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United States Department of Agriculture Forecasts: A Meta-Analysis Study

Bahram SANGINABADI[1]

Abstract

The primary goal of this study is doing a meta-analysis research on two groups of published studies. First, the ones that focus on the evaluation of the United States Department of Agriculture (USDA) forecasts and second, the ones that evaluate the market reactions to the USDA forecasts. We investigate four questions. 1) How the previously published studies evaluate the accuracy of the USDA forecasts? 2) How they evaluate the market reactions to the USDA forecasts? 3) Is there any heterogeneity in the results of the mentioned studies? 4) Is there any publication bias? About the first question, while some researchers argue that the forecasts are unbiased, most of them maintain that they are biased, inefficient, not optimal, or not rational. About the second question, while a few studies claim that the forecasts are not newsworthy, most of them maintain that they are newsworthy, provide useful information, and cause market reactions. About the third and the fourth questions, based on our findings, there are some clues that the results of the studies are heterogeneous, but we could not find enough evidences of publication bias.

Keywords: *USDA forecasts, meta-analysis, publication bias*

JEL Classification: *D49, Q10*

ABD Tarım Bakanlığı Tahminleri: Bir Meta-Analiz Araştırması

Özet

Bu çalışmanın temel amacı, yayınlanmış iki grup çalışma üzerinde bir meta-analiz araştırması yapmaktır. Bunlardan birincisi, ABD Tarım Bakanlığı (USDA) tahminlerinin değerlendirilmesine odaklanan, ikincisi ise bu tahminlere piyasanın gösterdiği tepkileri değerlendiren çalışmalardır. Çalışmada bu dört soru araştırılmıştır: 1) Daha önce yayınlanan çalışmalar USDA tahminlerinin doğruluğunu nasıl değerlendiriyor? 2) Bu çalışmalar USDA tahminlerine piyasanın gösterdiği tepkileri nasıl değerlendiriyor? 3) Söz konusu çalışmalar sonuçları bakımından heterojenlik gösteriyor mu? 4) Bu yayınlarda yayın yanlılığı var mı? İlk soruya ilişkin olarak, bazı araştırmacılar tahminlerin tarafsız olduğunu savunurken, araştırmacıların çoğunluğu bu tahminlerin yanlı, etkinsiz, optimal olmadığını veya rasyonel olmadığını iddia etmiştir. İkinci soru hakkında, tahminlerin haber değeri taşımadığını az sayıda çalışma ileri sürse de, çalışmaların çoğunluğu tahminlerin haber değeri taşıdığını, faydalı bilgiler sağladığını ve piyasa tepkilerine neden olduğunu savunmuştur. Üçüncü ve dördüncü sorulara ilişkin elde edilen bulgular ise, çalışmaların sonuçlarının heterojen olduğuna yönelik bazı ipuçları sunmakla birlikte yayın yanlılığına dair yeterli kanıtın olmadığını göstermiştir.

Anahtar Kelimeler: *USDA tahminleri, meta-analiz, yayın yanlılığı*

JEL Sınıflandırması: *D49, Q10*

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1. Introduction

Meta-analysis is a systematic approach to analyze literature review by statistical methods where the goal is to compile and contrast the findings of several related studies. For the first time, this method proposed by Glass (1976: 3-8). Also, other researchers such as Jarrell and Stanley (1990: 54-67) are among the first ones that applied meta-analysis. The studies that aim to aggregate and synthesize the literature on a certain topic progressively apply meta-analysis (Olkin,1995: 457–472). Currently researchers apply this method in many different areas including psychology, education, science, marketing, and social sciences. Meta-analysis is popular among the economists as well.

In this paper we exclusively focus on two types of studies. First, the studies that evaluate the United States Department of Agriculture (USDA) forecasts. Second, the ones that evaluate the market reactions to these forecasts. Note that almost all the studies that focus on the USDA forecasts can be categorized in one or both of mentioned categories above. The number of published papers in mentioned areas are high and they report mixed often contradict findings.

USDA provides the monthly report "World Agricultural Supply and Demand Estimates" (WASDE) which is a comprehensive forecast of supply and demand for major crops (produced in U.S. and the rest of the world) and livestock (U.S. only). WASDE report applies the statistical reports compiled by the USDA agencies and other government agencies (Xiao et al., 2014: 17-18).

We are interested in finding answers for four questions. First, how the academic published studies evaluate accuracy of USDA forecasts? In other words, do their findings show that the USDA forecasts are accurate? Second, how the academic published studies evaluate market reactions to the USDA forecasts? Third, are results of the academic papers heterogeneous? Fourth, are there any clues of publication bias?

In the rest of this paper, we focus on answering the mentioned questions above. In the next section, we briefly talk about the USDA forecasts. 'Methodology of data-analyzing' is the topic thing that we discuss. Then, we represent 'Analysis', 'Accuracy of the USDA Forecasts', 'Market Reactions to the USDA Forecasts', 'Meta-analysis', and 'Discussion' respectively.

The rest of this paper is organized, as follows. Section 2 discusses the literature. Section 3 outlines the research methodology of paper. Section 4 provides the results and discussion and section 5 presents the conclusion of the study.

2. Literature Review

In a comprehensive search in the literature we found 54 relevant studies. We mainly applied the key words "USDA forecast", "USDA", "forecast", "Evaluation", "Accuracy", "market reaction", "market participants", etc. The searching process

has been done mainly through Google Scholar[2] and ScienceDirect[3]websites. Figure 1 represents the scatter plot that shows the number of published papers each year.

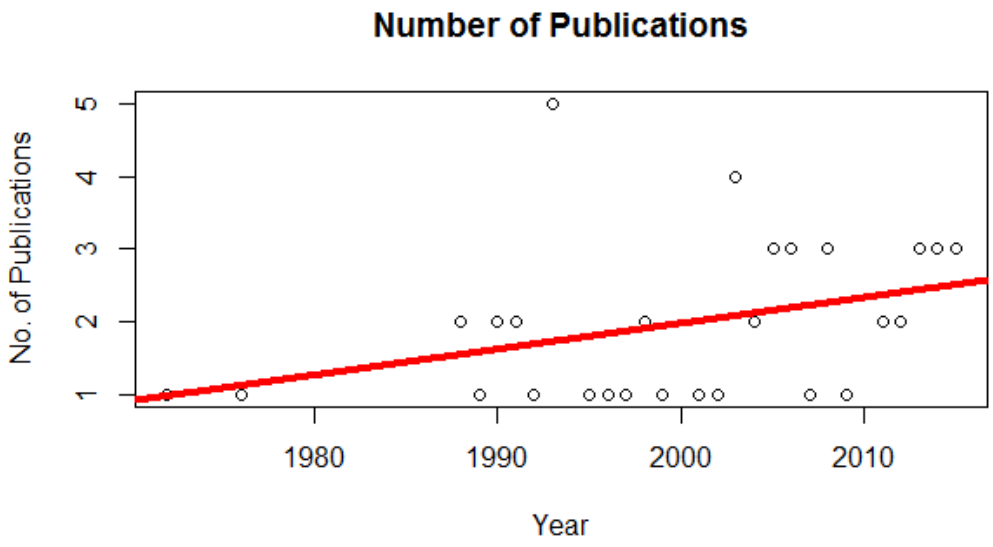

Figure 1: Scatter Plot of Number of Relevant Publications.
Note: Each dot shows the number of publications in one specific year. The positive slope of the red line shows that the number of publications per year has been increasing.

2.1. Summary of the Literature

In this section, first, we provide the summary of findings of the studies that evaluate the USDA forecasts, then we summarize the findings of the ones that evaluate market reactions to the USDA forecasts.

Researcher & Topic (Accuracy of the USDA Forecasts)	**Summary of study**
Egelkraut et al. (2003: 92-94). An evaluation of crop forecast accuracy for corn and soybeans: USDA and private information agencies.	Even though, all agencies' forecast accuracy is improved, and relative accuracy is varied by crop and time, the USDA predictions are more accurate than other agencies. However, when it comes to soybeans the forecast errors are very similar for all agencies.
Good & Irwin (2005: 10-15). Understanding USDA corn and soybean production forecasts: Methods,	The USDA production forecast errors are largest in August. For August, the private market forecasts for soybeans are more accurate than the USDA forecasts, but the USDA corn production forecasts

[2] https://scholar-google-com.eres.library.manoa.hawaii.edu/
[3] http://www.sciencedirect.com.eres.library.manoa.hawaii.edu/

performance and market impacts over 1970-2005.	are more accurate than the private market. In addition, as the growing season goes on the accuracy of the USDA forecast for soybeans improves.
Gunnelson et al. (1972: 640). Analysis of the accuracy of USDA crop forecasts.	The USDA forecasts are improved moderately over 1929 to 1970, but it still underestimates the crop size, year to year production changes, and its own errors in earlier forecasts when it revises the new forecasts.
Irwin et al. (2014: 52-59). Evaluation of Selected USDA WAOB and NASS Forecasts and Estimates in Corn and Soybeans.	Neither for corn nor for soybeans the accuracy of the WAOB forecasts have not changed significantly over time. Also, there is no evidence of bias in NASS forecasts for corn. In addition, there is some evidences of improvement in the accuracy of NASS corn forecasts over time. However, soybean forecasts usually underestimate the yield.
Isengildina-Massa et al. (2013a: 105-106). Do Big Crops Get Bigger and Small Crops Get Smaller? Further Evidence on Smoothing in US Department of Agriculture Forecasts.	The USDA forecasts for both soybeans and corn increase in big crop years and decrease in small crop years and the magnitude of smoothing is significantly large.
Isengildina-Massa et al. (2006: 1101-1102). Are Revisions to USDA Crop Production Forecasts Smoothed?	The USDA forecasts are smoothed, but due to smoothing, loss in forecast accuracy happens which is statistically and economically significant in several cases.
Isengildina-Massa et al. (2011: 3801-3802). Empirical confidence intervals for USDA commodity price forecasts.	This study suggests that empirical approaches such as kernel density, quantile distribution, and best fitting parametric distribution methods might be used to construct more accurate confidence intervals for USDA wheat, soybean, and corn forecasts.
Isengildina-Massa et al. (2013b: 5101-5102). When do the USDA forecasters make mistakes?	The errors in ending stocks forecasts are usually driven by errors in production forecasts across all commodities. In addition, for all commodities, errors in price forecasts are caused by errors in U.S. ending stocks forecasts.
Isengildina-Massa et al. (2012: 111). A comprehensive evaluation of USDA cotton forecasts.	The USDA forecast overestimates China's exports, but underestimates China's domestic use and rest of the world imports. In addition, USDA repeats errors in ROW (i.e. rest of the world except China) production forecasts and overcorrects errors in ROW exports forecasts.
Isengildina-Massa et al. (2011: 11-12). What Can We Learn from our	Correction for correlation in forecast revisions does not improve the USDA cotton forecasts. Correction for correlation of errors with previous year's errors

Mistakes? Evaluating the Benefits of Correcting Inefficiencies in USDA Cotton Forecasts.	and correlation of errors with forecast levels, result in improvement of USDA cotton forecasts.
Kastens et al. (1998: 259). Evaluation of extension and USDA price and production forecasts.	For livestock series, Extension forecasts are more accurate than the USDA forecasts, but for the crops USDA forecasts are more accurate. However, in most of the cases Composite forecasts are more accurate than both of Extension and the USDA forecasts.
Manfredo & Sanders (2004: 128-130). The value of public price forecasts: Additional evidence in the live Hogs market.	The lean Hogs futures-based forecast is more accurate than Extension and the USDA forecasts.
Meyer & Lawrence (1988: 28-29). Comparing USDA Hogs and Pigs Reports to Subsequent Slaughter: Does Systematic Error Exist?	Seasonal nature of Hogs production must be scrutinized. Pigs and Hogs forecasts over emphasize this seasonality.
No & Salassi (2009: 480-481). A sequential rationality test of USDA preliminary price estimates for selected program crops: Rice, soybeans, and wheat.	The USDA estimates are unbiased in the short-run, but they are not rational in the long-run.
Sanders & Manfredo (2002: 123-126). USDA production forecasts for pork, beef, and broilers: an evaluation.	The USDA forecasts are unbiased, but they are not efficient. The reason is USDA do not completely consider the information from the previous forecasts.
Sanders & Manfredo (2003a: 331-333). USDA livestock price forecasts: A comprehensive evaluation.	The USDA forecasts are not optimal. Broiler price forecast is biased and overall all the forecasts repeat errors.
Sanders & Manfredo (2005: 4-7). A Test of Forecast Consistency Using USDA Livestock Price Forecasts.	The USDA quarterly livestock price forecasts are not consistent in the long run.
Sanders & Manfredo (2008: 59-65). Multiple horizons and	Although the USDA forecasts are not rational, they provide useful information for their users. Likewise, turkey and milk forecasts show the most consistent performance, but beef provides little information.

