



The Use Of Linear Programming In Audit Task Planning

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Abstract

In audit firms, the auditing activities, operating periods and hourly rates of the auditors differ as regards to their status. Under normal circumstances, task planning in auditing is made by taking the professional judgment of a responsible auditor into account besides the qualitative characteristics of the auditors. However, it can also be made by means of a mathematical model assuming that auditors with the same title have similar characteristics. By this way, labor costs are minimized. In this context, the aim of this study is to make a task planning by assigning auditors to auditing activities through a linear programming model in a way to minimize the costs. Linear programming model is one of the methods used in solving optimization problems. The model which is set with various assumptions has been analysed through WINQSB packaged software called "Linear and Integer Programming". As a result of the modelling study, the number of hours and the kind of auditing activity in which the auditors are supposed to carry out have been specified and thus the most optimum cost has been found out.

1. Introduction

In Turkey, since 1970s, international economic relations have become prevalent, and international financing possibilities for foreign capital investments and Turkish companies have started to increase. And so on reasons, financial statement auditing has become a basic need for companies (Kiraci, 2009: 42). This need has been tried to be met with new Turkish Code of Commerce. With this law, an auditing requirement has been brought for all companies with share capitals which stay above the limit laid down by the cabinet council. Besides, with a legislative decree dated 26.09.2011 and numbered 660, Public Oversight Accounting and Auditing Standards Authority (KGK) was founded. This institution has been issuing accounting and auditing standards in Turkey and fulfilling the duty of authorizing and observing the audit firms. At the planning stage of auditing, in which status and how many auditors will be assigned is of quite importance. Because, in audit firms, besides sophisticated and experienced auditors, there are also intern auditors or auditor candidates who have just gone into profession. In this context, at the planning stage of an auditing activity, assignment of auditors at different status to the right task at the right time cannot be random. For this reason, at this planning stage, the type of activities, the characteristics of auditors to be assigned to these activities, the hours to be allocated for these activities and working hours of the auditors must be taken into account. Given these circumstances, the aim of this study is to assign the auditors in an optimum way and thus to minimize the costs. Another aim of the study is to test the availability of mathematical methods in auditing under various assumptions with the model established.

As regards to the definition made in 1972 by Basic Auditing Concepts Committee which is operating within the scope of American Accounting Association, auditing is a systematic process which impartially gathers evidence and evaluates it in order to investigate whether the claims related to economic activities and practices match predetermined criteria and to inform those who are interested about the results (Esendemir, 2011: 3891). According to the auditing regulation published in gazette dated 26.12.2012 and numbered 28509, financial statements audit is the auditing, evaluating and reporting through records and documents of financial statements and other financial information regarding their accuracy and compliance with financial reporting standards by implementing essential independent

auditing techniques proforma in auditing standards so as to obtain sufficient and proper independent auditing proofs providing reasonable guarantee. A similar description is made by Kavut et al. (2009: 58) and Selimoğlu et al. (2009: 5). In other words, financial statements audit is the inspection of financial statements of firms by the auditors who are out of the firm and do not have an organic bond with the firm in the framework of supervision contract (Durmuş and Taş, 2008: 10; Uyar, 2009).

ISAs 200; the purpose of an audit is to enhance the degree of confidence which the target users feel for the financial statements. This is achieved with the opinion issued by the auditor on whether the financial statements, in all its parts, are properly prepared in accordance with the valid financial reporting framework. A foresaid remark in most general purpose frameworks is about whether the financial statements, in all its parts, are presented realistically or whether they provide a realistic outlook. An audit being conducted in pursuant of ISAs and relevant ethical provisions enables an auditor to build this opinion (Ref: Para. A1).

According to the auditing regulation published in gazette dated 26.12.2012 and numbered 28509, auditors are people who are authorised to audit by the KGK among the members of the profession who obtained certified public accountant or chartered accountant license according to the law 3568. An auditor is a specialist conducting auditing activities, having professional knowledge and experience, acting independently and a man of high moral standing (Uyar, 2009: 15; Durmuş and Taş, 2008: 8; Güredin, 2014: 21).

