Direct labor cost volume variance in success measurement and an application

Prof. Dr. Selim Yüksel PAZARÇEVİREN[a], Doç. Dr. Duygu CELAYİR[b]

[a]*Prof.Dr., İstanbul Ticaret Üniversitesi, İşletme Fakültesi, Muhasebe ve Denetim Bölümü, e posta: spazarceviren@ticaret.edu.tr, Orcid: 0000-0001-8198-4424
[b]*Doç.Dr., İstanbul Ticaret Üniversitesi, İşletme Fakültesi, Muhasebe ve Denetim Bölümü, , e posta: dcelayir@ticaret.edu.tr, Orcid: 0000-0002-1435-3910

Abstract

It is possible to benefit from the variance analysis used in the enterprises, where the standard cost system is implemented in order to apply the management principle according to the exceptions, in success (performance) measurements. While using variance analysis in success measurement, the effects of activity and top management on the characteristics of the production type in the enterprise and the results of the production activity should be examined.In this study, it is revealed that in businesses with certain production characteristics, the top management should also be responsible for the direct labor time variance, which has been held under the responsibility of the activity management until today, and that the management of the activity will not be objective in all of the time variance. In the study, the responsibility of the top management on direct labor time variance is explained with a new concept called "direct labor cost volume variance".

Başarı ölçümünde direkt işçilik maliyeti hacim farkı ve bir uygulama

Özet

Standart maliyet sistemi uygulayan işletmelerde sapma analizlerinden maliyet kontrolünün yanında, performans / başarı ölçümünde de yararlanmak mümkündür. Ancak, başarı ölçümünde sapma analizlerinden yararlanırken, işletmedeki üretim şeklinin özelliği ve üretim faaliyetinin sonuçları üzerinde faaliyet ve tepe yönetiminin etkilerinin incelenmesi gerekmektedir.Bu çalışmada, belirli bir üretim özelliği taşıyan işletmelerde, bugüne kadar faaliyet yönetiminin sorumluluğu altında tutulan direkt işçilik zaman sapması üzerinde, tepe yönetiminin de sorumluluk taşıması gerektiği ve bu özellikteki işletmelerde, zaman sapmasının tamamından faaliyet yönetiminin sorumlu tutulmasının objektif olmayacağı ortaya konmaktadır. Çalışmada, direkt işçilik zaman sapması üzerinde tepe yönetiminin sorumluluğu, "direkt işçilik maliyeti hacim sapması" kavramı ile açıklanmaktadır.

Introduction

It is possible to utilize variance analysis in cost control, as well as the success (performance) measurement in the enterprises that apply the standard cost system (Dalcı & Tanış, 2006). In our study, a new approach is introduced in measuring the success of managers in controlling direct labor cost in a production enterprise (IMA, 1996) where direct labor activity depends on machine and plant activity.

As it is known, the variance between the secondary and standard direct labor times, which are determined on the basis of the standard hourly rate in direct labor costs in mounted and workshop-type productions, is called time or efficiency variance (Lucey, 1981; Keythman, 2020). An exception to this is the re-analysis of time variance as efficiency and product variance in the production of formulated products (Kaplan & Atkinson, 1989). In this study, in order to objectively measure the success of the efficiency of the productive workforce and the activity management in direct control of labor costs ino a production enterprise where direct labor activity depends on machine and plant activity (Schmitz, 2012), the time variance is separated as efficiency and volume variance, and it is suggested that the top management should be responsible for the volume variance.

The first reason we re-analyze the direct labor time variance for the purpose of success measurement is the fact that the variance between the actual and standard direct labor times cannot be the result of the the inefficiency of the productive workforce and the failure of operation managers to control the efficiency of the productive workforce, when there are significant differences between the objective and actual production capacity use in enterprises with this type of production characteristics where the standard cost system is applied (Kenton, 2019). The second reason is that the responsibilities in this variance arising from the fact that the top management keeps the size of the production capacity well above the demand in the market or unable to load work in proportion to the size of the production capacity is not revealed in the literature and practice.