information in USDA production forecasts.	
Sanders & Manfredo (2003b: 21-22). Keep up the good work? An evaluation of the USDA's livestock price forecasts.	USDA Broiler price forecasts are biased. Overall, the USDA price forecasts are not optimal, and almost in all the forecasts it repeats errors.
Schaefer & Myers (1999: 9-12). Forecasting accuracy, rational expectations, and market efficiency in the US beef cattle industry.	The USDA forecasts are inefficient and biased.
Von Bailey & Brorsen (1998: 520-524). Trends in the accuracy of USDA production forecasts for beef and pork.	The USDA forecast underestimates production in the 1980s, but the bias disappears later. So, the accuracy of the forecasts is improved and even though the USDA forecasts are not optimal in 1980s, they show optimality after then.
Xiao et al. (2014: 17-18). USDA and private analysts' forecasts of ending stocks: how good are they?	The USDA forecasts are unbiased, but both of the USDA and private forecasts are inefficient. Also, the accuracy of both of the USDA and private forecasts is the highest for wheat and the lowest for soybeans.
Researcher & Topic (Market Reactions to the USDA forecasts)	**Summary of study**
Aulerich et al. (2007: 16-18) The Impact of Measurement Error on Estimates of the Price Reaction to USDA Crop Reports.	Implication of Identification by Censoring (ITC) method shows that market reactions to unanticipated information in the USDA forecasts are significantly high.
Colling & Irwin (1990: 93) The reaction of live Hogs futures prices to USDA Hogs and Pigs reports.	Live Hogs future prices do not react to anticipated changes in the USDA forecasts, but considerably react to unanticipated changes in the reports. However, the Hogs prices adjust to unanticipated reports on the day following release of the forecasts.
Colling et al. (1992: 268) Weak-and strong-form rationality tests of market analysts' expectations of USDA Hogs and Pigs reports.	Expectations of Pigs and Hogs reports are strong-form rational.
Colling et al. (1996: 134-136) Reaction of Wheat, Corn, and Soybean Futures Prices to USDA" Export Inspections" Reports.	Soybean prices respond substantially to unanticipated information in "Export Inspections" reports. Also, corn prices react notably to unanticipated information during the December to February quarter, but soybean prices respond to

	such an unanticipated information during June to August quarter.
Colling et al. (1997: 396-400) Future price responses to USDA's Cold Storage report.	Live Hogs and pork belly prices react significantly to unanticipated information from the USDA forecasts. Therefore, the forecasts provide information to the markets.
Darby (2015: 22-24) Information Content of USDA Rice Reports and Price Reactions of Rice Futures.	The USDA forecasts provide useful information to the rice markets and rice futures react to the USDA information consistently.
Fortenbery et al. (1993: 171-172) The effects of USDA reports in futures and options markets.	The effects of the USDA forecasts are minimal, but regression tests show that market participants cannot forecast market future.
Good & Irwin (2005: 10-15) Understanding USDA corn and soybean production forecasts: Methods, performance and market impacts over 1970-2005.	The USDA corn and soybeans production forecasts are reasonably well.
Irwin at al. (2001: 16-17) The value of USDA outlook information: an investigation using event study analysis.	The USDA forecasts have significant impacts in soybeans and corn markets. Also, the reports reduce uncertainty of the expected distribution of the prices which improves the market participants' welfare.
Isengildina-Massa et al. (2004: 12-13) Does the Market Anticipate Smoothing in USDA Crop Production Forecasts?	Except for some cases market participants are aware of USDA smoothing practices and efficiently apply this information into their own forecasts.
Fortenbery & Sumner (1993: 171-172) The effects of USDA reports in futures and options markets.	During the time, market participants have learned how to digest the USDA reports. Hence, forecasts do not cause abnormally large price changes.
Hoffman et al. (2015: 156-169) Forecast performance of WASDE price projections for US corn	The USDA WASDE projections of corn season-average price provide valuable information to the market and improves the efficiency of the United States agricultural sector.
Karali (2012: 94-95) Do USDA Announcements Affect Comovements Across Commodity Futures Returns?	On the release days of the grain stocks, feed outlooks, and Hogs and Pigs report the largest movements in covariances happen.
McKenzie (2008: 365) Pre-harvest price expectations for corn: The information content of USDA reports and new crop futures.	Results indicate that the USDA forecasts are newsworthy. Also, price reactions to the reports are rational.

Patterson & Brorsen (1993: 373-377) USDA Export Sales Report: Is It News?	The USDA forecast doesn't provide new information to the market and indeed the traders predict the reports.
Pruitt et al. (2014: 30-32) End user preferences for USDA market information.	Results show preference for farm level forecasts by Extension agents.
Roberts (2006: 17) The value of plant disease early-warning systems: A case study of USDA's soybean rust coordinated framework	The USDA forecasts provide valuable information to the market. Probably in 2005 the value of information by the USDA forecasts exceeds the cost of getting information.
Schroeder et al. (1990: 303) Abnormal returns in livestock futures prices around USDA inventory report releases.	The USDA forecasts do not have consistent upward or downward influences on the prices, but the volatility of returns increases around the report release time which suggests forecasts provide new information to the market. Also, comparing to the other markets the forecast contains less information for the Hogs market. Hence, the Hogs prices are more volatile after the release of the USDA forecasts.
Summer & Mueller (1989: 5-7) Are harvest forecasts news? USDA announcements and futures market reactions.	There are significant differences between the means and variances of prices following a USDA announcement and the means and variances of prices of the other days.

2.2. Accuracy of the USDA Forecasts

As the summery of the relevant studies above show, not all the researchers agree about accuracy of the USDA forecasts. On the one hand some studies maintain that USDA estimates are *unbiased* (e.g. No and Salassi[4], 2009: 480-481; Sanders and Manfredo[5], 2002: 123-126; Xiao et al[6]., 2014: 17-18; Irwin et al[7]., 2014: 52-59) and on the other hand, other studies claim that USDA forecasts are *biased* (e.g. Sanders and Manfredo[8], 2003a: 21-22; Sanders and Manfredo, 2003b: 331-333; Schaefer and Myers, 1999: 9-12).

multiple studies maintain that the USDA forecasts are *inefficient* (e.g. Schaefer and Myers, 1999: 9-12; Sanders and Manfredo, 2002: 123-126; Xiao et al., 2014: 17-

[4] No and Salassi (2009: 480-481) argue that USDA forecasts are unbiased in the short-run, but not rational in the long run.
[5] Sanders and Manfredo (2002: 123-126) maintain that USDA forecasts are unbiased but not efficient.
[6] Xiao et al. (2014: 17-18) argue that USDA forecasts are unbiased but inefficient.
[7] Irwin et al. (2014: 59) maintain that USDA NASS forecasts for corn are unbiased.
[8] Sanders and Manfredo (2003a: 21-22) and Sanders and Manfredo (2003b: 331-333) indicate that USDA forecasts of Broiler price is biased.

18), *not optimal* (e.g. Von Bailey and Brorsen, 1998: 520-524; Sanders and Manfredo, 2003a: 21-22; Sanders and Manfredo, 2003b: 331-333), or *not rational in the long run* (e.g. Also, Sanders and Manfredo, 2008: 59-65; No and Salassi, 2009: 480-481).

Some of the studies report an *improvement in accuracy* of USDA forecasts (e.g. Gunnelson et al[9]., 1972: 640; Egelkraut et al., 2003: 92-94; Good and Irwin[10], 2005: 10-15; Irwin et al[11], 2014: 52-59).

Some studies *compare* the accuracy of the USDA forecasts with that of other forecasts (e.g. Kastens et al., 1998: 259; Manfredo and Sanders, 2004: 128-130). Furthermore, at least two studies indicate that USDA forecasts are *more accurate in case of corn production*, but this is not the case for soybeans production (e.g. Egelkraut et al., 2003: 92-94; Irwin et al., 2014: 52-59).

Figure 2. A represents the summary of major findings of the studies that focus on evaluation of accuracy of USDA forecasts. Overall the authors of 4 studies believe that at least for some of the Agriculture products the forecasts are unbiased, 4 studies point out that the accuracy of the forecasts have improved, and 2 studies maintain that USDA does a better job about corn forecasts comparing to soybeans forecasts. However, 3 studies indicate that the USDA forecasts are biased, 3 of them report inefficiency, another 3 studies specify that the forecasts are not optimal, and 2 studies argue that they are not rational.

3. Methodology

In this section we discuss the methodology of data-analyzing and that of the meta-analysis respectively.

3.1. Methodology of Data-analysis

To answer the first and the second questions, we summarize the findings of the relevant studies, and then we refine the results to find the patterns of their findings. To do meta-analysis we apply the metaphor package which provides functions to do the analysis in R. The package enables us to study the fixed and random effect models (Viechtbauer, 2010: 1-42). Then we test for heterogeneity and publication bias which enable us to tackle the third and the fourth questions.

3.2. Methodology of Meta-analysis

In a meta-analysis study usually two models are discussed: fixed-effect and random-effect models. In a fixed-effect model the assumption is that the dataset in not random and the individuals are from a same population while in random effect models the dataset is from a hierarchy of different populations and the differences among the dataset observations relates to that hierarchy. As an example, the dataset which is collected from a same population in a same library may qualify for the

[9] Gunnelson et al. (1972: 640) report a moderate improvement in USDA forecasts.
[10] Good and Irwin (2005: 10-15) report an improvement in accuracy of USDA forecasts for soybeans.
[11] Irwin et al. (2014: 52-59) maintain that USDA NASS forecasts for corn are improved.

fixed-effect model. A fixed-effect model doesn't account for heterogeneity and if the dataset is from different populations it overestimates the effect sizes. In that condition applying the random-effect models is suggested. When there is heterogeneity in the dataset the calculated Confidence Intervals (CI) are much wider if the researcher applies the random-effect models, but if the dataset is homogeneous the CI is the same as the estimated CI using fixed-effect models.

To determine heterogeneity in the sample sizes we calculate Q-statistic. The null hypothesis for the Q-statistic test is that 'all of the studies share a same effect size' and the alternative hypothesis is that 'the studies do not examine a common effect size'. In other words, a statistically significant Q-statistic means that the studies do not share a common effect size. However, a non-significant Q-statistic does not prove that the dataset is homogeneous.

An alternative test for heterogeneity applies I2-statistic. I2-statistic is a percentage that shows that the proportion of variance is from actual differences between studies rather than within the study variance. Higgins and Thompson (2002: 1540-1557) provide thresholds of 25%, 50%, and 75% which indicate low, moderate and high variance for I2-statistic.

Another important concept in meta-analysis literature is publication bias which indicates that the studies with stronger effect-sizes are more probable to get published. In other words, the publisher looks at the findings of the research and the studies with strong and positive results have more chances to get published. Funnel plot is a helpful tool to determine publication bias. In this plot the vertical axis shows individual effect sizes while the horizontal axis represents standard errors. A symmetric Funnel plot indicates the possibility of unbiased publication while an asymmetric plot shows the possibility of publication bias. If the plot shows a negative correlation, then it is likely that the studies with small and negative results do not get published and they are missed from the left corner of the plot.

4. Results and Discussion

In this section, first we discuss the market reactions to the USDA forecasts and then we focus on the meta-analysis.

4.1. Market Reactions to the USDA Forecasts

Market reactions to the USDA forecasts are not unambiguously identified. While on the one hand some researchers argue that the forecasts are newsworthy and provide new and useful information to the market (e.g. Summer and Mueller, 1989: 5-7; Schroeder et al., 1990: 303; Fortenbery and Sumner, 1993: 171-172; Roberts, 2006: 17; McKenzie, 2008: 365; Darby, 2015: 22-24, Hoffman et al., 2015: 156-169), on the other hand other researchers maintain that the USDA forecast are not newsworthy and in fact market participants predict the reports (e.g. Patterson and Brorsen, 1993: 373-377; Isengildina-Massa et al., 2004: 12-13).

Also, several studies note that the USDA forecasts cause market reaction or movement in the prices (e.g. Colling and Irwin, 1990: 93; Colling et al., 1996: 134-136; Colling et al., 1997: 396-400; Irwin at al., 2001: 16-17 (corn and soybeans);

Aulerich et al., 2007: 16-18; McKenzie, 2008: 365; Karali, 2012: 94-95). Furthermore, Colling and Irwin (1990: 93), Colling et al. (1996: 134-136), Colling et al. (1997: 1396-400), Aulerich et al., (2007: 16-18) argue that market reacts to the unanticipated changes in the forecasts. Fortenbery and Sumner, (1993: 171-172) believe that USDA forecasts do not cause uncertainty. In addition, Colling et al., (1992: 268) maintain that expectations of Pigs and Hogs reports are strong-form rational. Other researchers such as McKenzie (2008: 365) claim that reactions to prices are rational.