2. Task Planning in Auditing

Task planning is the timely assignment of the necessary staff with the required ability and skill level to the places wherever needed in accordance with realizing the integrated purpose of the enterprise (Küçüksille and Güngör, 2009:95). An effective task planning is a complex process and it aims quality, moral and productivity to be gathered. Contribution of existing labor force can be optimized through an influential mode of rule, redesignation of services and staff development (Harden ve Fraher, 2010: 195-197). For an effective task planning, future labor requirements should be estimated; whether the existing workforce sources are employed optimally should be identified; and issues such as selection, education, rotation,

promotion and wage system of labors should be programmed. In this context, aims of task planning can be as follows (Küçüksille ve Güngör, 2009):

- Provide optimal productivity with efficient use of human resources,
- Meet future labor requirement in terms of number and qualification,
- Provide employee with education and development,
- Adapt rapidly to changing environment such as technological innovation and market conditions,
- Act according to legal regulations and modifications,
- Set up a human resources management information system,
- Support the coordination of human resources management activities,
- Provide labor requirement in accordance with the development plan of the business,
- Provide the control of labor costs.

One of the most important steps in task planning is audit planning. Audit planning is the predetermining activity of what, how, where, when and by whom the audit will be carried out to achieve its goal. In other words, audit planning is an anticipatory function which will provide audit activity to be on time with the least audit risk and the cheapest cost (Usul ve Ünal, 2009: 3). Before getting to work, auditors should have a detailed knowledge of principal business activity, sector specifications, the organizational structure of the business, site of establishment, goods and services manufactured, financial situation, individuals and institutions within the enterprise relations and so on (Kavut vd., 2009: 71). Almost in all audits, audit process has similar nature. However, the auditee may differ in scale, corporate structure and complexity. That's why, audit activities become distinct as to substance. For this reason, audits should be planned and programmed well as to be conducted efficiently and productively (Esendemir, 2011: 3902). Moreover, workspace standard which is one of the generally accepted auditing standards also requires audit activities to be planned carefully and assistants, if any, to be supervised as necessary.

Task planning aims to keep costs under control and find proper arrangement of shifts. The existing paradigm in task planning is to minimize labor costs in a present time interval without compromising on quality (Castillo et al., 2008: 162). As is known, the aim of audit

firms is not to maximize their income but to serve public. Nevertheless, while this service is being carried out, audit firms should make a satisfying profit (Usul ve Ünal, 2009: 4). Unfit task plannings may lead to high costs. To illustrate, firms employing auditor more than adequate are obliged to pay more insurance premium and wage, which increases the cost of service provided. Therefore, the keystone of audit planning process is optimum task planning. Task planning is the identification of by whom the audit activities will be carried out and is the bonding of audit activities to a person or people (Türedi, 2007: 120).

In this context IAS 300: In Independent Audit Planning Standard of Financial Statement, it is indicated that while setting a general audit approach, especially in audit spheres becoming more of an issue and in spheres which are highly risky, correct usage of experienced team members or involving expert in complicated issues is of great importance. In small enterprise audits, the whole audit can be conducted by a small audit team. In most of the small enterprise audits, there is a responsible auditor working with a member of the audit team. In a small audit team, it is easier for the team members to coordinate and communicate with one another (IAS 300, paragraf: A8).

After data gathering about the sector in which the customer operates and preparation of audit plans, the auditor team to mastermind is assigned. While the audit activities are being carried out, the main responsibility and workload are on the shoulders of the auditor or the audit team. During the practices, employees of the firm being audited are also made use of. In the course of a small scale auditing activity, a single auditor can conduct the whole audit activity with a small team. During the audit activities in medium or large-scaled businesses, a larger teamwork is necessary for an efficient audit. While organizing an audit team and identifying the required number of auditors, attention should be given to the qualification of the task and the business, experience, responsibility and technical knowledge of the auditor and the auditing programme (Türedi, 2007: 120; Dönmez, 2002: 106; Kepekçi, 2004: 62). In audits iterated for specific customers, generally the same audit team performs the duty. Nevertheless, a periodic rotation is necessary so that the autonomy in audit will not get damaged (Güredin, 2014: 196). At audit planning stage, choosing the task team, time intervals, communication among the members and the inspection of them should be achieved properly by developing a source management plan. Considering the standards, the abilities

and the qualifications expected from the auditors to be assigned in the team are as follows (Cömert et al., 2013: 162-165):

- Having an experience to understand and carry out auditing,
- Having a sufficient knowledge of audit standards, legal and legislative regulations,
- Having the ability to use related information technology,
- Having sufficient knowledge of the sector in which the auditee customer operates,
- Having the ability of professional decision making,
- Having adopted the quality control culture of the audit firm.