In our study, we are discussing a variance that requires responsibility of the top management in direct labor time variance, resulting from the difference between objective and actual capacity uses, and what we call direct labor cost volume variance (Bragg, 2018). In addition, we will focus on how the direct labor cost efficiency variance should be determined as a fair and objective measure, which will be the basis for measuring the success of productive workforce and production activity managers.

Direct labor cost volume variance

We will examine the direct labor cost volume variance for two typical situations, namely

(1) over-employment conditions,

(2) idle capacity conditions, which cause the difference between objective and actual capacity uses (Keller & Ferrara, 1966).

Direct Labor Cost Volume Variance under Over-employment Conditions

Direct labor cost volume variance in over-employment conditions arises from the employment of more productive labor than the current capacity utilization (production) requires, especially as a result of predicting the objective capacity utilization (production level) higher than the capacity utilization (production level) in labor intensive enterprises (Kenton, 2019; Hayes, 2019; Walther & Skousen, 2009).

As it is known, unlike direct raw materials and materials, labor is not a production factor that can be stocked and used as desired, so the benefit of spending on this production factor depletes during their holding in the enterprise (Banton, 2019). Especially in labor intensive enterprises, keeping the total actual direct labor cost at the level of total standard direct labor costs depends on the accurate estimation of the capacity utilization and the number of productive workers to be employed accordingly (Bacon & Kojima, 2011). As a result of the high estimation of the capacity utilization level, if more productive workers are employed when the current capacity utilization requires, there will be a continuous, negative variance between total actual and standard direct labor costs (Syverson, 2011), unless the costs of dismissing the worker are incurred. In these conditions, when the wage variance is eliminated from the total variance between these two expenses, it is an important error, especially in terms of success measurement, that the remaining variance is defined as the efficiency variance. Because part of this variance arises from the total direct labor costs to be determined based on standard wages due to the over-employed productive workforce is higher than the total direct labor costs that would arise if the required number of productive workers are employed for the current production capacity (Biesebroeck, 2014). This difference, which has arisen due to over-employment for an accurate measurement of success and cost control, must be covered in a variance that can be called direct labor cost volume variance.

The efficiency variance can be an accurate and fair measure of success valuation if the production fixed realistically is determined by the difference between the actual direct labor hours and the standard direct labor hours (https://www.principlesofaccounting.com/chapter-22/variance-analysis/) .

If the direct labor time that can be utilized in production from the productive workforce that is above the required level due to over-employment is taken as the actual direct labor hours of production, the efficiency variance will also include the provisions for the top management responsibilities in direct labor expenses (Horngren, 1974; Matz & Usry, 1976). In this case, the productivity variance, as we have stated above, will lose its quality of being an accurate and fair measure in the success of productive workforce and production activity managers.

In cases where actual direct labor hours of production can be determined realistically under over-employment conditions, the productive (direct) labor times that are idle due to waiting for work in the enterprise will be revealed automatically. It will clearly reveal the responsibility of the top management in the budgeting of the direct labor cost, if the idle production cost, under the responsibility of the top management (Inua, 2017), which is to be found by multiplying the idle productive labor time and standard hourly rate, is included in the direct labor cost volume variance for the purpose of success evaluation (Anthony, et. al. 1985).

In case of variance arising from the difference between the time that the enterprise can benefit from the productive workers in production over the standard hourly rate in direct labor costs in a certain period, and the standard time of the performed production, it is possible to separate the responsibility shares of the productive workforce and production management with the top management by analyzing the direct labor cost volume and productivity variance correctly (Bragg, 2019).

The accuracy and objectivity of the analysis results depend on our ability to accurately determine (a) the actual direct labor time (DLT) of the production carried out for a certain period of time, and (b) the time that the enterprise can benefit from productive workers in production. The authenticity of actual DLTs of production can be achieved through a serious application of production management and labor time differences. The time that the enterprise can benefit from the productive workers in production should be found by deducting the idle time due to the reasons such as "machine failure, power outage, etc." emerging out of the will of the business executives from the time that can be used in production from the productive workers, which will be calculated theoretically.