Figure 2. B represents the summary of major findings of the studies that focus on the market reactions to the USDA forecasts. All in all, 2 studies claim that the forecasts are not newsworthy, while 7 of them argue that they are newsworthy. 7 studies specify that USDA forecasts cause market reactions. 4 of them maintain that markets react to unanticipated information, 2 studies argue that market expectations are rational, and 1 study maintain that the forecasts do not cause uncertainty.

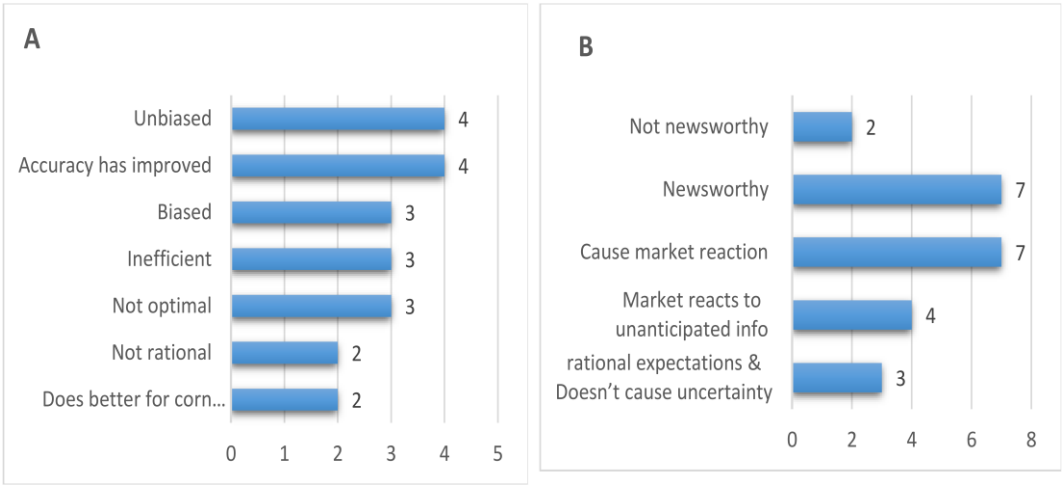

Figure 2. Summary of the Major Findings of the Published Studies.

Note: A represents a summary of main findings of the studies which focus on analyzing the accuracy of the USDA forecasts, while B shows the ones which study market reactions to the USDA forecasts.

4.2. Meta-analysis

A possible problem with the USDA forecasts can be repeating the past errors or over-correcting them. A correlation with the past errors represents the forecasts tendency to repeat or overcorrect the past errors. Positive correlation with past forecasts means that the new forecasts repeat the same errors, while negative correlation represents over-correction of the errors (Isengildina-Massa et al., 2013a: 105-106). Multiple studies calculate the Pearson correlation of the USDA forecasts using their past errors (e.g. Sanders and Manfredo, 2002: 123-126, Sanders and Manfredo, 2003: 21-22; Isengildina-Massa et al., 2004: 12-13; Isengildina-Massa et al., 2006: 1101-1102; Isengildina-Massa et al., 2012: 111, Isengildina-Massa et al., 2013b: 5101-5102; Good and Irwin, 2005: 10-15; and McKenzie, 2008: 365). We apply their findings which are represented in Table 1 to do meta-analysis in this study.

Table 1. The Dataset to do meta-analysis

	Authors	Year of publication	Time Period studies	Item studied	Pearson Correlation	Forecast
1	Sanders & Manfredo	2002	1982-2000	beef	0.31	USDA
2	Sanders & Manfredo	2002	1982-2000	pork	0.15	USDA
3	Sanders & Manfredo	2002	1982-2000	broiler	0.25	USDA
4	Sanders & Manfredo	2002	1982-2000	beef	-0.12	AR4
5	Sanders & Manfredo	2002	1982-2000	pork	-0.02	AR4
6	Sanders & Manfredo	2002	1982-2000	broiler	0.03	AR4
7	Sanders & Manfredo	2003	1982-2002	cattle	0.24	USDA
8	Sanders & Manfredo	2003	1982-2002	Hogs	0.18	USDA
9	Sanders & Manfredo	2003	1982-2002	broiler	0.31	USDA
10	Sanders & Manfredo	2003	1982-2002	cattle	0.02	AR4
11	Sanders & Manfredo	2003	1982-2002	Hogs	-0.21	AR4
12	Sanders & Manfredo	2003	1982-2002	broiler	0.17	AR4
13	Isengildina et al.	2004	1970-2002	corn	0.45	USDA
14	Isengildina et al.	2004	1970-2002	soybeans	0.22	USDA
15	Good & Irwin	2005	1970-2005	corn	0.54	USDA
16	Good & Irwin	2005	1970-2005	soybeans	0.35	USDA
17	Isengildina et al.	2006	1970-2002	corn	0.23	USDA
18	Isengildina et al.	2006	1970-2002	soybeans	-0.8	USDA
19	McKenzie	2008	1970-2005	corn	0.66	USDA
20	Isengildina et al.	2012	1985-2009	corn	-0.31	USDA
21	Isengildina et al.	2013	1987-2010	soybeans	0.11	USDA
22	Isengildina et al.	2013	1987-2010	wheat	0.16	USDA

Note: AR4 which is a time series model represents a substitute method of forecasting.

To determine heterogeneity in the sample sizes we calculate Q-statistic. A statistically significant Q-statistic means that the studies do not share a common effect size. However, a non-significant Q-statistic does not prove that the dataset is homogeneous. The test for heterogeneity results show that Q-statistic is 77.3 and p-value < 0.0001 which means that the studies do not share a common effect size and the dataset is heterogeneous.

An alternative test for heterogeneity applies I2-statistic. I2-statistic is a percentage that shows that the proportion of variance is from actual differences between studies rather than within the study variance. As mentioned before, Higgins and Thompson (2002: 1540-1557) provide thresholds of 25%, 50%, and 75% which indicate low, moderate and high variance for I2-statistic. For our dataset I2-statistic is 70.3% (95% CI: 48.5, 83.8) which represents moderate to high variance.

Even though the mentioned tests show that there is heterogeneity in the dataset, but they don't provide any clue that which studies may disproportionally affect heterogeneity. Instead, Baujat plot which introduced by Baujat et al. (2002: 2642-2651) makes it possible to see which studies contribute to the heterogeneity. The horizontal axis in Baujat plot shows the study heterogeneity while the vertical axis indicates the influence of studies on the overall results. Figure 3 represents Baujat plot.

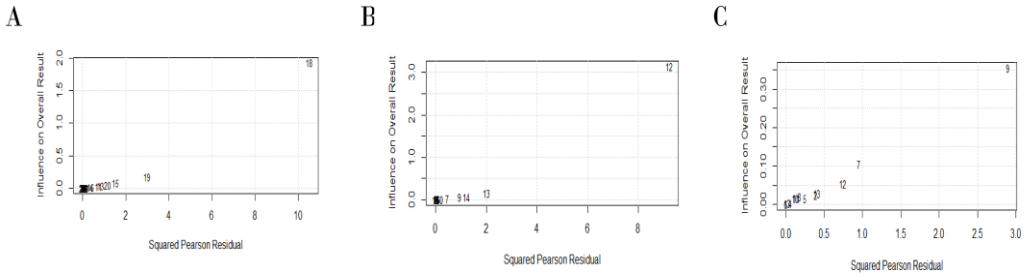

Figure 3: Baujat plot to identify the studies that contribute to heterogeneity.

Note: Each number represents a study. Studies on top right have greater influence on the results and have a bigger contribution to heterogeneity. plot A considers all of the studies. As can be seen in the graph, study 18 which is Isengildina-Messa et al. (2006: 1101-1102) for soybeans contributes the most to heterogeneity of the results. In plot B, the AR4 models are eliminated and only the studies which focus on USDA forecasts are left. Here study 12 is in the right corner above. In plot C the studies with biggest variation and small effect size are eliminated.

As discussed before another important concept in meta-analysis literature is publication bias. Funnel plot is a helpful tool to determine publication bias. In this plot the vertical axis shows individual effect sizes while the horizontal axis represents standard errors. A symmetric Funnel plot indicates the possibility of unbiased publication while an asymmetric plot shows the possibility of publication bias. If the plot shows a negative correlation, then it is likely that the studies with small and negative results do not get published and they are missed from the left corner of the plot. Figure 4 represents Funnel plot for our dataset. As can be seen in most of the cases the plot shows positive correlations.

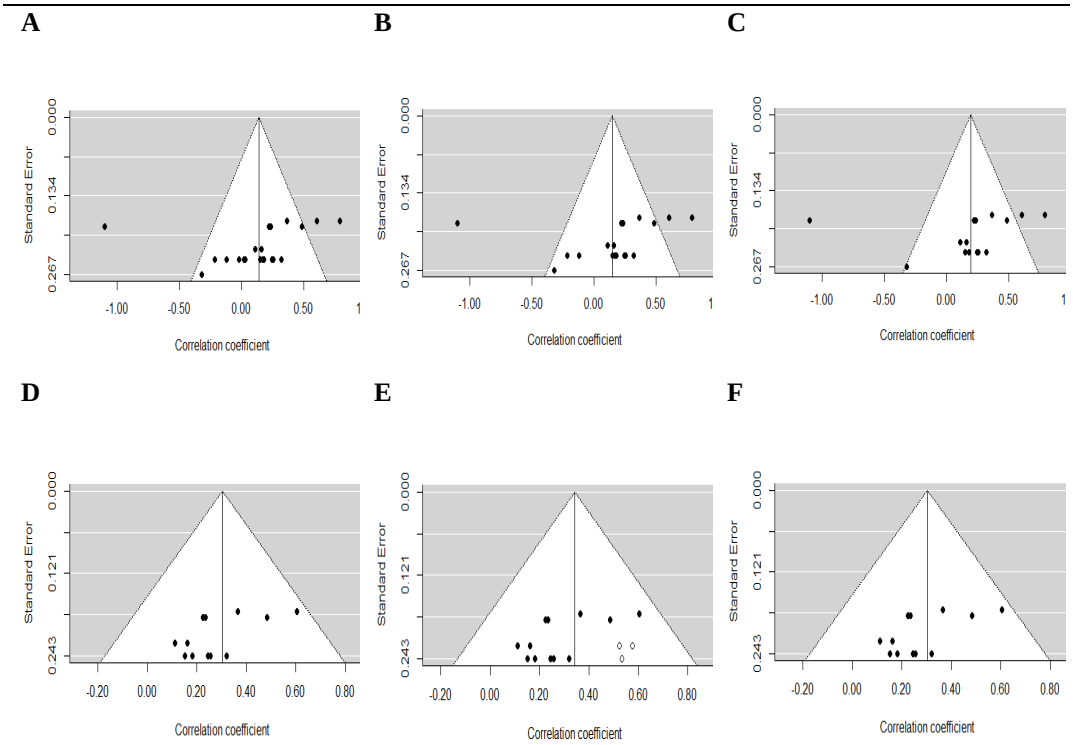

Figure 4. Funnel Plot to represent publication bias.

Note: Plot A which includes all of the studies in Table 1 shows a positive correlation and therefore the dataset can be interpreted as asymmetric. In plots B and C, we remove the studies with small effect sizes and big variations. Funnel Plot D includes all of the studies in plot A except the AR4 models. Plot E simulates three removed studies of plot D which if they were there the plot would be symmetric. In Funnel Plot F, the studies with small effect sizes and big variations are removed from Plot D which again sounds like an asymmetric plot. Overall, the Funnel Plot in all of the scenarios is asymmetric which demonstrates the possibility of publication bias.

A weakness of Funnel Plot is that it is only a subjective measure of possibility of publication bias. We apply Rank Correlation and Egger's tests as objective tools to test for publication bias. Begg and Mazumdar (1994: 1097-1098) propose Rank Correlation test. Based on their method $P<0.05$ is consistent with asymmetrical Funnel plot. However, Rank Correlation test cannot be fully trusted for analyses with less than 25 studies (Sterne at al., 2000: 1120-1127). An alternative test which is more useful for meta-analysis with less than 25 studies is Egger's Test represented by Egger et al. (1997: 630-634). Our results suggest that p value from the Egger's test equals to 0.2408 which is not statistically significant. This finding suggests that the studies are not symmetric in the Funnel plot. In other words, based on the results of the Egger's test there in no evidence of publication bias

5. Conclusion

Many researchers have studied USDA forecasts, but the academic publications in this area can be divided in two groups. The studies which evaluate the accuracy of the USDA forecasts and the ones that evaluate the market reactions to the USDA forecasts. These groups of studies provide a variety of results and in many cases

their findings contradict. Therefore, in this study we do a meta-analysis on the published studies to answer the following questions:

1) how the academic published studies evaluate accuracy of the USDA forecasts?