An audit team consists of auditors with different qualifications. In this context, auditors can be named with different titles as follows (Çalgan et al., 2008: 55):

- Responsible auditor who will take the whole responsibility of the inspection agreement,
- One or more senior auditors who coordinate and observe the conduct of audit programs,
- One or more auditor who will be responsible for the parts of audit programmes and review the works of audit assistants and lead them,
- Assistant auditor who will perform the tasks given.

While constituting the audit team structure, issues such as responsibility, monitoring, technical knowledge, experience and audit program must be taken into account. Distribution of auditors among audit spheres and inspection agreements should be realized properly. Only in this way can each task of inspection be completed of good quality and relevant, without resorting overtime working and thus providing a good professional experience for assistants. The number and complexity of the inspection agreements undertaken and an increase in the number of auditors make distribution of auditors among the tasks more difficult. As the issue is an optimisation problem, audit firms which have achieved a particular operating volume resort to various quantitative programming methods on this issue (Güredin, 2014: 196). However, these methods do not only provide an assignment which maximise the targets of audit firms but also provide useful information for the issues mentioned below (Summers, 1972: 443):

- Career development planning and training,

- Which auditors will be made to do extra work,
- Determining a fair and reasonable compensation policy,
- Which customers need extra work,
- Whether a new customer will be accepted in cases which the audit firm works in full capacity,
- Determining compensation rates,
- How the individual productivity of auditors will affect the next assignment,
- Determining the probable effects of improper assignments.

In this study, with basic assumptions, how the distribution of audit tasks should be done is shown with a mathematical model.

3. Linear Programming Model in Task Planning

Optimization is described as a technology which enables to achieve certain goals (cost minimization, profit maximization, capacity usage maximization and productivity maximization) by efficient use of existing sources in a system (labor force, time, capital, processes, raw materials, capacity and equipment). Optimization technology accelerates the decision making processes and increase the quality of decision. This technology is utilized in efficient, accurate and real-time solutions of the problems encountered in real life. Besides the earnings it provided in economic aspects, optimization is used as an efficiently applied method in customer, employer and employee preferences and constraints to take place in decision making process (Türkay, 2011).

Today, developments in information technology cause the structure of business activities to be more complex. Businesses are gradually quitting seeking solutions to the problems with conventional techniques. While solving such problems, mathematical methods and models are set into motion (Çevik, 2006: 157). Linear programming which is one of the issues closely related to the branches of business, economics and accounting is also one of the most important issues in operational research. It is a method used in optimization problem resolution and a technique which helps to obtain the optimal distribution of the sources, minimize costs but maximize profits (Özden, 2010: 5).

Linear programming is a mathematical programming technique used in identifying the variable values that renders a linear objective function the best (optimal/maximization/

minimisation) under the restrictive conditions of well-defined linear equalities and inequalities (Özden, 2010: 5; Alan and Yeşilyurt, 2004: 152). It involves planning activities which provides to obtain the most optimal result among all the congruent options (Öztürk, 2005: 35). Each linear programming model has three basic components; decision variables, objective function and constraints (Ulucan, 2004: 25). In linear programming process, first the necessary data is gathered, a model related to the problem is set up and then the solutions of this model are found with computer-aided software packages. After the applicability of these solutions to real life problems is tested, it is submitted to directors (Alan ve Yeşilyurt, 2004: 152). Linear programming technique is based on the following assumptions (Bircan and Kartal, 2004: 133):

- The objective function and the restrictive conditions must be defined accurately. Whether the goal is profit maximization or a cost minimization should be indicated clearly.
- Variables should be quantitative. Linear programming is not used for qualitative variables (unable to be expressed in numbers).
- Variables should be correlated with one another.
- Resources to be used should be limited.
- Established correlations among variables should be linear.
- There should be an alternative choice possibility among variables.
- Operational problems which the linear programming will be applied should be short term.
- Dependent variables should be positive or zero.

4. Literature Review

In this section of the study, studies addressing task planning in auditing through mathematical programming models are reviewed. Studies conducted have revealed that many mathematical models such as linear programming, integer and multiple objective linear programming and goal programming are used in audit task planning. Below, studies conducted on this subject are included.

