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Bitcoin as an Alternative Financial Asset: Relations Between Geopolitical Risk, Global Economic Political Uncertainty, and Energy Consumption[1*]

Alternatif Bir Finansal Varlık Olarak Bitcoin: Jeopolitik Risk, Küresel Ekonomik Politik Belirsizlik ve Enerji Tüketimi Arasındaki İlişkiler

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Abstract

The aim of this research is to investigate the causality between Global Economic Political Uncertainty (GEPU) and Geopolitical Risk (GPRT) and Bitcoin Energy Consumption (BTCE). In order to test the stationarity of the variables, the Lee-Strazich unit root test, which takes into account the structural breaks, was used, and the causality relationship between the variables was analyzed with the Hatemi-J (2012) causality test. Monthly data between May 2011 and February 2022 were used in the research. According to the results obtained from the research, geopolitical risk and global economic policy uncertainity are effective on bitcoin energy consumption. In addition, it has been determined that the negative effects of geopolitical risk and global uncertainties are more dominant. The results show that the demand for bitcoin, which is considered an alternative financial asset class, and accordingly bitcoin energy consumption, increases in case of global risks and economic uncertainties.

Keywords: *Bitcoin, Financial Asset, Global Economic Policy Uncertainity, Geopolitical Risk, Energy Consumption.*

JEL codes: *C58; F37; G14; G15; Q31*

[1]. Yazarlar bu çalışmanın tüm süreçlerinin araştırma ve yayın etiğine uygun olduğunu, etik kurallara ve bilimsel atıf gösterme ilkelerine uyduğunu beyan etmişlerdir. Aksi bir durumda Pamukkale Journal of Eurasian Socioeconomic Studies Dergisi sorumlu değildir. İntihal raporu alınmıştır.
The authors declared that all processes of this study comply with research and publication ethics, and comply with ethical rules and scientific citation principles. Otherwise, Pamukkale Journal of Eurasian Socioeconomic Studies is not responsible. A plagiarism report is received.

INTRODUCTION

Cryptocurrencies and their energy consumption have become an important matter of discussion in recent years. As of today, more than 2,500 types of cryptocurrencies are being traded in financial markets and this generates a new blockchain ecosystem (Huynh et al., 2022). Introduced as a new financial technology by Satoshi Nakamoto in 2009, Bitcoin continues to be the best-known and most valuable cryptocurrency as of today.

It is possible to categorize the studies conducted on the cryptocurrency market into two main groups. The first of these involves the studies that deal with the investment instrument aspect. In this regard, there is a large literature examining cryptocurrency markets in various different aspects such as risk management tools (Gurdgiev and O'Loughlin, 2020; Das et al., 2020), different asset classes, and investment tools (Corbet et al., 2019; Dyhrberg et al., 2018) effectiveness (Urquhart, 2016), its association with geopolitical uncertainty (Kyriazis, 2021). The second group of studies, however, deals with technologies supporting digital currencies and considers the subject within the framework of the internet of things and smart contracts (Khan and Salah, 2018; Huh et al., 2017). Nonetheless, the number of research studies examining the relationship between bitcoin energy consumption, geopolitical risk and threats (GPRT), and global economic political uncertainty (GEPU) is quite limited. Especially, the significant impact of increasing energy demand on climate change and intense energy requirement of Bitcoin mining both raises concerns and increases the interest in the subject (Küfeoğlu and Özkuran, 2019; Das and Dutta, 2020).

