribution manager converted services offered to the rotation groups of the current program into packages according to status of tasks such as being performed in a work day, on Saturday, Sunday and off-days and entered this data into the SIS software to create preference forms. Employees could view service and sign-board information, beginning and end hours of related bus services that could be chosen through the interface of preference list according to its type (With Rest Break – Normal). Employees could also view compatibility of preferred services with the days they do not work. The software was adjusted to allow employees prefer services according to this list (Figure 2).

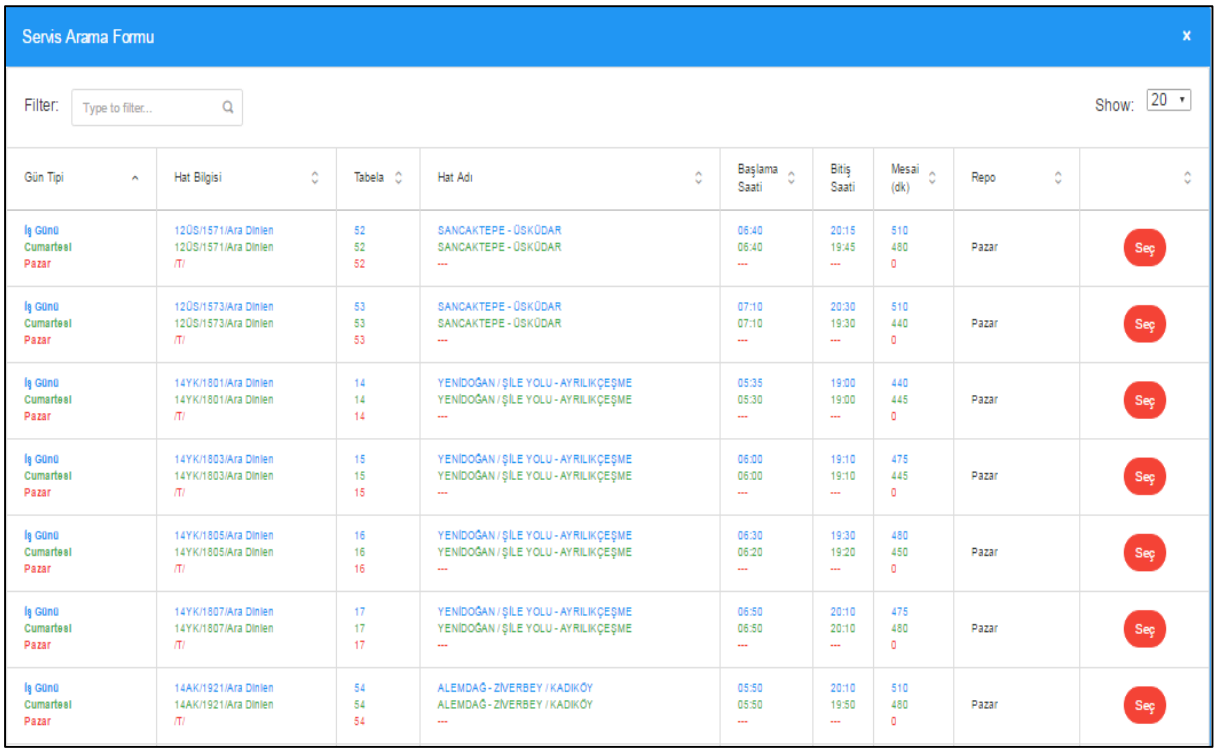


Figure 2. List of preferable service packages

Actual preference process was launched after the necessary adjustments were applied to the system interface and preference lists.

If any route is transferred from one terminal of IETT to another, the directorate may exchange employees of those terminals as well. As a result of this transfer policy, the number of employees working for Sarigazi Terminal decreased from 184 to 173. Performance points of these 173 employees were measured according to the data of 11th Month (November) and the preference process was launched by Sarigazi Terminal Directorate.
Thanks to the necessary adjustments made according to experiences, a pleasing result was obtained. 80% of all employees was placed after the 1st Preference Term, thus a 2nd Term was unnecessary. Findings of the analysis on actual preference process are given below (Table 3).