In the study conducted by Summers (1972), a linear programming is suggested to maximise the financial goals of audit firms. In addition, Bailey, Boe and Schnack (1974) developed a

model of goal programming in choosing the auditors to be assigned to audit activities (Lee ve Jeong, 1995). In 1981, Balachandran and Zoltners developed an integer linear programming model which would provide optimization in audit task planning. And in the study they conducted in 1982, they argued the use of multiple objective linear programming models to minimise the problems of profit maximisation, destaffing, recruiting and overtime working. Gardner and et al. (1990) developed a goal programming and multiple objective linear models to optimize the goals they set in audit task planning. Dodin and Chan (1991) developed integer linear programming to be used in assigning the auditors in a complicated real life audit sphere. Lee and Jeong (1995) used the linear programming, post model analysis and intelligent coordinating agent models in their studies. Through these models, they aimed to balance between the profit or risk of the firm and the preferences of the individual auditor at the stage of assigning. Dodin ve Elimam (1997) used integer linear programming model in choosing the optimal auditor to be assigned. With the model they used, they aimed to solve the setup times and costs emanating from changing the assignments of the auditors and the lead and lag relationships between the audit tasks. Dodin, Elimam and Rolland (1998) achieved an explicit recovery in cost minimisation by using tabu search method based on heuristic programming on audit task planning. Kwak (2000) developed a fuzzy set model which provides possible optimal option and produces comparable senarios in audit task planning. In the study conducted by Rossi and et al. in 2010, they seek solutions to find out the optimal timing of audit activities in an enterprise by using Mixed Integer Linear Programming and Constraint Programming.

5. Applying Linear Programming to Audit Task Planning¹

5.1. Setting the Model, Model Assumptions and Symbols Used

In the study, ABC audit firm is chosen as a sample in order to set the model which the auditors are assigned to audit activities. This audit firm made a team consisting of a responsible auditor, a senior auditor, an auditor and an assistant auditor for the auditee firm. Issues such as how many hours the auditors will work totally in auditing activities, how much time to

¹ The application part of the study is inspired by Ünal's thesis on "Optimal Workforce Planning in Auditing Practice" (2006).

spare for each auditing activity and at least how many hours the auditors are supposed to work in each auditing activity are stated in the limitations section. Within the frame of these assumptions, for the audit firm to minimise its costs, optimal auditor distribution will be achieved through this model. While setting the model, the assumptions stated below are approved:

- The numbers of auditors who are in charge in the auditing team and the fees paid are accepted as assumptions. Auditors who will participate in the auditing activities will perform the activities complying with their status and their wages will be set in this way. While the responsible auditor gets the highest fee which is 500 TL, the assistant auditor gets the lowest fee which is 160 TL and the auditor gets 200 TL per hour. Whatever may be the reason, no fee is paid to the auditors for nonattended activities.
- Auditing period is planned as 200 hours. Auditors do not have to work only in one activity. For example; a responsible auditor is able to work 5 hours in “risk appraisal and audit planning”, 10 hours in “activity account auditing” and 10 hours in “reporting” in a period of 25 hours working time.

Symbols used in Established Linear programming model are as follows;

- x_{ij} : i. The Auditor's, j. Working hours in case he is assigned to auditing activities (i: 1,2,3,4; j: 1,2,...,9).
- c_{ij} : i. The Auditor's j. Hourly wage equivalent in Turkish Liras which he will gain from the audit firm after an hour working our (i: 1,2,3,4; j: 1,2,...,9).

5.2. Definitions Related to Auditor and the Activities

As regards to the established model, an audit team consists of four auditors. These auditors are coded in model formulation. These are;

Responsible Auditor : 1st Auditor
Senior Auditor : 2nd Auditor
Auditor : 3rd Auditor
Assistant Auditor : 4th Auditor

It is accepted that an auditing process consists of risk appraisal and audit planning, liquid assets and financial instruments auditing, sale and assets auditing, purchases and stocks auditing, tangible and intangible long-term assets auditing, debt auditing, wage audit, income

and expenses auditing and reporting activities. These activities are coded in the model as follows:

- Risk Appraisal and Audit Planning : 1st Activity
- Liquid Assets and Financial Instruments Auditing : 2nd Activity
- Sale and Assets Auditing : 3rd Activity
- Purchases and Stocks Auditing : 4th Activity
- Tangible and Intangible Long-term Assets Auditing : 5th Activity
- Debt Auditing : 6th Activity
- Wage Audit : 7th Activity
- Income and Expenses Auditing : 8th Activity
- Reporting : 9th Activity