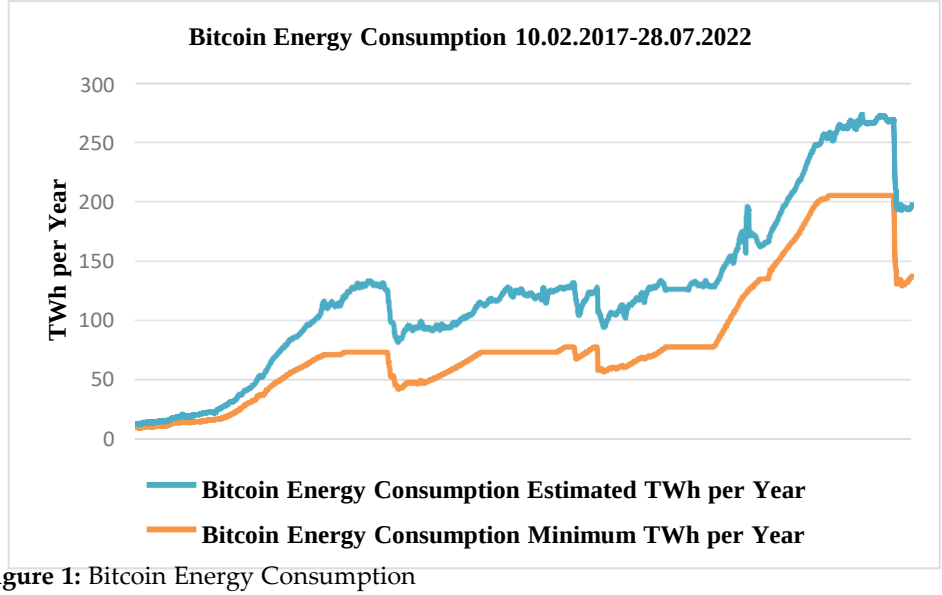


Figure 1: Bitcoin Energy Consumption
Source: https://digiconomist.net/bitcoin-energy-consumption/, 28.07.2022.

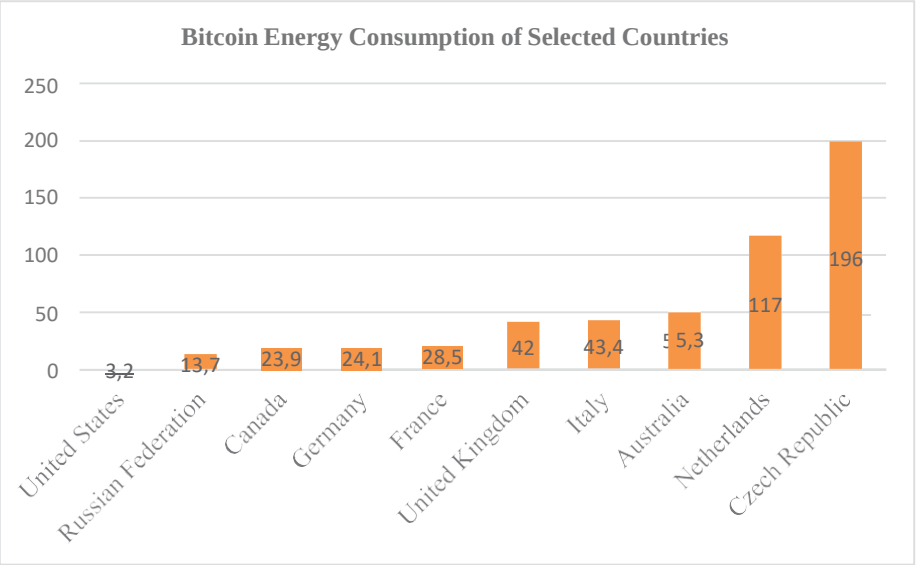


Figure 2. Bitcoin Energy Consumption for Selected Countries
Source: https://digiconomist.net/bitcoin-energy-consumption/, 28.07.2022.

Besides, the recessions in the world stock markets as of 2020, the impact of the COVID-19 pandemic on the global financial markets, as well as the uncertainty, low confidence that dominate the world economy, and high inflation expectation have significantly increased the demand for Bitcoin as an alternative investment tool (BinanceAcademy, 2021). Despite the high risk and volatility, cryptocurrencies have performed better than conventional investment instruments (Sarkodie et al., 2022). For instance, Bitcoin's price rose to $68,000 in November 2021, whereas its market cap was $1.2 trillion USD. In this context, the high performance of Bitcoin in an environment of uncertainty has increased the demand, and the miners who wish to gain a competitive advantage have begun to utilize more powerful computers and have caused higher levels of energy consumption (Sarkodie, 2022). Therefore, it is essential to investigate the relationships between Bitcoin energy consumption and the risk and uncertainty indexes, namely, GPRT and GEPU.

Figure 3. BTC/USD price chart 01.01.2017-28.07.2022
Source: https://coinmarketcap.com/tr/currencies/bitcoin/, 29.07.2022.