2) how the academic published studies evaluate market reactions to the USDA forecasts?

3) Is there heterogeneity in the results of the studies?

4) Is there any publication bias in the published studies?

After aggregating and synthesizing all published papers that we could find, we figured out that some of the studies maintain that the forecasts are unbiased, while most of the studies point out that at least for some of the products the USDA forecasts are not efficient, they are biased, and they are not optimal.

About market reactions to the USDA forecasts, we found a few studies that claim that the forecasts are not newsworthy, and the market participants could predict the reports. However, most of the studies argue that the forecasts are newsworthy, they provide useful information to the market participants, and they cause market reactions and affect the prices. We did meta-analysis using a package named "metaphor" in R to answer the third and the fourth questions. We applied Q-statistic, I2-statistic, and Baujat plot to test for heterogeneity in the findings of the academic papers discussed in Table 1. Based on the findings from the mentioned tests the results of the studies are heterogeneous. Also, we applied Funnel plot, Rank Correlation test, and Egger's test to test for publication bias. Funnel plot and Rank Correlation test results show publication bias. However, as we already mentioned Egger's test findings are more accurate for small datasets and the results of this test does not confirm publication bias.

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Sustainable Food: What Perception do Young Algerian Consumers Have?*

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Abstract

This paper examines the perception of sustainable food and the development of food systems. It's purpose to assess the perceptions of Algerian consumers on sustainable food and to know how to design and promote sustainable food products. A questionnaire survey of a random sample representative of the population of the wilaya of sidi bel Abbes (Algeria) was conducted in 2016. According to the results of this study, 37% of those surveyed believe that sustainable food should contain traditional foods. 40% think that food supplements should be excluded in order to obtain a sustainable diet. 48% believe that sustainability of food is a global problem. The majority of the population questioned agrees that the use of environmentally friendly agricultural practices is essential and recommends better nutritional education for children at school and at home. Finally, sustainable food is a whole system and useful diet. The educational and cultural dimensions are much evoked in consumers' perceptions of sustainable food.

Keywords: *Food security, sustainable food, food system, perception, Algeria*

JEL Classification: *F18, I25, Q13*

Sürdürülebilir Gıda: Cezayirli Genç Tüketicilerin Algısı Nedir?

Özet

Bu makalede, sürdürülebilir gıda algısı ve gıda sistemlerinin gelişimi incelenmektedir. Amaç, Cezayir tüketicilerin sürdürülebilir gıda hakkındaki algılarını değerlendirmek ve sürdürülebilir gıda ürünlerinin nasıl tasarlanıp tanıtılacağını bilmek. sidi bel Abbes (Cezayir) wilaya nüfusunun rastgele bir örnek temsilcisiyle ilgili bir anket 2016 yılında yürütüldü. Bu çalışmanın sonuçlarına göre, ankete katılanların %37'i sürdürülebilir gıdaların geleneksel gıdaları içermesi gerektiğine inanıyor. %40'si, sürdürülebilir bir beslenme elde etmek için gıda takviyelerinin dışarıda bırakılması gerektiğini düşünüyor. %48'si, gıda sürdürülebilirliğinin küresel bir sorun olduğuna inanıyor. Sorgulanan nüfusun büyük kısmı, çevre dostu tarım uygulamalarının kullanılmasının şart olduğunu kabul ediyor ve okulda ve evde çocuklar için daha iyi beslenme eğitimi öneriyor. Son

* The survey carried out as part of this article was presented at the 1st Mediterranean Forum of CIHEAM-IAMM under the theme: «Designing sustainable agricultural and food production systems in a context of global change in the Mediterranean», 18-19 July 2016 in Montpellier-France and in 170th EAAE seminar on "Governance of food chains and consumption dynamics: what are the impacts on food security and sustainability?" SupAgro Montpellier, France, May 15-17, 2019.

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olarak, sürdürülebilir yemekler bütün bir sistem ve yararlı bir diyettir. Eğitimsel ve kültürel boyutlar, tüketicilerin sürdürülebilir gıda algısında çok uyarılmaktadır.

Anahtar Kelimeler: *Gıda güvenliği, sürdürülebilir gıda, gıda sistemi, algı, Cezayir*

JEL Sınıflandırması: *F18, I25, Q13*

1. Introduction

Food is a much more complex system than the only quantitative and sanitary satisfaction of nutritional needs: it is also deeply cultural, consumerist, social, economic and local (Esnouf and al., 2011: 11-12). Today, we are witnessing a change in food strategies and policies. They are gradually moving from a productionise ethic to an agroecological ethic (Pastore-Reiss, 2006: 84; Schneider and al., 2015: 396). It is necessary to promote both progress in productivity and the imperative of sustainability through the reasoned modernization of agriculture in the world (Petit, 2011: 34; Feillet, 2014: 47). For an eco-food, the educational dimension is highly integrated, aiming to promote an individual and collective path towards a healthy diet, produced, distributed and consumed with respect for ecosystems and a concern for social equity (Sauvé and al., 2013: 106; Berthet, 2014: 237; Garnotel, 2014: 149).

The industrialization of food has led to an unbalanced supply of nutrition, thus maintaining a number of metabolic diseases. Today, consumers seek to adopt a safe eating behaviour when subjected to so much contradictory information. The time has come to commit to a more sustainable diet through a change in dietary patterns (Rémésy, 2010: 19).

A diagnosis of the global food security situation shows that contemporary food production and consumption patterns are “little sustainable” (Rastoin and al., 2017: 23). Driven by agri-food industries, the current food system is not sustainable. Studies and expertise are multiplying to show the limits in terms of resource use, distance, health, equity, employment etc. Faced with these findings, public or private actors are mobilizing, and we see the emergence of initiatives where "urban governments" appear to be more and more active and powerful (Brand and al., 2017: 28). Today, there is a need to address the different facets of sustainability issues in the agri-food sector and food security: training and trades, consumer protection (quality, accessibility), environmental preservation and social equality (Chikhi, 2018: 276). In Algeria, food policies focus on the quantitative aspect of food security rather than qualitative (food availability, access to food, stability and food wholesomeness). A study conducted by the Algerian Society of Nutrition (SAN), demonstrates "the weaknesses of the Algerian consumer in terms of nutritional balance". The findings of the study recommend changing food policy and systems (Subsidize fruits and vegetables instead of sugar and oil). It is also indicated that the Algerian food model loses its nutritional balance by degrading itself towards a model of excess, with an increase in the quantities consumed and the immoderate consumption of animal products and the need to follow “nutrition education associated with the promotion of physical activity” (Bouchenak, 2017).

These are the signs of a path to sustainable food. So, our study addresses three research questions:

RQ1: What are Algerian consumers' perceptions of sustainable foods?

RQ2: What are their expectations for sustainability?

RQ3: How to design and promote sustainable food products

To test the research questions, a questionnaire will be used to assess the perceptions of Algerian consumers about sustainable food, to deduce their expectations of sustainability and to know their opinions on the design of sustainable food production systems.

2. State of the Art

Food and the environment are at the heart of sustainable development (Combris and al., 2011: 1). The field of research on sustainable food is recent and interdisciplinary in nature (Redlingshöfer, 2006: 84). Many research shows that food is sustainable if the entire process, from production to consumption, health preserves, environment, solidarity and the local economy. However, to ensure access to food and meet their needs, men have designed "food systems" that have evolved significantly since the emergence of agriculture. Sustainable food also known as "sustainable diets " protects biodiversity and ecosystems, is culturally acceptable, accessible, economically fair and realistic, safe, nutritionally adequate and good for health, optimizes the use of natural and human resources (FAO, 2010: 1; Esnouf and al., 2011: 5).

Based on the FAO definition, sustainable food is based on 4 pillars: environment, socio-cultural, economy and nutrition related to health (cf. Figure 1).

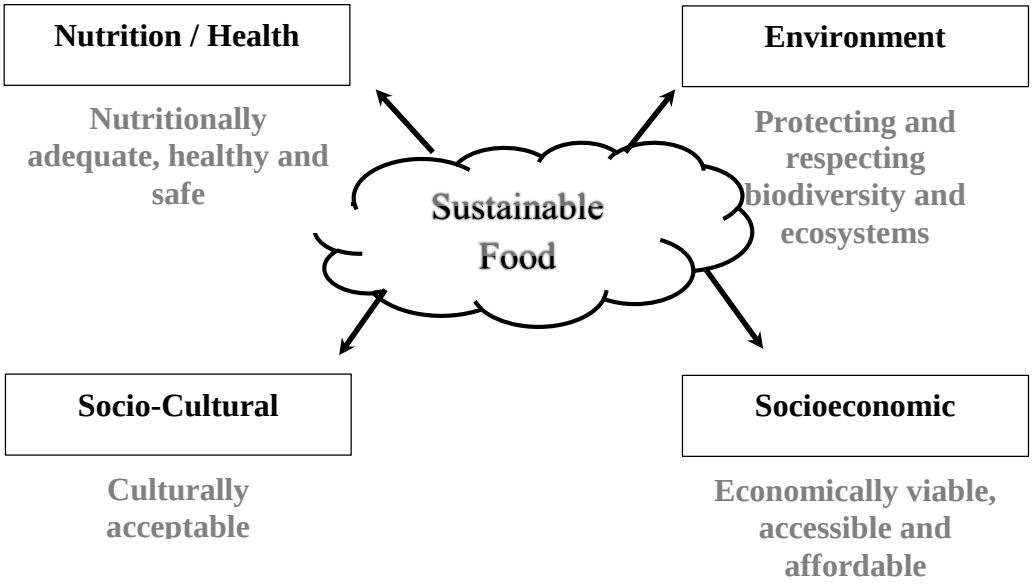


Figure 1: The 4 Pillars of Sustainable Food.

Source: Prepared by the Author According to FAO.

Today, our food is industrialized and globalized. This diet is characterized by a strong transformation of consumed products, significant distances between producer / processor and consumer. Thus, the intensive agriculture set up in the second half of the 20th century has managed to meet the demand for food by increasing the income of producers. This model was then destructive of agricultural jobs and generated strong income inequalities between farmers, jeopardizing natural resources (water, soil, biodiversity) (Yveline, 2013). However, increased consumption of meat and / or meat products is damaging the environment and leading to health problems (Novel, 2010: 11; Chikhi and Bencharif, 2016: 436).

The cultural and social function is also among the ecosystem services. It is often underestimated but is nevertheless essential, as much by the link that links the society to the act of agricultural production or to the rural landscapes, as by the cultural dimension of the agricultural products and their link with the territories (Schneider and al., 2015; Meybeck and al., 2016, op cit). Beyond the environmental aspect, plant-based diets derive their legitimacy from their benefit to human health, which is unanimously recognized by the scientific community in nutrition (Redlingshöfer, 2006: 93).

The main environmental issues (ADEM, 2019)[4] are:
- Contribute to a sustainable food chain: provision of food to consumers with low environmental impact (organic, local, seasonal, etc.), Eco design throughout the food chain (support to agroecology, development of logistics platform, and reduction of packaging, Etc.);

- To change food practices: responsible purchases in proximity circuits, environmental labelling of products, respect for the seasonality of products, rebalancing of diets (integration of legumes and reduction of proteins of animal origin);

- Fight against food waste at each link in the chain: production, processing, distribution, consumption.

An examination of consumer trends and expectations shows that consumers are demanding more information about the environmental aspects of a product, clarity on the presentation of nutrition information (labelling, logo, etc.) and packaging (Redlingshöfer, 2006, op cit; Ouillet, 2012: 74-102; IPSOS, 2014a). “Sustainable” consumers tend to buy more food products with a quality and / or environmental signature or label. The decisive choice criteria in the buying situation (the price, the origin, the traceability of the product, the respect for the environment by the farmer, the brand, the fact that it comes from fair trade and packaging) (Mathé, 2009: 55; Morgan and al., 2010: 213; IPSOS, 2014b).