Let us explain how to analyze direct labor cost volume and productivity variance in over-employment conditions with a numerical example that we simplified in order to facilitate our explanations. Let us assume that in our example enterprise where only X product is installed, 10 productive workers are employed for the objective production at the beginning of the activity year, the standard processing time of 1 X product is 1 DLT and the standard hourly rate is 10 TL/DLT. If at this plant, 1800 X products were installed by spending 105 DLT productive labor time per production unit, working 25 days in the first month of the year, and a 30 DLT idle time occurred due to power outage outside the will of the business management, the direct labor cost, volume and productivity deviations of January will be calculated as in Table 1.

As it can be seen from Table 1, the fact that the separation of the variance caused by the difference between the actual and standard productive labor (direct labor) times in direct labor costs as we suggest, as productivity and volume variance, ensures that the responsibilities of the productive workforce and production management and the top management are directly and explicitly revealed for the control of labor costs. For example, when the productivity variance is determined as we recommend, the productive labor can only be held responsible for the "time variance" (90 DLT/Month) caused by the "inefficient operation of the productive labor" between the actual and standard DLTs of production, but the top management, which is responsible for the over-employment, is held responsible for the time that productive labor can benefit from (caused by the "time variance" between DLT and actual DLT of the production (80 DLT/Month) by determining the volume variance we recommended. Even if the actual DLT of production and accordingly the productivity variance is determined realistically, the top management's responsibility for direct labor costs to be above the required level as a result of over-employment will be ignored if the volume variance we recommend is not separated and the direct labor times are not analyzed correctly. As an exceptional case, when determining the direct labor cost volume variance, if the actual DLT of production falls below the standard DLT, it should be noted that we need to determine the direct labor cost volume variance based on the time difference between the time that the enterprise can benefit from productive workers in production, and the standard time of production.

Table 1. Direct *labor cost volume and efficiency variance in january*

*Theoretical time that the enterprise can benefit from productive workers in production*10 Workers/Dayx25 Workday/Monthx8 Working Hour/Day)	*2000 Direct Labor Time (DLT)/Month*
Idle time emerging out of the will of the business executives – mechanical fault (-)	30 DLT/Month
Time that the enterprise can benefit from productive workers in production	*1970 DLT/Month*
Standard direct labor hour consumption at the level of budgeted production quantity - 1000 pieces/ months x1,8 DLT/pieces(-)	1800 DLT/Month
Direct labor hour that cannot be used due to lack of demand - (1970-1800 DLT/month)Time that the productive workers cannot be benefited from in production	*170 DLT/Month*
Standard hourly rate x	10 TL
Direct labor cost volume variance (170DLT/month x 10TL/pieces)	*1700TL/Month*

Actual DLT of production	1890 DLT/Month
Standard DLT of production (-) (1800 Pieces/Monthx1 DLT/Piece)	*1800 DLT/Month*
Variance between the actual and standard DLTs of production	90 DLT/Month
Standard DLT rate x	*10 TL/DLT*
Direct labor cost efficiency variance	900 TL

Direct Labor Cost Volume Variance under Idle Capacity Conditions

Another typical case when direct labor cost volume variance needs to be analyzed is the idle capacity conditions. Especially in workbench and machine-intensive enterprises, in cases where the required number of productive workers are employed for each machine and workbench and there is not over-employment, direct labor cost volume variance will be caused by idle capacity conditions.

Under the idle capacity conditions, the total direct labor hours that the productive workforce can be benefited from which will be found theoretically as of the basis period at various capacity utilization levels down from the practical capacity limit of the enterprise, while the total standard direct labor hours of the productions performed will be different according to the different capacity utilization levels (CFI, 2015). In this case, if it is desired to determine (measure) the real efficiency of the productive workforce, the time that productive workers can be benefited from in production in that period should definitely not be measured as actual labor time in order to determine the actual time of the production performed (Maç, 2000). If the time to benefit from the productive workforce as the actual time of production is measured, even though the average working time (ie, their productivity) per production unit of productive workers at various capacity utilization levels does not change, the negative difference between actual and standard production times will increase gradually as the total standard time of production decreases with the capacity utilization level and as a result, productive workers are evaluated as inefficient increasingly unfairly (Chew, 1988). Let us explain this situation and how to analyze direct labor cost efficiency and volume variance in idle capacity conditions with a numerical example.