In accordance with the literature mentioned above, the research model is developed as follows:

Figure 4. Model of the research
Source: Developed by the author.

Various studies have also been conducted in the literature on energy consumption (Soytaş et al. 2020; Kartal, 2022; Rahaman et al., 2022). A significant portion of these studies is pertinent to environmental degradation. For instance, Abbasi et al. (2021) for Pakistan, Bal et al. (2022) for India, stated that electricity consumption increased CO2 emissions, and all those studies indicated the significant impacts of energy consumption on environmental degradation. Moreover, according to Corbet et al. (2019), it is clear that due to its large market share, Bitcoin also demands a high amount of energy during the validation and mining processes. Krause and Tolaymat (2018) supported this view and stated that cryptocurrency mining was associated with environmental degradation.

Upon considering the gap in the literature, although the investment aspect of cryptocurrencies, particularly Bitcoin, and the environmental impacts of cryptocurrency mining are subject to country-specific research, the issue of the extent to which Bitcoin energy consumption is affected in the presence of uncertainty and risk situations that emerge as a question that needs to be answered. In this context, the research study examines the asymmetric causal relationship between Bitcoin energy consumption and GPRT and GEPU. To this end, the monthly data obtained over the period May 2011 - February 2022 are utilized by performing the Hatemi-J Asymmetric causality analysis. Unlike other tests, the Hatemi-J causality test considers the potential impacts of positive and negative components separately. Thus, the research study would be able to reveal the existence and direction of causality running from GPRT and GEPU independent variables to BTCE. Based on the method mentioned above, the research study investigated (i) the impact of GPRT and GEPU on Bitcoin energy consumption, (ii) if there is an impact, the direction of this impact, (iii) if there is causality, whether or not it is asymmetrical. Empirical findings indicate that GPRT and GEPU have both negative and positive impacts on BTCE, and a causal relationship exists between the variables.

The research study contributes to the literature in various aspects. Firstly, Hatemi-J examines the impact of GPRT and GEPU on BTCE by performing the causality test and expands the existing literature. Secondly, the monthly data are utilized in the empirical analyses, and thus, a dataset with high frequency is used. This is crucial since the high-frequency dataset enhances the predictive power of the econometric model. Although some of the studies such as Al Mamun et al. (2020) and Sarkodie et al. (2022) used daily data, these data were finalized in 2021 at the latest. In this regard, our dataset is quite new compared to other studies and includes the most recent data. Thirdly, unlike the classical tests such as the Toda-Yamamoto

causality (1995) and Granger causality (1969) tests, which are frequently performed in previous studies, the research study prefers to perform the Hatemi-J (2012) causality test and examine the impacts of positive and negative components simultaneously.

The research study consists of five parts. In the second part, a literature review is presented. The third part introduces the methodology, and the findings are presented in the fourth part. The fifth and last part is comprised of the conclusion.

1. LITERATURE REVIEW

The GPRT and GEPU indexes, which are the variables that affect Bitcoin energy consumption in the research study, are widely accepted criteria in the literature that assess global economic uncertainties and geopolitical risks (Aysan, 2019; Antonakakis et al., 2017; Bouri et al., 2017). Early studies on economic and political uncertainty were conducted by Baker et al. (2013) who generated the economic policy uncertainty (EPU) index. The EPU index is developed by examining 10 major newspapers in the USA, in general, and the frequency of news containing keywords associated with economy, politics, and uncertainty.

The EPU index is categorized under 3 headings. Although the EPU index was calculated only for the USA at first, eventually it began to be calculated for various European countries. Baker et al. (2016) was conducted in a framework that included the USA and 11 European countries. The developed index was tested by employing the VAR method. The results indicated that EPU had impacts on financial markets, stock markets, construction, and healthcare sectors. Later on, the global economic policy uncertainty (GEPU) index was developed by Davis (2016) employing the same method. This is the GDP-weighted national EPU index, which accounts for 2/3 of global output for 16 countries. Each national EPU index reflects the relative frequency of country-specific newspaper articles, which include triad terms on economics, uncertainty, and policy-related topics. The GEPU index currently consists of the national EPU index of 21 countries. The 21 countries included in the GEPU Index account for approximately 71% of global output and an average of 80% of market exchange rates on a purchasing power parity-adjusted basis (Gürsoy, 2021: 121).