Characterizing sustainable diets requires first of all distinguishing between the two dimensions of their definition (cf. Figure 2): on one hand, the nutrition and health dimension, people-oriented, and the on the other hand, the impact on the food

[4] Environment and Energy Management Agency: Climate change - ecological and energy transition.

system, and its sustainability, in all its dimensions (economic, social, environmental), which is measured at different scales (from the local to the global level).

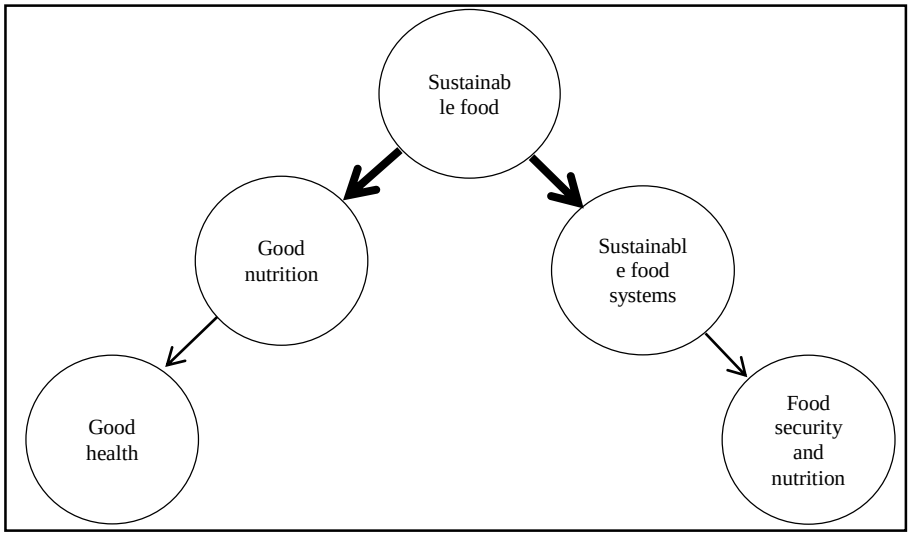


Figure 2: The Two Dimensions of a Sustainable Diet as a Driver of Change at the Individual and Systemic Level.

Source: Meybeck and Gitz, 2016: 309.

The food system itself is shaped by many factors. First, it depends on the sum of all the plans. The widespread existence of unsustainable diets, their predominance and market influence, is in itself, by systemic effect, an obstacle to the emergence of sustainable diets on a larger scale (Price and affordability of food as well as information and education). However, prices, education and consumer information are the parameters influencing food choices. (Meybeck and al., 2016: 311; Chikhi, 2018, op cit).

Consumers are increasingly asking for local foods with a traditional character or image, often perceived as high quality and responding to a need for cultural identity (Chikhi and al., 2014: 51). Thus, the use of short circuits for the sale of agricultural products at the place of production. Products from organic farming, the "organic" remains a fundamental element of a sustainable food to the extent that its mode of production is non-polluting and preserves natural resources. In addition, organic products often have better nutritional quality (more fiber, vitamins and minerals, etc.) and taste.

According to the review of food and nutritional security in Algeria, it was found that the available food ration was still unbalanced, the place occupied by wheat being too important and that of protein and fat still too low. In addition, it has also been found that the insufficient nutritional balance of the available ration leads to the rise of chronic diseases such as diabetes or cardiovascular events (Bedrani and al., 2018: 14). In addition, it has been shown that the quantitative improvement of the food supply available has been, constantly, the result of a resort to imports to

fill a structural deficit of domestic agricultural supply, especially for the most consumed goods (Durum wheat, soft wheat, milk, sugar, edible oils), a deficit explained by the rainy nature of most of Algerian agriculture and slow progress in yields and productivity. This is the "food dependency" and "food vulnerability" of Algeria. Indeed, since 2014, there has been a regression linked to the strongly constrained macroeconomic and financial framework that needs to be rethought in the agricultural and food policy and the growth model that constitutes its current base (Bessaoud, 2016: 73). In Algeria, there are no detailed studies dealing with consumer perception to the sustainable food.

After this brief state of the art about sustainable food and its characteristics, we can then ask ourselves about "the general idea of individuals in relation to sustainable food in Algeria". The objective of our study is divided as follows: To evaluate the perceptions of Algerian consumers about sustainable food; Identify their expectations of sustainability; Know how to design and promote sustainable food products. This should lead us to think of food production systems from a sustainable marketing perspective.

3. Methodology (Data Source, Method of Data Collection)

In most research on sustainable food, the methodology used and advocated is the Delphi method (Clément and al., 2006: 297). This method involves anonymous interviewing of experts to explain and build forecasts on technological topics. At the methodological level, we use a questionnaire survey (cf. Table 1) with a sample of 100 mostly young people aged 18 and over with a high level of education living in rural or urban areas representative of the population of the wilaya of Sidi Bel Abbess (Master students at the University of Sidi Bel Abbes - Algeria), to assess their perceptions of sustainable food, identify their sustainability expectations and information on how to design sustainable food products. Data collection was conducted in April / May 2016. The underlying assumption is that young people are unaware of the characteristics of sustainable food and that older people would be closer to the natural and traditional products that characterize sustainable food.

Table 1: Sustainable Food Determinants (Questionnaire Elements)

N°	Characteristics	Modalities X frequencies
01	Age	4
02	Profession	8
03	Sex	2
04	Choice of elements characterizing sustainable food	8
05	Choice of items not related to sustainable food	9
06	Issues of sustainable food and territoriality	3
07	Link between sustainable food and food security	3
08	Important frequency of elements for sustainable diets	11x5
09	How to design a sustainable diet	6
10	Recommendations on sustainable diets and biodiversity	5
11	Usefulness of Code of Conducting to Sustainable Diets	3
12	Definition for sustainable food	/
13	Additional comments	/

Source: Synthesis of the Work: Mathé, 2009; FAO, 2010; Esnouf and al., 2011; FAO, 2014.

Table 1 contains the characteristics and indicators selected from this literature review and a survey of sustainable diets conducted by FAO in November 2010[5]. The type of analysis chosen in our study is multivariate analysis[6].

4. Empirical Results and Discussion

4.1. Sample of Population Characteristic

Our sample is very representative since 80% of the respondents are between 18 and 30 years old. The other class (from 31 to 60 years old) represents 20% of our sample. The sample is 55% women and 44% men, which leads to an over representation of women compared to the Algerian reality of 49.4% women and 50.6% men (ONS, 2019: 11). 51% of our sample are university students who do not have a job, 20% have a profession in the public or private sector, 15% in education, 5% in agriculture and the rest (4% in health, 2% in culture). Thus, our sample consists mainly of a young population with a university level and unemployed (Cf. Table 2).

Table 2: Demographic and Professional Profile of Respondents (n = 100)

Demographic variables	Details	Percentage (%)
Gender	Women	55
	Man	44
Age	18-30 years old	80
	31-60 years old	20
Education	Diploma in Graduation	100
Profession	Environment	1
	Health	4
	Nutrition	1
	Agriculture	5
	Education	15
	Culture	2
	Public or private service	20
	Unemployed	51

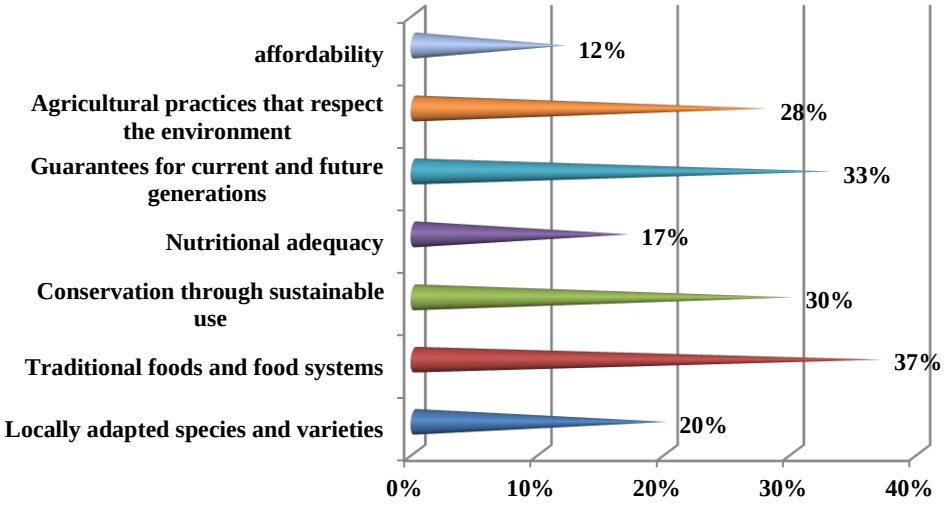
Source: Our Inquiry, 2016.

4.2. The Results of Our Investigation are as Follows

So, 37% of respondents say that sustainable food should include traditional foods and more sustainable food systems (cf. Graph 1). That is, developing a collaborative territorial network that integrates production, processing, distribution, food consumption and waste management, with the goal of increasing the environmental, economic and social health of the community. 33% suggest that safeguards should be introduced for current and future generations While. That is, the excessive use of natural resources; 20% of respondents believe that sustainable food should include locally adapted species and varieties, and 12% think of affordability (economic aspect) for sustainable food.

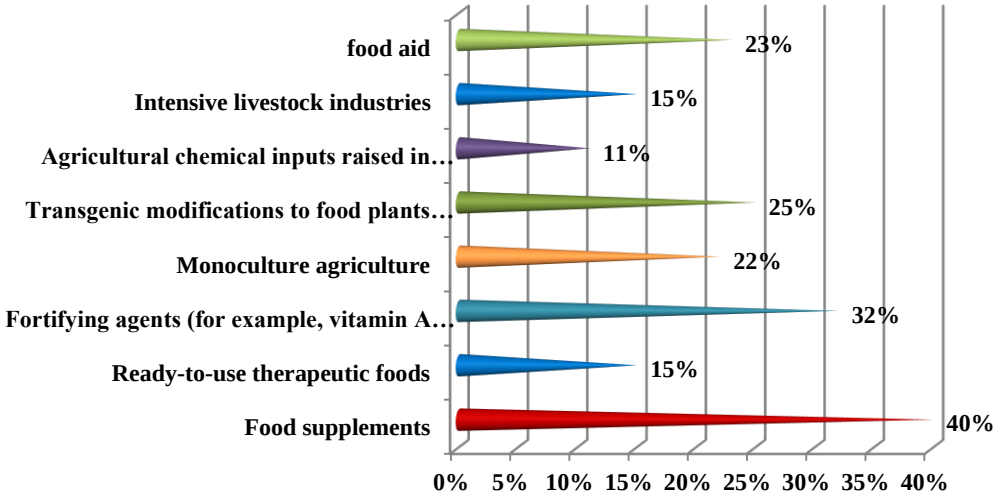
[5] (*cf.* https://www.surveymonkey.com/r/D9DF8NC).

[6] Multivariate analysis refers to a set of methods and techniques for studying multivariate tables describing multiple individuals (Niang and al., 2016).



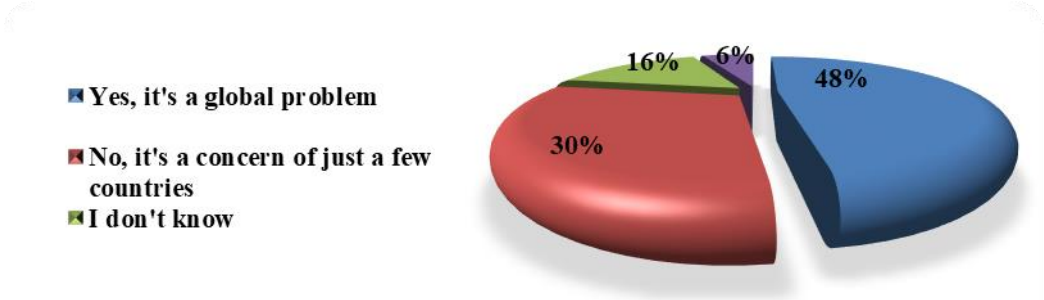
Graph 1: Perception of Respondents on the Components of a Sustainable Diet.
Source: Our survey, 2016.

Thus, 40% of respondents believe that dietary supplements should be excluded to have a sustainable diet, because they contain chemical and pharmacological substances, additives, flavours and technological aids (additive support) whose purpose is to supplement the natural diet (cf. Graph 2). As well, 32% of them think that fortifiers should be discarded, who have the same goals as dietary supplements. 25% of respondents say that transgenic modifications to food plants and animals and genetically modified organisms (GMO) should be excluded and go back to natural farming. While only 11% of them do not think of including agricultural chemical inputs raised in agriculture and its rational use for food to be sustainable.