5.3. Model's Objective Function and Limitations

The aim of the model is the distribution of labor force which will minimise the costs by determining the contribution of each auditor to audit activities. In this context, the objective function is identified as follows:

Objective Function:

$$\text{Min } Z = 500X_{1,1} + 500X_{1,2} + 500X_{1,3} + 500X_{1,4} + 500X_{1,5} + 500X_{1,6} + 500X_{1,7} + 500X_{1,8} + 500X_{1,9} + 300X_{2,1} + 300X_{2,2} + 300X_{2,3} + 300X_{2,4} + 300X_{2,5} + 300X_{2,6} + 300X_{2,7} + 300X_{2,8} + 300X_{2,9} + 200X_{3,1} + 200X_{3,2} + 200X_{3,3} + 200X_{3,4} + 200X_{3,5} + 200X_{3,6} + 200X_{3,7} + 200X_{3,8} + 200X_{3,9} + 160X_{4,1} + 160X_{4,2} + 160X_{4,3} + 160X_{4,4} + 160X_{4,5} + 160X_{4,6} + 160X_{4,7} + 160X_{4,8} + 160X_{4,9}$$

Limitations of the Model:

- Minimum working constraints of the auditors:

(1) 1st auditor: $X_{1,1} + X_{1,2} + X_{1,3} + X_{1,4} + X_{1,5} + X_{1,6} + X_{1,7} + X_{1,8} + X_{1,9} \geq 10$

(2) 2nd auditor : $X_{2,1} + X_{2,2} + X_{2,3} + X_{2,4} + X_{2,5} + X_{2,6} + X_{2,7} + X_{2,8} + X_{2,9} \geq 15$

(3) 3rd auditor: $X_{3,1} + X_{3,2} + X_{3,3} + X_{3,4} + X_{3,5} + X_{3,6} + X_{3,7} + X_{3,8} + X_{3,9} \geq 100$

(4) 4th auditor: $X_{4,1} + X_{4,2} + X_{4,3} + X_{4,4} + X_{4,5} + X_{4,6} + X_{4,7} + X_{4,8} + X_{4,9} \geq 75$

(5) All: $X_{1,1} + X_{1,2} + X_{1,3} + X_{1,4} + X_{1,5} + X_{1,6} + X_{1,7} + X_{1,8} + X_{1,9} + X_{2,1} + X_{2,2} + X_{2,3} + X_{2,4} + X_{2,5} + X_{2,6} + X_{2,7} + X_{2,8} + X_{2,9} + X_{3,1} + X_{3,2} + X_{3,3} + X_{3,4} + X_{3,5} + X_{3,6} + X_{3,7} + X_{3,8} + X_{3,9} + X_{4,1} + X_{4,2} + X_{4,3} + X_{4,4} + X_{4,5} + X_{4,6} + X_{4,7} + X_{4,8} + X_{4,9} \geq 200$

- Time Constraints at the level of activities:

- (6) 1st activity: $X_{1,1} + X_{2,1} + X_{3,1} + X_{4,1} \geq 26$
(7) 2nd activity: $X_{1,2} + X_{2,2} + X_{3,2} + X_{4,2} \geq 15$
(8) 3rd activity: $X_{1,3} + X_{2,3} + X_{3,3} + X_{4,3} \geq 25$
(9) 4th activity: $X_{1,4} + X_{2,4} + X_{3,4} + X_{4,4} \geq 36$
(10) 5th activity: $X_{1,5} + X_{2,5} + X_{3,5} + X_{4,5} \geq 34$
(11) 6th activity: $X_{1,6} + X_{2,6} + X_{3,6} + X_{4,6} \geq 22$
(12) 7th activity: $X_{1,7} + X_{2,7} + X_{3,7} + X_{4,7} \geq 19$
(13) 8th activity: $X_{1,8} + X_{2,8} + X_{3,8} + X_{4,8} \geq 20$
(14) 9th activity: $X_{1,9} + X_{2,9} + X_{3,9} + X_{4,9} \geq 3$

- Minimum working constraints of the auditors on the basis of activities:

- | | |
|--|--|
| (15) 1 st auditor: $X_{1,1} \geq 2$ | (35) 3 rd auditor: $X_{3,3} \geq 2$ |
| (16) 1 st auditor: $X_{1,2} \geq 1$ | (36) 3 rd auditor: $X_{3,4} \geq 2$ |
| (17) 1 st auditor: $X_{1,3} \geq 1$ | (37) 3 rd auditor: $X_{3,5} \geq 2$ |
| (18) 1 st auditor: $X_{1,4} \geq 1$ | (38) 3 rd auditor: $X_{3,6} \geq 2$ |
| (19) 1 st auditor: $X_{1,5} \geq 1$ | (39) 3 rd auditor: $X_{3,7} \geq 2$ |
| (20) 1 st auditor: $X_{1,6} \geq 1$ | (40) 3 rd auditor: $X_{3,8} \geq 2$ |
| (21) 1 st auditor: $X_{1,7} \geq 1$ | (41) 4 th auditor: $X_{4,1} \geq 3$ |
| (22) 1 st auditor: $X_{1,8} \geq 1$ | (42) 4 th auditor: $X_{4,2} \geq 3$ |
| (23) 1 st auditor: $X_{1,9} \geq 2$ | (43) 4 th auditor: $X_{4,3} \geq 3$ |
| (24) 2 nd auditor: $X_{2,1} \geq 2$ | (44) 4 th auditor: $X_{4,4} \geq 3$ |
| (25) 2 nd auditor: $X_{2,2} \geq 1$ | (45) 4 th auditor: $X_{4,5} \geq 3$ |
| (26) 2 nd auditor: $X_{2,3} \geq 1$ | (46) 4 th auditor: $X_{4,6} \geq 3$ |
| (27) 2 nd auditor: $X_{2,4} \geq 1$ | (47) 4 th auditor: $X_{4,7} \geq 3$ |
| (28) 2 nd auditor: $X_{2,5} \geq 1$ | (48) 4 th auditor: $X_{4,8} \geq 3$ |
| (29) 2 nd auditor: $X_{2,6} \geq 1$ | |
| (30) 2 nd auditor: $X_{2,7} \geq 1$ | |
| (31) 2 nd auditor: $X_{2,8} \geq 1$ | |
| (32) 2 nd auditor: $X_{2,9} \geq 1$ | |
| (33) 3 rd auditor: $X_{3,1} \geq 2$ | |
| (34) 3 rd auditor: $X_{3,2} \geq 2$ | |

5.4. Optimal Solution of the Problem and the Result of the Model

The model, the detail of which has been given above is solved with WINQSB computer programme named "Linear and Integer Programming". This model is a sample of minimisation consisting of 36 variables (4*9) and 48 constraints. The results obtained with the solution of the model are shown in three different tables below. Results of auditor assignments to auditing activities concerning the result of the model are shown in Table 1.

Table 1: Auditor Assignments to Auditing Activities

ACTIVITIES	AUDITORS				TOTAL
	1	2	3	4	
1	2	7	15	3	27 hours
2	1	1	6	7	15 hours
3	1	1	2	21	25 hours
4	1	1	2	32	36 hours
5	1	1	29	3	34 hours
6	1	1	17	3	22 hours
7	1	1	14	3	19 hours
8	1	1	15	3	20 hours
9	2	1	0	0	3 hours
TOTAL	11 hours	15 hours	100 hours	75 hours	201/ 201

As seen in Table 1, the responsible auditor (1st auditor) should work 2 hours for risk appraisal and audit planning (1st activity); 2 hours for reporting (9th activity) and 1 hour for other activity (activities 2, 3, 4, 5, 6, 7, 8). Senior auditor (2nd auditor) should work 7 hours for risk appraisal and audit planning (1st activity) and 1 hour for other activities (activities 2, 3, 4, 5, 6, 7, 8, 9). Auditor (3rd auditor) should work 15 hours for risk appraisal and audit planning (1st activity), 15 hours for liquid assets and financial instruments auditing (2nd activity), 6 hours for sales and assets auditing (3rd activity), 2 hours for purchases and stocks auditing (4th activity), 29 hours for tangible and intangible long-term assets auditing (5th activity), 17 hours for debt auditing (6th activity), 14 hours for wage audit (7th activity), 15 hours for income and expenses auditing (8th activity).