Table 3. Analysis of results obtained in Sarigazi Terminal's actual placement process

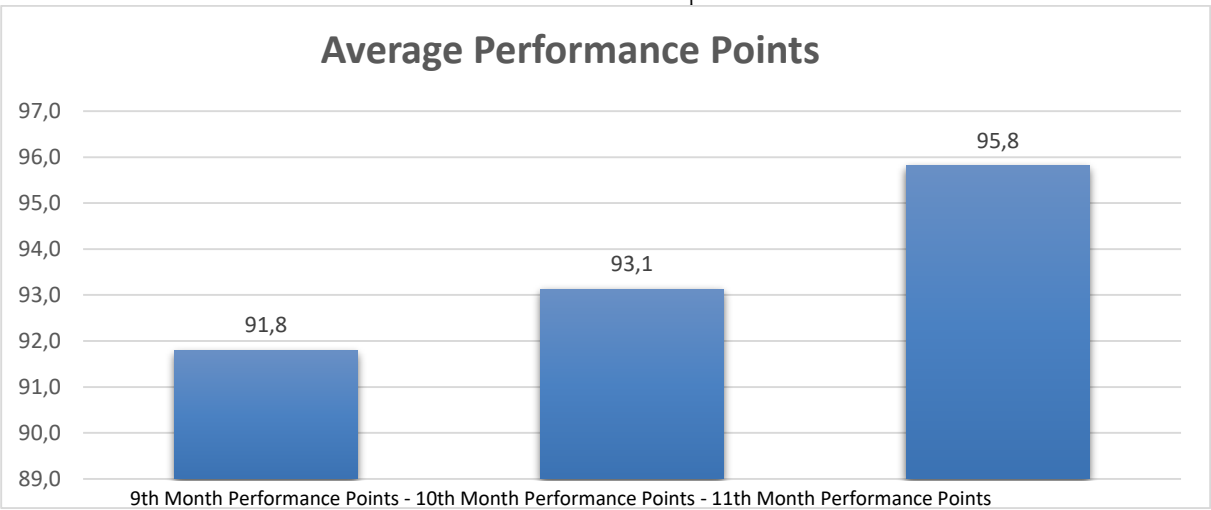
SARIGAZİ TERMİNAL PERFORMANCE-BASED PLACEMENT ANALYSIS					
Number of Participants	Preferred Placement		Random Placement		Not Placed
173	139		19		15
Order of Preference	With Substitute Driver	With Rest Break	According to Tendencies	Random	
	64	75	10	9	
1st Preference	41				
2nd Preference	23				
3rd Preference	13				

4th Preference	17			
5th Preference	6			
6th Preference	4			
7th Preference	7			
8th Preference	2			
9th Preference	7			
10th Preference	5			
11th Preference	6			
12th Preference	1			
13th Preference	3			
14th Preference	1			
15th Preference	3			
TOTAL	139			

5. Analysis of Results

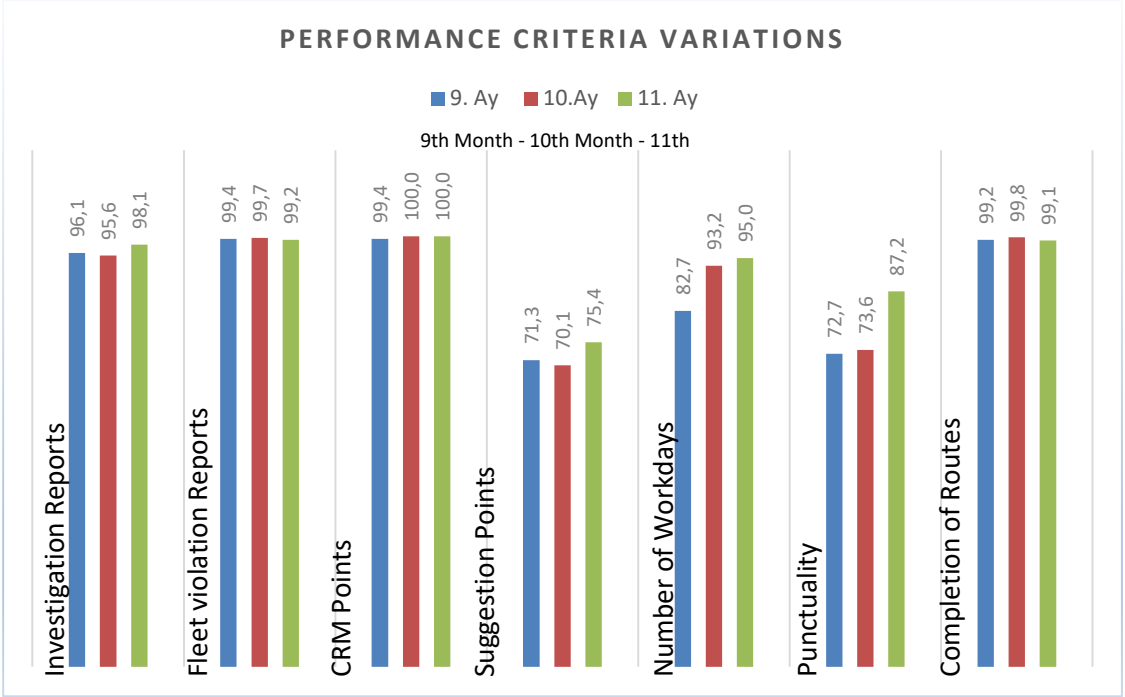
Results obtained through the pilot scheme of the model were found as satisfying. It was observed within this process that a large number of drivers working for Sarigazi Terminal increased their performance points. It was identified that average point of 178 employees working for Sarigazi Terminal was 91,8 in the 9th month while this figure increased up to 93,1 and 95,8 in the 10th and 11th months respectively (Table 4).