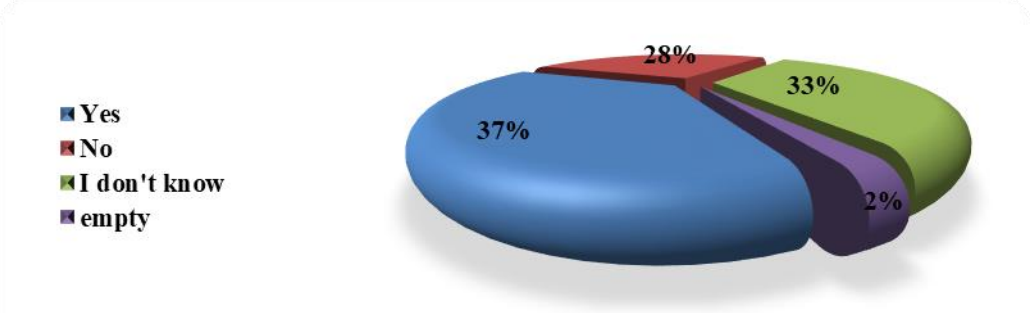


Graph 2: Perception of Respondents on Excluded Elements of a Sustainable Diet.
Source: Our survey, 2016.

However, 48% of respondents say that the sustainability of the food systems is a global problem (cf. Graph 3). Because by 2050, the world's population will be 9 billion, and the demand for food will only grow. On the other hand, 30% of them think it is a concern of only a few countries. While, only 16% totally ignore the answer to this question.

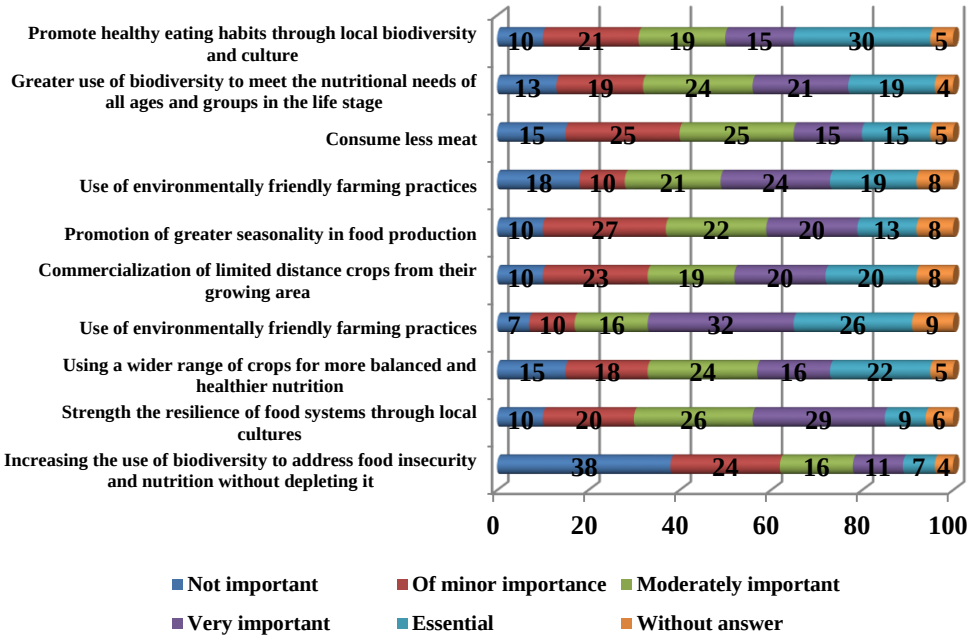


Graph 3: Perception of Respondents on Regions Concerned About Sustainable Diets.
Source: Our survey, 2016.



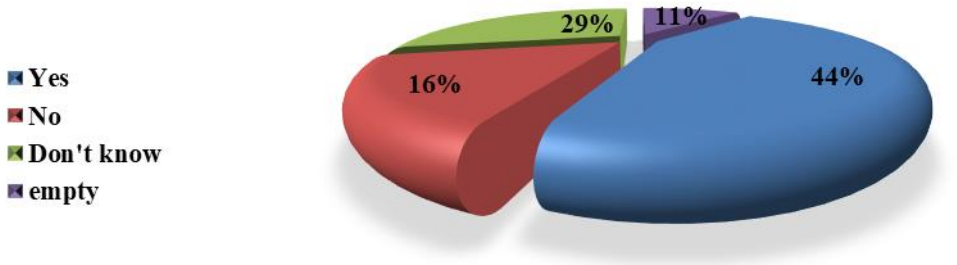
Graph 4: Perception of Respondents on the Link between Sustainable Food and Food Security.
Source: Our survey, 2016.

So 37% of respondents believe that sustainable food is strongly linked to food security (cf. Graph 4). While 28% of them think it is not just food security, it concerns in particular biodiversity and other subjects. In other hand, 33% know absolutely nothing.



Graph 5: The Importance of Each Element for Sustainable Diets.
Source: Our Survey, 2016.

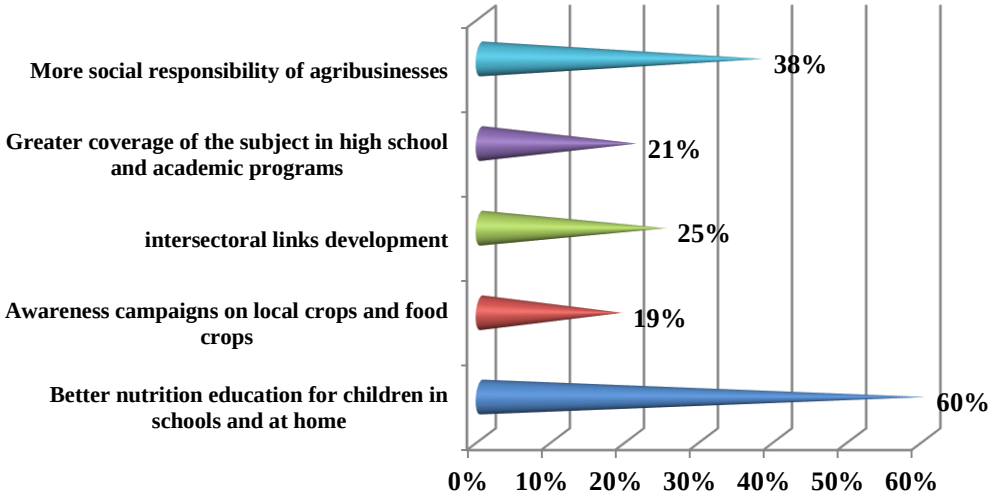
Concerning the importance of each element for sustainable diets, (58%) of those surveyed believe that it is essential to use environmentally friendly farming practices (cf. Graph 5). This should preserve the pollution of surface and underground water resources, as well as, the contamination of aquatic environments, the massive and uncontrolled use of pesticides and nitrates, the quality of air and soil and promote organic farming. While, (45%) say it is essential to promote healthy eating habits through local biodiversity and culture and promote biological farming. So (43%) of them consider it necessary to the limited processing of food products and the restricted use of packaging in the transformation process. While, 62% of respondents believe that it is not very important to gradually increase biodiversity to avoid food insecurity but also to address the nutrition problem.



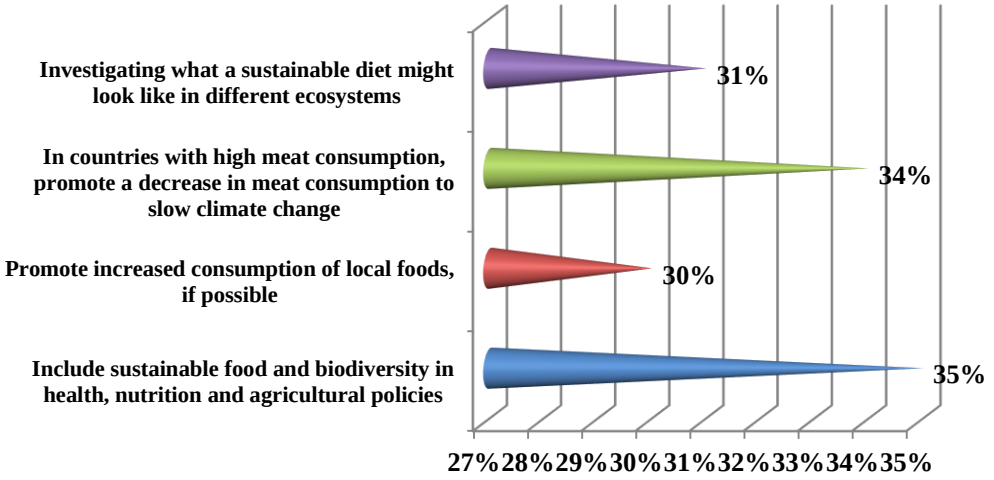
Graph 6: Respondents' Opinions on the Usefulness of a Code of Conduct on Sustainable Diets.
Source: Our Survey, 2016.

Otherwise, 44% of respondents say that a code of conduct on sustainable diets is very useful and necessary because it allows following the rules of a good behaviour and learning to sustainable diets (cf. Graph 6). While, 16% of them think it is not really useful. On the other hand, 29% of them are not interested with this idea.

On how to design sustainable food products (cf. Graph 7), we note that most respondents (60%) want better nutritional education of children in schools and at home and better nutritional information (38%) of them say it more social responsibility of agri-food companies. In fact, corporate social responsibility (CSR) is today more and more present in the world of large companies and SMEs. This presence expresses the desire of companies to get involved in social action and allows them to promote their brand images.



Graph 7: Respondents' Opinions on How to Design Sustainable Food Products.
Source: Our Survey, 2016.



Graph 8. Surveyor's Recommendations on Sustainable Diets and Biodiversity.
Source: Our Survey, 2016.

5. Conclusion

If sustainable food contributes to the nutritional status and good health of the individual, and contributes to the sustainability of food systems, thus participating to overall food security and good nutrition in the long term (Meybeck and al., 2016). Our study reveals that the Algerian consumers believe that sustainable food is a whole system. It is synonymous with continuous, correct and useful diet and / or dietary restriction (less meat and less sugar and oil) for human welfare. Some of them think that it is a problem that affects much more Africa because it can develop due to the diversity of technologies. In addition, they emphasize the need to inform and educate the general public by dietary experts to move towards a balanced diet.

The educational and cultural dimension is highly evoked in respondents' perceptions of sustainable food. It mainly concerns food consumption and social equity. Sustainable food is considered to be a good breakthrough and should be generalized and disseminated for the maintenance of human life. Our study shows that young people surveyed in Algeria neglect the aspect related to respect for ecosystems and the economic aspect in the perception of sustainable food. The results of the survey seem to confirm our hypothesis. Young people are unaware of the characteristics of sustainable food as older people move closer to natural and traditional products and focus more on sustainable food. These consumers recommend encouraging in-depth studies on sustainable food (improvement of educational methods) to improve general knowledge on this topic and to support biological agriculture and the peasantry as there is a close link between sustainable food and agriculture.

Finally, the opinions of the consumers surveyed demonstrate the importance and the need to apply the 5 principle keys recommended by FAO[7] for the sustainability of food and agriculture, and the design of a sustainable food system, particularly in Algeria. At the same time, food policies should be improved by promoting standards, criteria and frameworks, and advocating for policy changes that contribute to healthy diets and sustainable food systems, including market regulations and economic incentives, and reconsidering subsidy policy for essential food products, by strengthening strategic partnerships with non-state actors (private institutions, NGO[8], associations, etc.), and finally, promoting innovation, particularly in the financial sectors targeting rural people; and facilitating the exchange of knowledge and coordination between different sectors.

This study was limited by the sample of consumers included in the analysis and the period examined. Future studies could include a different sample of consumers and include other time periods. This study provides a benchmark for future studies assessing agribusiness and food business practices from a sustainability perspective. With respect to sustainable foods, this study has described some of the

[7] 1/ Improving the efficiency of resource use. 2 /Conserving, protecting and enhancing natural ecosystems. 3/ Protecting and improving rural livelihoods and social well-being. 4 /Building the resilience of people, communities and ecosystems communities. 5/ Promote good governance of both natural and human systems.

[8] Non-governmental organizations.

benefits of sustainable food, such as improving the health of populations and increasing food production, as well as related environmental concerns.

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Antecedents and Consequences of Workplace Deviance: A Literature Review with Suggestions for Future Studies

Cansu TANYOLAÇ[1]

Abstract

The reason for the growing interest in the topic of 'workplace deviance' is the prevalence of the deviant behavior in almost all organizations. Each year numerous organizations experience substantial financial and non-monetary costs caused by deviant behavior of their employees. Therefore, it becomes important to understand more deeply the antecedents of the workplace deviance in order to take the necessary precautions. In recent years, the literature regarding workplace deviance has been enriched by research studies examining the reasons and outcomes of employee deviant behavior. This literature review will contribute to the existing literature with its two main findings. First, there are few studies that have examined the interrelationships between the antecedents of deviant behavior. Second, despite many studies regarding the negative aspects of workplace deviance, some studies draw attention to the possible positive consequences of deviant behavior in the organization. These findings will help to develop better theoretical insights for the topic workplace deviance.