Let us assume that there are 3 workbenches in our example enterprise, each workbench is operated by 2 workers, the enterprise produces only X parts, and the standard processing time of 1 unit of the X part is 1 machine hour, thus 2 DLT. In this enterprise, where the standard hourly rate is 10 TL/DLT, 540 X pieces were produced in January, 480 in February and 420 in March. To make our explanations easy, let us assume that the average actual processing time of 1 unit of X part is 2.06 DLTs for three months, and that there is no idle time emerging out of the will of the business management.

Table 2 shows how to analyze the time variance caused by the difference between actual and standard direct labor times when the time that productive workers can be benefited from in production is accepted as actual DLT of production, and Table 3 shows how to analyze efficiency and volume variance in idle capacity conditions.

Table 3. Analysis of Direct Labor Cost Efficiency and Volume Variance under Idle Capacity Conditions

Months	January	February	March
Production amount	540 Pieces/Month	480 Pieces/Month	420 Pieces/Month
Theoretical time that the enterprise can benefit from productive workers in production	1200 DLT/Month	1200 DLT/Month	1200 DLT/Month
Idle time emerging out of the will of the business management.	-	-	-
Time that productive workers are benefited from in production	1200 DLT/Month	1200 DLT/Month	1200 DLT/Month
Actual DLT of production*	(-) 1112.4 DLT/Month	(-)988,8 DLT/Month	(-)865,2 DLT/Month
Time that Pro. Work. are not benefited from in Prod.	87.6 DLT/Month	211.2 DLT/Month	344 DLT/Month
Standard DLT rate	x10 TL/DLT	x10 TL/DLT	x10 TL/DLT
	876TL/Month	2112TL/Month	3348TL/Month
Direct labor cost volume variance	1112.4 DLT/Month	988.8 DLT/Month	865.2 DLT/Month
Actual DLT of production			
St. DLT of production	(-) 1080 DLT/Month	(-) 960 DLT/Month	(-) 840 DLT/Month
Variance between the actual and St. DLTs of production	32,4 DLT/Month	28,8 DLT/Month	25,2 DLT/Month
Standard DLT rate	x10 TL/DLT	x10 TL/DLT	x10 TL/DLT
Direct labor cost efficiency variance	324 TL/Month	288 TL/Month	252 TL/Month

(*) Since there is no idle time emerging out of the will of business management, and the workdays, the numbers of workers and shifts in each month are considered equal in our example, the theoretical time that productive workers can be benefited from in production, which is equal in each month, is accepted as 1200 DLT/Month (6 Workers/Dayx25 Day/Monthx8 Hour/Day).

(**) By multiplying the production amount of each month and standard DLT part per production unit of X part, the standard DLTs of production performed in months are found 1080 DLT/Month (540 Pieces/Monthx2 DLT/Pieces) in January, 960 DLT/Month (480 Pieces/Monthx2 DLT/Pieces) in February, and 840 DLT/Month (420 Pieces/Monthx2 DLT/Pieces) in March.

(***) In our example, since efficiency rates on the basis of actual production times of productive workers are 97.08737% (2 DLT/Pieces/2.06 DLT/Piecesx 100), it is assumed to be approximately 97%, and this ratio was accepted equally within three months, as the average actual DLT (2.06 DLT/Pieces) per production unit of every three months is equally assumed.

Table 2. Determination of Direct Labor Cost Efficiency Variance under Idle Capacity Conditions Based on the Time that Productive Workers can be Benefited from in Production			
Months	**January**	**February**	**March**
Production amount	540 Pieces/Month	480 Pieces/Month	420 Pieces/Month
Time that Pro. Work. are not benefited from in Prod.*	1200 DLT/Month	1200 DLT/Month	1200 DLT/Month
St. DLT of prod.**	(-) 1080 DLT/Month	(-) 960 DLT/Month	(-) 840 DLT/Month
Time that Pro. Work. are considered to work overtime for the production they perform	120 DLT/Month	240 DLT/Month	360 DLT/Month
Standard hourly rate	x 10 TL/DLT	x 10 TL/DLT	x 10 TL/DLT
Direct labor cost efficiency variance	1200 TL/Month	2400 TL/Month	3600 TL/Month
Standard DLT per prod. unit	2 DLT/Piece	2 DLT/Piece	2 DLT/Piece
Ave. actual DLT per prod. unit	*2.06 DLT/Piece	*2.06 DLT/Piece	*2.06 DLT/Piece
Efficiency rate of productive workers based on actual*** production time	97%	97%	97%