Assistant Auditor (4th auditor) should work 3 hours for risk appraisal and audit planning (1st activity), 7 hours for liquid assets and financial instruments auditing (2nd activity), 21 hours for sales and assets auditing (3rd activity), 32 hours for purchases and stocks auditing (4th activity), 3 hours for tangible and intangible long-term assets auditing (5th activity), 3 hours for debt auditing (6th activity), 3 hours for wage audit (7th activity), 3 hours for income and expenses auditing (8th activity).

As it can be remembered from the assumptions of the model, auditing period was planned as 200 hours at first. However, due to the constraints of the model, the model is seen to have been completed to 201 hours. According to the table, only if the responsible auditor works 11 hours, senior auditor works 15 hours, auditor works 100 hours and assistant auditor works 75 hours, can the process optimization be provided.

Table 2 shows the fees which the auditors assigned to audit activities will get from the audit firm per activity.

Table 2: Distribution of Fees for Auditors in Audit Activities

ACTIVITIES	AUDITORS				TOTAL
	1	2	3	4	
1	1.000	2.100	3.000	480	6.580 TL
2	500	300	1.200	1.120	3.120 TL
3	500	300	400	3.360	4.560 TL
4	500	300	400	5.120	6.320 TL
5	500	300	5.800	480	7.080 TL
6	500	300	3.400	480	4.680 TL
7	500	300	2.800	480	4.080 TL
8	500	300	3.000	480	4.280 TL
9	1.000	300	0	0	1.300 TL
TOTAL	5.500 TL	4.500 TL	20.000 TL	12.000 TL	42.000/42.000 TL

Accordingly; responsible auditor (1st auditor) should get 1.000TL from risk appraisal and audit planning (1st activity), 1.000TL from reporting activity (9th activity) and 500TL from other activities (2,3,4,5,6,7,8). Senior auditor (2nd auditor) should get 2.100TL from risk appraisal and audit planning (1st activity) and 300 from the other activities (2,3,4,5,6,7,8,9). Auditor (3rd auditor) should get 3.000TL from risk appraisal and audit planning (1st activity), 1.200 TL from liquid assets and financial instruments auditing (2nd

activity), 400 TL from sales and assets auditing (3rd activity), 400 TL from purchases and stocks auditing (4th activity), 5.800 TL from tangible and intangible long-term assets auditing (5th activity), 3.400 TL from debt auditing (6th activity), 2.800 TL from wage audit (7th activity), 3.000 TL from income and expenses auditing (8th activity). Assistant auditor (4th auditor) should get 480 TL from risk appraisal and audit planning (1st activity), 1.120 TL from liquid assets and financial instruments auditing (2nd activity), 3.360 TL from sales and assets auditing (3rd activity), 5.120 TL from purchases and stocks auditing (4th activity), 480 TL from tangible and intangible long-term assets auditing (5th activity), 480 TL from debt auditing (6th activity), 480 TL from wage audit (7th activity), 480 TL from income and expenses auditing (8th activity).

According to the model, when above assumptions are considered, the minimum cost of auditing is calculated as 42.000 TL. And it can also be seen that the cost of a responsible auditor to the audit firm is 5.500 TL that of the senior auditor is 4.500 TL, the auditor's is 20.000 TL and the assistant auditor's is 12.000 TL so as to realize the cost minimization. Similarly, the cost of each activity to the audit firm is as calculated in Table 2.

6. Conclusion

One of the most crucial activities of auditing process consisting of risk assesment reciprocation to risk and reporting stages is audit planning. A good plan has a direct influence on the success of audit activity. In the process of audit planning, task planning has an important position.

Assigning the right auditors to the right jobs and at the right time both contributes to the success of audit activities and enables maximizing the profit while minimizing the costs. In small enterprises, assigning auditors is quite easy. However, in big enterprises it is the opposite when the numbers of auditors and the quality of the task to be performed are taken into account. For this reason, distribution of auditor or task planning can be achieved in a reasonable and lower cost through mathematical methods.

In this study, task planning is revealed through a model under the assumptions set for an audit firm chosen as a sample. In the study, assignment problem applied is solved with WINQSB computer programme. Results obtained reveals that the optimal cost is achieved and similar assignment problems can be used in practice.

When taken into account that the characteristics of the auditee firms and the competence of the auditors with similar titles may be different, instead of mathematical models,

responsible auditor may use his position to make a team and can do proper assignments. It may be a further study field for future researchers to find out which method is the best.

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