***Keywords**: Workplace deviance, deviant behavior, organizational behavior*

***JEL Classification**: M12, M54*

İş Yeri Sapkınlığının Ardılları ve Sonuçları: Gelecek Çalışmalar İçin Öneriler İçeren Bir Literatür Taraması

Özet

İş yeri sapkınlığı' konusuna duyulan ilginin giderek artmasının nedeni, hemen hemen her örgütte iş yeri sapkınlığının yaygın hale gelmiş olmasıdır. Her yıl sayısız örgüt, çalışanlarının iş yeri sapkınlığı davranışlarından kaynaklanan önemli maddi ve maddi olmayan maliyetlere maruz kalmaktadır. Bu yüzden, gerekli önlemlerin alınması için iş yeri sapkınlığının ardıllarının derinlemesine anlaşılması önemli hale gelmektedir. Son yıllarda, iş yeri sapkınlığı ile ilgili literatür, çalışanların sapkın davranışlarının nedenlerini ve sonuçlarını inceleyen araştırmalarla zenginleşmiştir. Bu literatür taraması ise, mevcut literatüre iki temel bulgusuyla katkı sağlayacaktır. Birincisi, literatürde iş yeri sapkınlığının ardılları arasındaki karşılıklı ilişkileri inceleyen çok az çalışma bulunmaktadır. İkincisi, literatürde iş yeri sapkınlığının olumsuz yönleri ile ilgili çok sayıda çalışma mevcut olmasına rağmen, bazı araştırmalar örgüt içerisindeki sapkın davranışın olası olumlu sonuçlarına dikkat çekmektedir. Bu bulgular, iş yeri sapkınlığı konusu ile ilgili daha iyi kuramsal bilgiler geliştirmeye yardımcı olacaktır.

***Anahtar Kelimeler**: İş yeri sapkınlığı, sapkın davranış, örgütsel davranış*

***JEL Sınıflandırması**: M12, M54*

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1. Introduction

The concept 'deviant behavior' has been defined as *"voluntary behavior that violates significant organizational norms and in so doing threatens the well-being of an organization, its members, or both"* (Robinson and Bennett, 1995: 556). As can be understood from the definition, for a behavior to be considered deviant it must include an intentional desire of damaging the organization. Additionally, deviant behavior may or may not be legally acceptable; however, first and foremost it is contrary to the general social norms (Agwa, 2018). 'Stealing from the company', 'gossiping about co-workers', 'taking excessive breaks' and 'verbal abusing' are different forms of workplace deviance. In their study Robinson and Bennett (1995) have classified the workplace deviance into two categories and have also identified four types of deviant behavior. These categories are determined by the target to whom deviant behavior is directed. A deviant behavior can be directed at the organization or its members (Lawrence and Robinson, 2007; Robinson and Bennett, 1995). Firstly, *organizational deviance* refers to deviant behaviors that targets organization and it includes 'vandalism', 'sabotage', 'theft', 'coming to work late without permission' or 'putting little effort into work'. Secondly, *interpersonal deviance* implies deviant acts aimed at other individuals in the organization and comprises behaviors such as 'physical assault', 'making fun of others', 'acting rudely' and 'blaming co-workers' (Bennett and Robinson, 2000; Agwa 2018; Robinson and Bennett, 1995; Lawrence and Robinson, 2007). Robinson and Bennett (1997) asserted that deviant behavior may also vary from minor forms to serious forms. The potential harmfulness of deviant behavior to the organization or its members determines the severity of this behavior (Robinson and Bennett, 1995). 'Social loafing' and 'unjustified absenteeism' are examples of minor forms of deviant behavior, whereas severe forms may include 'physical aggression' and 'theft' (Lawrence and Robinson, 2007). Hereby, target and severity dimensions of workplace deviance specify four specific types of deviance as; *production deviance, property deviance, political deviance* and *personal aggression* (Robinson and Bennett, 1995). As can be understood from the examples given above, organizational deviance embodies production and property deviance where political deviance and personal aggression take part in interpersonal deviance.

Bennett and Robinson (2000) stated that engaging in one behavior from a family increases the likelihood of employees engaging in another behavior from that family. For this reason, understanding the origins of this behavior is becoming increasingly crucial in terms of preventing harm which deviant behavior creates in the workplace. This study aims to review the existing literature with theoretical background in detail, as well as to make some suggestions for future studies. In the first part of the paper, the antecedents of workplace deviance are explained under two sub-headings. Then, in the second part, the consequences of workplace deviance are discussed. In the next part of the paper, recommendations regarding the prevention of workplace deviance are given. Lastly, in the final part, the main findings and contribution of this literature review are emphasized and some suggestions for future studies are presented as well.

2. Antecedents of Workplace Deviance

Bennett and Robinson (2000) have identified in their studies 19 different "families" of deviant behavior causes. It is obvious that there are many variables mentioned in the studies conducted so far about the reasons of workplace deviance. For instance, in some studies antecedents of the workplace deviance were gathered under four major headings as 'individual factors', 'social factors', 'interpersonal factors', 'group & role factors', 'organizational factors' and 'environmental factors' (Harris and Ogbonna, 2002; Peterson, 2002), while another studies have grouped the causes of deviant behavior as 'external factors', 'leadership factors' and 'unit-level factors' (Götz el al, 2019). Generally, literature on the causes of workplace deviance has identified two basic sources of workplace deviance as situation-based and person-based factors. "Situation-based factors" are generally related with the organizational environment, while "person-based factors" are arising from the personality traits and any other specific characteristics of a person. Although it occurs on an individual level, workplace deviance cannot be attributed solely to the personality characteristics (Appelbaum et al, 2007). In other words, workplace conditions are as effective as personal variables in the emergence of deviant behavior (Appelbaum et al, 2006). Therefore, it would be more comprehensible to classify the antecedents of workplace deviance under these two sub-headings.

2.1. Situation-Based Factors

It is obvious that deviant behavior is strongly related with the integrity and *culture* plays a crucial role in designating this relationship (Kurtz, 2014). In some organizations deviant behavior can be normalized. One of the most common factors that encourage workplace deviance is *toxic organization*. This century, in which organizations seek variety of ways to survive under the conditions of advance technology and tough competition, challenges the generally accepted views of ethical behavior. Therefore, in some organizations survival is much more appreciated than conforming to organizational norms. Small working units with intensive face-to-face communication provide the basis for a toxic organization as well (Sims, 1992). Generally, honest people are expected to be loved in any organization (Appelbaum et al, 2006). However, in toxic organizations dishonesty and deceitfulness can be tolerated and even supported in the case it brings success to the company (Sims, 1992). Similarly, *ethical climate* should be considered as one of the most important factor which triggers not only the unethical behavior (Robinson and Bennett, 1995) but also workplace deviance. Studies have reported that there is a significant relationship between the dimensions of ethical climate and the types of workplace deviance (Appelbaum et al, 2005). Undoubtfully, *norms* have substantial impact on the emergence of deviant behavior as well. Götz et al (2019) stated that norms set explicit and implicit standards that guide the behavior of the group members. For this reason, it becomes crucial to decide which behavior of the individual will be considered as deviant behavior. This is because even a single organization can have many dissimilar organizational levels and different normative reference groups.

"Social exchange theory" provides a framework that explains the relationship between workplace deviance and supervisory mistreatment (Thau et al, 2008). This theory suggests that when supervisors engage in abusive behavior, employees are more likely to behave improperly in order to restore the balance in their exchange relationship (Bennett and Robinson, 2000). According to 'social exchange theory', *organizational politics* may also lead employees to engage in deviant behavior by creating an imbalance in the exchange relationship between employee and the organization. To put it differently, when employees perceive their working environment as political, they are more likely to engage in negative behavior in order to rebalance the employment relationship (Crawford et al, 2019).

Another factor that has initiates workplace deviance is *operational environment* of the firm. According to Baucus and Near (1991) and Appelbaum et al (2006), larger firms that operate in a dynamic environment with greater resources pave the way for engaging in illegal behavior. Moreover, employees working part-time and having low-paying positions are more prone to deviant behavior (Baucus and Near, 1991). *Job characteristics* like serving alcohol, handling guns, employee's contact with the public, supervising others, carrying out security functions also play a large role in conducting deviant behavior (Appelbaum et al, 2005). *Job design* and *control systems* have also significant impact on the occurrence of workplace deviance. Some jobs are designed in a way that employees may take advantage of or misuse organizational resources. Likewise, certain jobs involve operations such as home delivery of food services which cash transactions cannot be directly monitored (Weitz and Vardi, 2007). Components of *organizational structure*, especially 'centralization' and 'formalization', may lead employees to deviant behavior as well (Marasi et al, 2018). In addition to all these organizational factors, *job stressors (i.e. workload), lack of control over the work environment, weak sanctions for rule violations, normlessness, organizational changes* such as *"downsizing"* can also be accounted for workplace deviance (Agwa, 2018; Appelbaum et al, 2005; Bennett and Robinson, 2000; Appelbaum et al, 2006). It is clear that a stressful work environment is more likely to lead employees to behave improperly.

In addition to the events taking place at the organizational level, attitude and behavior of the managers can also affect the workplace deviance. *Actual behavior of top management* affects ethical climate of the organization significantly (Appelbaum, 2005). Recognizedly, the best way to promote a behavior is to set an example for that behavior. Therefore, deviant behavior can be attributed to the *lack of a moral leader and role model* (Appelbaum et al, 2006; Appelbaum et al, 2007). A well-known example is Bernie Ebbers, the former CEO of WorldCom. Although Ebbers' managerial skills helped the company to succeed, the lack of moral leadership led to the collapse of the company (Trevino and Brown, 2005). If leaders do not behave ethically and there is no manager in the organization who communicates explicitly and frequently about the code of ethics, the occurrence of deviant behavior will be increased. It is possible to say that the absence of an ethical and open climate that dominates the organization makes employees more likely to behave unethically. In addition, whether or not the leader's behavior is rewarded,

increases the likelihood that employees will imitate their behavior (Appelbaum et al, 2007).

Abusive supervision is another factor related to managers' attitudes and behaviors that leads to workplace deviance. Abusive supervision has also detrimental effect on individual's basic psychological needs in a way that fosters employees to engage in deviant behavior. Valle et al (2019) stated that employees with abusive supervisors are more likely to engage in moral disengagement and thereafter in organizational deviance. Besides, this relationship is found stronger when the leader-member exchange is high. Also in the study of Thau et al (2008) a positive relationship is found between abusive supervision and organizational deviance. Another important finding is that this relationship was stronger when authoritarian management style was low. As it is understood, *management and leadership style* have a significant impact on the occurrence of deviant behavior within the organization. In line with 'social learning theory', deviant behavior of employees may more sensitive to negative behaviors of their leaders (Qi et al, 2020). Erkutlu (2017) revealed in his study that 'benevolent leadership' is more likely to decrease deviant behavior of employees. The reason is that, satisfaction and trust between the leader and employees increases when the leaders use benevolent leadership. This finding is also suggested by 'social exchange theory'. Similarly, in their study Zheng et al (2020) found out that there is a negative relationship between 'authoritarian leadership' and employee deviance under certain conditions. In other words, when the leader is authoritarian rather than benevolence, followers feel high resource dependency on their leader, subsequently authoritarian leadership deter deviant behavior of employees. On the other hand, many other studies have shown that authoritarian leadership leads employees to deviant behavior at workplaces (Qi et al, 2020). This is because authoritarian leadership style is perceived as restrictive and domineering by employees. The important point here is that what kind of leadership will prevent workplace deviance can vary depending on the situation. In addition to the management and leadership style, *organizational control and power* can also foster workplace deviance within the organization. Although these variables can be considered to restrain deviant behavior, they can also be a trigger for the emergence of the deviant behavior as well (Lawrence and Robinson, 2007).

Perceptions of the employees regarding the work environment play a substantial role in triggering deviant behavior as well. *Job satisfaction* is a significant variable which is strongly related to the likelihood of an employee engaging in deviant or unethical behavior. That is, when job satisfaction increases then the possibility of ethical rule violation decreases. It is also possible that an employee with a high level of job satisfaction has a high level of commitment to the organization as well. Such employees are sensitive to obey the rules laid down at work. In the study of Lee and Allen (2002) *job affect* and *job cognition* are found to be related with the deviant behavior as well. In another study, Xiao et al (2018) stated that job insecurity was related with the both organizational and interpersonal deviance. Moreover, Galperin and Burke (2006) found out that *workaholism* contributes to deviant deviance.