(**) By multiplying the production amount of each month and average DLT performed per production unit in that month, the actual DLT of production in months are found 1112.4 DLT/Month (540 Pieces/Monthx2.06 DLT/Pieces) in January, 988.8 DLT/Month (480 Pieces/Monthx2.06 DLT/Pieces) in February, and 865.2 DLT/Month (420 Pieces/Monthx2.06 DLT/Pieces) in March.

When the results in Table 2 and Table 3 are compared, the most important difference is the efficiency variance decreases as the amount of production increases in Table 2, while the efficiency variance increases as the amount of production increases in Table 3. While the difference between direct labor cost arising from the standard hourly rate in return for the time that productive workers can be benefited from in production and standard direct labor cost of the production performed is the responsibility of the productive workforce and production activity management as completely efficiency variance in Table 2, while the responsibility of top management for "not being able to fully feed the production capacity", as well as "not being able to perform production in standard time" in this difference is determined objectively in Table 3, by separating this difference as volume and efficiency variance as we suggested. For example, the responsibility of the productive workforce and production management resulting from the efficiency variance in March is determined as 3600 TL in Table 2, and 252 TL in Table 3. The difference at the amount of 3348 TL between these two figures shows the responsibility of top management due to the failure to fully feed the production capacity between the standard direct labor cost arising in return for the time that productive workers can be benefited from in production and the standard direct labor cost of actual time of production in Table 3. When Table 3 is examined, it is observed that the volume variance increases as the responsibility of the top management due to failure to fully the production capacity increases (as the capacity utilization level decreases), and the volume variance decreases as this responsibility decreases (the capacity utilization level increases). As an example, while the volume variance was 876 TL in January, when the capacity utilization rate was 90%, the volume variance increased to 3348 TL in March, when the capacity utilization rate decreased to 70% . This interaction is a clear indication of the correlation between volume variance and the responsibility of the top management. While the volume variance shows this change, since the average actual production times (2.06 DLT/Piece) per production unit of the productive workforce per month is constant (2.06 DLT/Piece), and hence the efficiency rates (97%), it will be seen that the efficiency variance changes in months at a constant rate with the total standard direct labor hours and the total standard direct labor cost of production. For example, the ratio of efficiency variance to standard direct labor hours is 0,3 TL/DLT (324 TL/Month/1080 DLT/Month) in January and 0,3 TL/DLT in February and March. Similarly, the ratio of efficiency variance to total standard direct labor cost of production is 3% in January ((324 TL/Month/10800 TL/Month)x100), and it has the same ratio in February and March. This clearly shows that the efficiency and volume variance to be determined as we suggest can be regarded as objective measures in determining and evaluating the responsibilities for direct labor costs.

Conclusion

The aim of this study is to show that the variance that will result from the difference between actual and standard direct labor times in enterprises implementing the standard cost system can be analyzed in a way that reveals the responsibilities of those responsible for the budgeting and control of direct labor costs. The first reason that leads us to this aim is determination of the actual direct labor hours of production, which is basis of direct labor cost efficiency variance, in many different ways in practice. The second reason is that in the variance in the direct labor cost arising from the absence of work as a result of over-employment or idle capacity in direct labor expenses, although top management is responsible, any variance of top management is not analyzed in return of this responsibility in theory and practice.

At the end of our study, the following conclusions, which are important to us, have been reached: The first result is that the direct labor cost efficiency variance can only be an objective criteria in measuring and evaluating the achievements of productive workforce and production management in controlling direct labor costs (especially in terms of ensuring that production is carried out at standard time) when the actual direct labor hour of production is accurately determined. The second conclusion is that , a difference may arise between the actual DLT of production resulting from over-employment or idle capacity and the time that productive workers can be benefited from in production (Direct Labor Volume Variance), and the top management is responsible for this difference, provided that the actual DLT of production is determined realistically. The third result is that the direct labor cost volume and efficiency variance we suggest can be accepted as objective success evaluation measures in evaluating the success of top management and productive labor and production management in budgeting and control of direct labor costs.