GPR is an index developed by Caldara and Iacoviello (2022) employing the calculation method and is being currently updated and published at www.policyuncertainty.com. Geopolitical risks, however, are described as the entire events that affect the normal and peaceful world order, such as political tension, war, or terrorism (Caldara and Iacoviello, 2016). According to Caldara and Iacoviello (2016), high levels of geopolitical risks lead to a decline in real sector activities, enhance volatility, and slow down the credit spread. Al Mamun et al. (2020) asserted that high geopolitical risk and global economic policy uncertainty generate a risk premium in unfavorable market conditions and that Bitcoin investors hedge their portfolios with merely gold investments in deteriorating market conditions and avoid investments in different financial assets. In this context, the demand for Bitcoin increases throughout the periods of high risk and uncertainty. Gürsoy et al. (2022) found a one-way causal relationship between cryptocurrency price uncertainty and cryptocurrency policy uncertainty indices and bitcoin energy consumption. According to this, in all crypto markets, it was determined that

variations in bitcoin's energy consumption had an impact on both pricing and cryptocurrency money policies. There are also studies examining the relations between BTCE and the energy markets. For instance, according to Kılıç et al. (2021), there is unidirectional volatility spread between the S&P 500 and SSE energy indices and a bidirectional volatility spread between the CBECI index and the MOEX energy index. According to research, shocks from the S&P 500 energy index raise the CBECI index while those from the MOEX energy index lower it. Consequently, Bitcoin is a digital currency based on a cryptographically secured distributed ledger, representing the first and best known blockchain application. The computationally intensive verification process, called mining, requires specialized hardware and large amounts of energy, especially electricity, to attain consensus on ownership and transactions (Gallersdörfer et al., 2020).

Being consistent with the existing literature, the study considers geopolitical risk and global economic political risk as dependent variables. Also, Bitcoin energy consumption is the dependent variable of the research study. The causal relationship between the variables is crucial in terms of indicating the impact of uncertainties on energy consumption. Therefore, Table 1 presents the explanations of the indicators used in the research study.

Table 1. Variables Used in The Research

Type of variable	Abbreviation	Explanation
Dependent	BTCE	Bitcoin energy consumption
Independent	GEPU	Global economic politic risk
Independent	GPRT	Geopolitical risk

2. METHODOLOGY AND DATA

The methodology of the research is given in Figure-5 below.

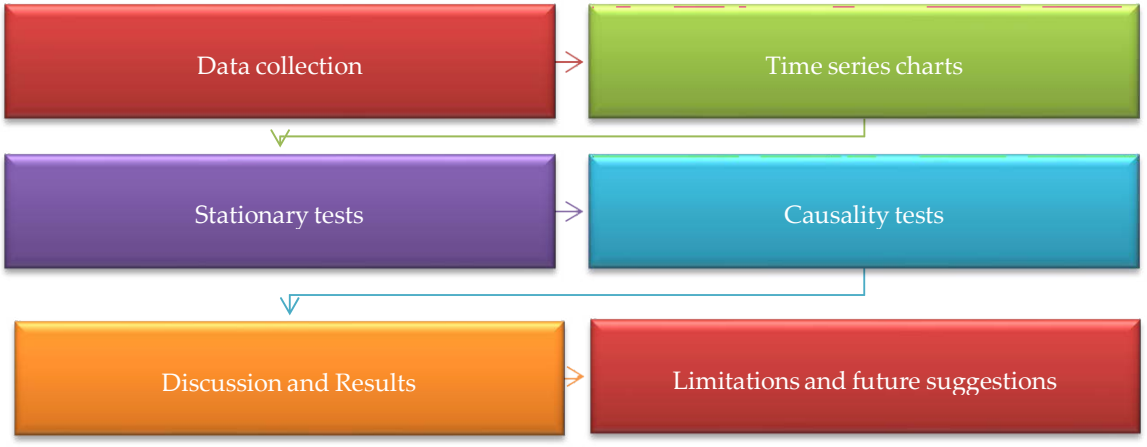


Figure 5. Research methodology

To examine the asymmetrical impact of global economic political uncertainties and geopolitical risks on Bitcoin energy consumption, a multi-stage methodology is employed as follows:

- Firstly, GEPU data are obtained from https://www.policyuncertainty.com/global_monthly.html, GPRT data from https://www.matteoiacoviello.com/gpr.htm, and Bitcoin energy consumption (BTCE) data from https://digiconomist.net/.
- In the second stage, using the monthly data obtained over the period May 2011 - February 2022 for three variables, the Hatemi-J (2012) Asymmetric causality test is performed.
- In the third stage, the degrees of stationarity of the series of variables are determined by performing Lee and Strazicich unit root tests, which also allows the structural breaks.
- In the fourth stage, the break dates of the series are presented simultaneously.