Organizational justice is also a significant predictor of workplace deviance. If a wrong behavior is punished in the organization, other employees realize that there is a fair punishment system. On the contrary, if a wrong behavior is rewarded, injustice is felt among the employees. In their study Syaebani and Sobri (2011) have found that organizational justice perception have a significant impact on the occurrence of the deviant behavior. Also "equity theory" asserts that employees perceive inequity in case they experience dissimilar outputs in response to same inputs compared to others. Consequently, they want to restore their sense of inequity either by action or by cognitive adaptations (Appelbaum et al, 2006; Lee and Allen, 2002; De Schrijver et al, 2010). When employees perceive injustice in the organization, they think they are right about violating organizational norms (Appelbaum et al, 2006). As a result, employees tend to engage in deviant behavior (Agwa, 2018). Appelbaum et al (2005) have found that procedural injustice and interactional injustice are negatively related with both interpersonal and organizational deviance. On the other hand, they found no correlation between distributive injustice and any type of deviant behavior.

According to "social bonding theory", if ties to the social order are strong then social controls are strengthened. As a result, individuals' motives are constrained and they will less likely to behave in a deviant way (Galperin and Burke, 2006). When viewed from the aspect of this theory, *organizational commitment* can influence workplace deviance behavior by affecting the ethical climate of the company (Appelbaum et al, 2005). As organizational commitment decreases, it can be said that employees are less motivated to behave properly and ethically. In contrast, when employees are loyal to their jobs and passionate about their workplace, they are most likely to engage in ethical behavior. However, this is not always the case. Appelbaum et al (2006) pointed out the presence of the studies which have results in the opposite direction.

Organizational frustration arising from the stressful work environment or from any other causes can also become a job stressor by affecting the physical and mental health of employees (Appelbaum et al, 2006; Bennett and Robinson, 2000). Also, discrepancies between current and ideal state can create frustration for employees (Lawrence and Robinson, 2007). Therefore, when employees feel frustration about their company, they are more likely to react in a deviant way. On the contrary, in the presence of *organizational citizenship behavior* - when employees care about their work and feel ready to give discretionary effort for the sake of their companies - it can be said that workplace deviance will be diminished (Bennett and Robinson, 2000; Appelbaum et al, 2007). In other words, organizational citizenship behavior enables organizations to run efficiently by spreading conscientiousness and courtesy (Appelbaum et al, 2006). Studies have indicated that when organizational citizenship behavior within the organization increases, both interpersonal and organizational deviance decrease. On the contrary, exceptional cases are investigated by some of the studies. For instance, Fox et al (2012) found out that organizational citizenship behavior and deviant behavior may relate positively. Therefore, it becomes important to make clear that under what circumstances

organizational citizenship behavior and deviant behavior will relate negatively or positively with each other.

According to "social learning theory", *a deviant role model* in a community may influence others in terms of misbehaving (Appelbaum et al, 2006). It is clear that employees' perceptions about their leaders affect their behaviors and attitudes substantially (Erkutlu and Chafra, 2013). Also "social information-processing theory" asserts that individuals adapt their behavior depending upon consequences that are observed but not experienced directly (Vardi and Weitz, 2016). It means that *group behavior* in the workplace has a significant impact on employees in terms of triggering the deviant behavior. First, individuals within the group affect both others and are influenced by others (Appelbaum et al, 2005). That is, they can model each other's good and bad behavior. Second, even if employees do not believe that they are doing the right things, they can behave like them to be accepted by others. Appelbaum et al (2006) stated that people who generally interact with each other, such as friends and peers, are tend to participate in deviant behavior because of the 'need for acceptance'. In summary, when employees perceive unfavourableness in their current situation at work, they are more likely to violate norms and engage in workplace deviance (Colbert et al, 2004). Also it should not be forgotten that due to the time and context limitations in terms of the type of deviant behavior that employees may engage, the deviance may take place in a distinct way based on the constraints of a specific situation (Bennett and Robinson, 2000).

2.2. Person-Based Factors

As mentioned before, person-based factors depend on the individual's personality, emotions and other specific characteristics regardless of the situation and environmental factors. It would not be wrong to say that *personality traits* are at the top of the person-based factors (Guay et al, 2016). Studies have shown that *Big 5 personality traits* and *dark triad personality traits* can affect the occurrence of workplace deviance (Baharom et al, 2017). Guay et al (2016) stated that the traits 'conscientiousness' and 'agreeableness' are closely related with both interpersonal and organizational deviance. Their study has shown that low levels of conscientiousness and agreeableness induce low levels of organizational commitment and employees with low levels of organizational commitment are more prone to engage in deviant behavior. Studies have also concluded that traits such as *machiavellianism* are related with both interpersonal and organizational deviance (Appelbaum et al, 2005). Since a machievallist individual who believes that "the ends justify the means" will not hesitate to exhibit bad behavior to achieve her/his purpose. According to Galperin (2012) machiavellianism is an important variable for the prediction of "constructive deviance" as well. In their study Xiao et al (2018) found out that employees with higher levels of *locus of control* are less likely to engage in deviant behavior. Additionally, personality characteristics like *neuroticism, feelings of anger, low conscientiousness, lack of control, frustration and dissatisfaction* are variables that associated with the workplace deviance (Bennett et al, 2018).

Other important person-based factors which trigger workplace deviance are *moods, emotions* and *affects.* According to "Affective Events Theory" (Weiss and Cropanzano, 1996) workplace events result in either positive or negative affective states, in turn, attitudes and behaviors of employees are shaped (Restubog et al, 2013). Therefore, *negative affectivity*, which expresses the individual's degree of experiencing negative emotions such as anger and hostility, has a direct effect on the individual's workplace deviance behavior. Studies have shown that people with high negative affectivity levels are more likely to encounter negative moods independent of any other specific stimulus (Appelbaum et al, 2006).

Some of the *demographic characteristics* like *gender, tenure, education* and *age* have an effect on deviant behavior as well. First, men are more likely to exhibit aggressive behavior in contrast with women (Chernyak et al, 2018; Appelbaum et al, 2005). Chernyak et al (2018) also expressed that these differences of gender on workplace deviance can be caused by psychological factors such as stress-relating problems, low levels of self-esteem, lack of confidence etc. Additionally, as the tenure, education level and age of the employees decrease, the likelihood of employees engaging in deviant behavior increases (Appelbaum et al, 2005). In other words, employees who are young and new to the job are more likely to commit production and property deviance (Baucus and Near, 1991; Appelbaum et al, 2005). On the contrary, older and tenured employees are tend to more committed to their work and motivated to act properly and ethically. In some of the studies both situation-based and person-based factors were analyzed as antecedents of workplace deviance. For instance, Colbert et al (2004) demonstrated the interactive effects of personality and perception of the work situation on the deviant behavior in their study. To conclude, managers should bear tremendous responsibility in terms of detecting the antecedents of the deviant behavior in the workplace and endeavor to minimize them.

3. Consequences of Workplace Deviance

First of all, different kinds of deviant behavior result in variety of negative consequences (Appelbaum et al, 2007). Regardless of whether the deviant behavior includes vandalism, sexual harassment, rumor spreading etc., it is obvious that workplace deviance can create many negative impacts on both organization itself and employees in the organization (Appelbaum et al, 2006). Many studies have shown that all these negative impacts may damage the overall well-being of the company and incline a decrease in the performance (Dunlop and Lee, 2004; Harris and Ogbonna, 2002). Bennett et al (2018) asserted that the costs of workplace deviance could be grouped into three categories such as *monetary costs, mental (emotional) costs* and *societal costs*. Among these, one of the most frequently mentioned negative result in literature is the *financial cost* experienced by organizations. Many organizations continue to lose millions of dollars stemming from employee theft and sabotage (Agwa, 2018; Appelbaum et al, 2007). Dunlop and Lee (2004) and Hussain et al (2014) point out that organizations have also some hidden costs arising from the fact that the company does not operate at maximum efficiency in the presence of deviant behavior.

In addition to the financial impacts of workplace deviance there are many other severe outcomes in terms of employees like *stress-related problems, decreased productivity, lost work time, low morale and performance, high turnover rates* and *forced to quit* (Appelbaum et al. 2006, Agwa 2018, Appelbaum et al, 2007). Considering all these negative effects of workplace deviance to the organization, it becomes crucial for managers to determine the variables that cause workplace deviance in detail.

4. Recommendations on Preventing Workplace Deviance

In order to prevent deviant behavior in the workplace, firstly *a clear philosophy and mission statement* should be formulated throughout the company. However, this precaution alone is not enough, it should be monitored by the managers either. At the same time managers should *encourage their employees* to act in an ethical way. Other precautions for deviant behavior are *paying attention to subcultures, reviewing norms* and *creating ethical core values in the workplace* (Appelbaum et al, 2007).

It is easy to guide the behavior of employees when managers can understand different values held in the subcultures (Appelbaum et al, 2005). Creating ethical core values is crucial for the company in terms of sustaining "subjectivity" as well. Bowles and Gelfand (2010) claim that evaluation of norm-violating behavior is not subjective because according to the sociological literature, deviant behavior of the lower-status employees will be criticized more harshly than the higher-status employees. Therefore, internalizing an ethical guideline throughout company will help managers carry out sound judgments. Another important point is that managers should put themselves into their employees' shoes in order to understand the background of the deviant behavior from the perspective of the perpetrator. It helps managers to perceive lower moral violation as well as to make attributions to external factors rather than internal factors (Fiori et al, 2016). Managers should also not forget the assumptions of "social labeling theory". According to the 'social labeling theory', if a person is labeled as a deviant by a group then this person is considered deviant. Therefore, deviance is not required to be associated with a specific kind of behavior; it can be only a "perception" (Hussain et al, 2014).

Presence of a toxic handler can aid to the organization in terms of dealing with the toxic environment (Appelbaum et al, 2005). *Frequent background checks* and *detailed screening in HR department* can be useful when recruiting new employees (Appelbaum et al, 2007; Bennett and Marasi, 2016). On the other hand, if positive deviant behavior dominates in an organization such as *whistle blowing* that detects illegal behavior, it should be supported (Appelbaum et al, 2007). Another point of view is that noticeable deviant behavior such as theft and sabotage can be considered as a signal so that the company take precaution (Bennett and Marasi, 2016). Of course, there are multiple techniques and number of ways to deter and reduce the workplace deviance in the organization; however, it should not be forgotten that all these methods come at price. For this reason, managers should conduct a detailed cost-benefit analysis while they are trying to minimize the workplace deviance (Bennett and Marasi, 2016).

Lastly, *formal sanction systems* can deter the workplace deviance, however managers should also pay attention to the existence of social sanctions in the organization that support unethical behavior. In his study Warren (2019) found that even undetected and minor social sanctions among employees may induce the permanence of the workplace deviance. On the other side, managers should be aware of the some functional outcomes of the workplace deviance as well (Robinson and Bennett, 1995). For example, making a phone call during work time in order to make sure a family member's well-being may increase the overall performance of an employee (Bennett and Marasi, 2016).

5. Conclusion and Suggestions for Future Studies

This literature review has two main findings which will contribute to existing literature by developing better theoretical insights for the topic workplace deviance. First, there are many different studies which focused on the definition, measurement, reasons and the outcomes of the deviant behavior. Among these studies, there are miscellaneous findings that have addressed the antecedents and consequences of workplace deviance. As stated previously, there are various reasons that increase the likelihood of deviant behavior of employees and these factors are interrelated with each other. Besides, the above-mentioned factors can directly or indirectly affect the workplace deviance. In literature, however, there are few studies that have examined the combined effect of both situation-based and person-based factors on the emergence of the workplace deviance. Despite extensive body of research on workplace deviance, more studies are needed to investigate the interrelationships between the antecedents of deviant behavior. Considering that the antecedents of workplace deviance are interrelated with each other, it will be more useful to conduct such comprehensive studies. Also, it is important to make a clear distinction between interpersonal and organizational deviance as they may have different kinds of antecedents. Second, there are many studies regarding the negative aspects of workplace deviance, however some studies also address the possible positive consequences of deviant behavior in the organization. For this reason, more research with different perspectives should be conducted that highlight the potential positive outcomes of workplace deviance. If these positive results can be determined in future studies, it will be easier for managers to deal with deviant behavior and this behavior may even be an opportunity in terms of improving overall performance and well-being of the organization.

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