The direct labor cost volume variance we recommend will enable the top management to focus attention and measures on over-employment and idle capacity. This difference emphasizes how the top management should be intertwined with micro- and macro-economic developments in the short and long term when making capacity estimates and realizations.

References

Anthony, Welsh & Reece (1985). Management Accounting, 4th Edition, Homewood, Illinois: Richard D. Irwin Inc., 1985.

Bacon, R., & Kojima, M. (2011). Issues in Estimating the Employment Generated by Energy Sector Activities.

Bragg, S. (2018). Variance Analysis. https://www.accountingtools.com/articles/what-is-variance-analysis.html

Bragg. S. (2019). Labor Efficiency Variance. https://www.accountingtools.com/articles/2017/5/5/labor-efficiency-variance

CFI. (2015). Corporate Finance Institute. What is Capacity Utilization? https://corporatefinanceinstitute.com/resources/knowledge/economics/capacity-utilization/

Chew, B. (1988). No- Nonsense Guide to Measuring Productivity. Harvard Business Review. https://hbr.org/1988/01/no-nonsense-guide-to-measuring-productivity

Dalcı, İ., & Tanış, V. N. (2006). The Effect and Implementation of Just in Time System from a Cost and Management Accounting Perspective. Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 15(1), 109-124.

Hayes, A. (2019). Production Volume Variance. https://www.investopedia.com/terms/p/production-volume-variance.asp

Horngren, C.T. (1974). Accounting For Management Control, Third Edition, Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

IMA. (1996). Measuring the Cost of Capacity. https://www.imanet.org//media/3682628786424e47b3f01b7d33174b33.ashx?as=1&mh=200&mw=200&hash=567C69DC15B9FC1031F6B999611C51AD766F82C2

Inua, O. (2017). Management Accounting. National Open University. https://nou.edu.ng/sites/default/files/2017-10/ACC313%20.pdf

Johnson, G.L. & Gentry, J. A. (1980). Finney and Miller's Principles of Accounting, 8th Edition, Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Kaplan, R.S & Atkinson, A.A. (1989). Advanced Management Accounting, Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Keller, W.I., Ferrara, W.L. (1966). Management Accounting For Profit Control, 2nd Ed., New York: Mc Graw Hill.

Kenton, W. (2019). Efficiency Variance. https://www.investopedia.com/terms/e/efficiency-variance.asp

Keythman, B. (2020). Comparison of Labor Price Variance vs. Labor Efficiency Variance. Small Business - Chron.com, http://smallbusiness.chron.com/comparison-labor-price-variance-vs-labor-efficiency-variance-39340.html.

Lucey, T. (1987). Costing, 2nd Edition, English Language Book Society.

Maç, M. (2000). Atıl Kapasite (Çalışılmayan Kısım veya Boşta Geçen Zaman) Maliyeti. http://www.vergi.tc/makaleDetay/MehmetMac/

Martin, J. R. Management Accounting: Concepts, Techniques & Controversial Issues. Management and Accounting Web. https://maaw.info/MAAWTextbookMain.htm

Matz, A. & Usry, M. (1976). Cost Accounting Planning and Control, Sixth Edition, Cincinnati, Ohio: South-Western Publishing.

Morse, W.J. & Roth, H. P. (1981). Cost Accounting, 3th Edition, Florida, USA: Addison-Wesley Publishing.

Sahaf, M. A. (2013). Management Accounting. Vikas Publishing House Pvt.Ltd., New Delhi,.

Schmitz, A. (2012). Managerial Accounting https://saylordotorg.github.io/text_managerial-accounting/s00-license.html

Syverson, C. (2011). What Determines Productivity? Journal of Economic literature, 49(2), 326-65.

Van Biesebroeck, J. (2014). How tight is the link between wages and productivity?: A survey of the literature. ILO.

Walther, L. M., & Skousen, C. J. (2009). Managerial and Cost Accounting. Bookboon. https://www.principlesofaccounting.com/chapter-22/variance-analysis/