Table 4. Performance points



Variations of performance criteria that were used in measurements are given in Figure 3. An increase in a number of criteria can be seen when it is analysed in detail.

Figure 3. Performance criteria variations



The increase in performance points reveals an improvement in quality of services as well. It is because of the positive impacts of improvement in performance criteria on passenger services. For instance, any improvement in punctuality shows the level bus drivers conform to the schedules. An increase in CRM points that represent complaints of passengers reveals the satisfaction level. To summarize, any positive change in performance indicators identified to measure employees' performances carries general performance of organizations to optimum levels.

This model also stimulates self-control skills of employees. In this case, employees started to express suggestions about possible improvements in the services. In addition, this system allowed us to obtain rough data of the implementation process, as a result of the cross checks. We can even say that the competitive environment that occurred after the application of this model raised awareness among the employees of the importance of duties they perform.

5. Conclusion and Evaluation

General Directorate of IETT, which provides round-the-clock urban transportation services in Istanbul, operates 848 different bus routes. These routes show differences according to the districts and regions they are operated in, as well as their levels of difficulty. For instance, while most of the drivers are reluctant to work on congested lines of D-100 Motorway, which are also called as minibus routes, and demand for routes heading to rural areas is rather high. There is no criterion to measure drivers' competency to work on easy or challenging routes within the current system. Drivers are appointed to all the routes in turn, with a rotation system.

Round-the-clock services bring about several challenges for the drivers. Most of the employees demand not to work on Saturday or Sunday to have enough time to spend with their wives and children. But, although the number of services declines, the system requires some of the drivers to work in weekends. In addition, there is not any criterion to choose the drivers who may take holidays in weekdays and the ones who may not.

The current system does not identify any criterion about these highly important issues for drivers, such as the determination of workdays and levels of difficulty. While the rotation system can be reasonably explained to some extent, determination of off-days is a complicated process to clarify. This situation makes employees to question fairness of the work distribution system, results in rumors among them, disturbs the peace of working environment and negatively affects employees' performances. The decrease in employees' performances also reflects on the quality of services.

The supposed model is grounded on the target to increase employees' performances. This can only be obtained by giving an end to the rumors among the employees and helping them understand that the work distribution is conducted fairly. Therefore certain performance criteria were determined and employees were asked to make their own preferences through this new "self-appointment" system. As a result, employees could change the routes they can work on, according to the numerical values of their monthly performances. This new performance-based task appointment model does not allow any kind of human interference and conducts all processes in a transparent way.

Thanks to this performance-based task appointment model, employees started to use their own self-control senses and question the current system. It was also identified looking at the decrease in passenger complaints that drivers developed a tendency to improve themselves analyzing their own performance points and deficiencies. They could even realize the errors within the system and contribute to its improvement as well.

References

Aggarwal, S. (1982). A focused review of scheduling in services. European Journal of Operational Research, 9(2):114–121.

Aickelin, U. (1999). Genetic algorithm for multiple-choice optimisation problem. PhD thesis, University of Wales Swansea.

Al-Tabtabai, H. and Alex, A. (1997). Manpower scheduling optimization using genetic algorithm. In Proceedings of the 1997 4th Congress on Computing in Civil Engineering, pages 702–709, Philadelphia

Armstrong, Michael (1993), Human Resource Management: Strategy And Action (London: Kogan, Page Limited).

Bechtold, S. E., Brusco, M. J., & Showalter, M. J. (1991). A comparative evaluation of labor tour scheduling methods. Decision Sciences, 22(4), 683-699.

Dantzig, G. (1954). A comment on Edie's traffic delay at toll booths. Operations Research, 2:339–341.

Edie, L. (1954). Traffic delays at toll booths. Journal Operations Research Society of America, 2(2):107–138.

Fındıkçı, İ. (1999). İnsan kaynakları yönetimi. İstanbul: Alfa Basım.

Goal System, http://www.goalsystems.com/en/goalbus/

Hastus, http://www.giro.ca/en/solutions/bus-metro-tram

IVU, www.ivu.de/fileadmin/ivu/pdf/aktuelles/broschueren/IVUrail_tr_web.pdf

Jordan, K. (2009). Performans Değerlendirme Harvard Business School Press Pocket Mentor, Çev: Melis İnan, İstanbul: Optimist Yayınları.

Lundy Olive, Cowling Alan (1996). Strategic Human Resource Management, Routledge, London,

Waxin, M. F. ve Bateman, R. (2009). "Public Sector Human Resource Management Reform Across Countries: From Performance Appraisal to Performance Steering?", European J. International Management, C.3 S.4, s.495-511.