2.1. Lee-Strazicich Unit Root Test

In terms of the reliability of the stationarity results in the time-series, spurious regression should be avoided and the stationarity of the series of the variables should be ensured. In this context, some of these unit root tests such as the Augmented Dickey Fuller-ADF (1981), Phillips-Perron (1988), and Ng-Perron (2001) do not allow structural breaks. In this study, however, a unit root test developed by Lee and Strazicich (2003, 2004) is performed. The results regarding the structural breaks of the series are listed below.

2.2. Hatemi-J Asymmetric Causality Analysis

In asymmetric causality analyses, a probable relationship between the variables is investigated. In this context, the existence of a unit root should be revealed in order to select the most suitable model for the variables, and the degree of stationarity assumes importance. It is expected that the variables in the Granger causality test, a conventional causality test, would be stationary at the same level. Nevertheless, such a requirement is not sought in the Toda-Yamamoto (1995) causality test, however, this causality test yields symmetrical results. Developed by Hatemi-J (2012), causality is investigated by categorizing the variables into positive and negative components. This would help to monitor the dynamics of the series in asymmetric causality analysis and reveal the possible relationship in possible future predictions.

Suppose we wish to test the causality relationship between two integrated variables y_{1t} and y_{2t} as follows (Hatemi-J, 2012: 449-450);

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{10} + \sum_{ii=1}^{t} \varepsilon_{1ii} \quad and \quad y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{20} + \sum_{ii=1}^{t} \varepsilon_{2ii} \tag{1}$$

Here, t=1,2,…T represents the constant terms, y_{1t} and y_{2t} denote the initial values, whereas ε_{1ii} and ε_{2ii} stand for the error terms. Positive and negative shocks are expressed as shown in Equation (5);

$$\varepsilon^{+}_{1ii} = \max(\varepsilon_{1ii}, 0), \varepsilon^{+}_{2ii} = \max(\varepsilon_{2ii}, 0), \varepsilon^{-}_{1ii} = \min(\varepsilon_{1ii}, 0) \; and \; \varepsilon^{-}_{2ii} = \min(\varepsilon_{2ii}, 0) \tag{2}$$

where $\varepsilon_{1ii} = \varepsilon^{+}_{1ii} + \varepsilon^{-}_{1ii}$ and $\varepsilon_{2ii} = \varepsilon^{+}_{2ii} + \varepsilon^{-}_{2ii}$. In this context, Equations (1) and (2) are revised and rewritten as shown below.

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{1,0} + \sum_{ii=1}^{t} \varepsilon^{+}_{1ii} + \sum_{ii=1}^{t} \varepsilon^{-}_{1ii} \quad (3)$$

$$y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{2,0} + \sum_{ii=1}^{t} \varepsilon^{+}_{2ii} + \sum_{ii=1}^{t} \varepsilon^{-}_{2ii} \quad (4)$$

Finally, the positive and negative shocks in each variable are expressed in cumulative form as follows;

$$y^{+}_{1t} = \sum_{ii=1}^{t} \varepsilon^{+}_{1ii}, \quad y^{-}_{1t} = \sum_{ii=1}^{t} \varepsilon^{-}_{1ii}, \quad y^{+}_{2t} = \sum_{ii=1}^{t} \varepsilon^{+}_{2ii}, \quad y^{-}_{2t} = \sum_{ii=1}^{t} \varepsilon^{-}_{2ii}, \quad (5)$$

Afterward, assuming that $y^{+}_{t} = y^{+}_{1t}, y^{+}_{2t}$, the causality relationship between the positive components is tested with the help of the p -lagged vector autoregressive model (VAR). The $VAR\,(p)$ model is expressed as shown in Equation (6);

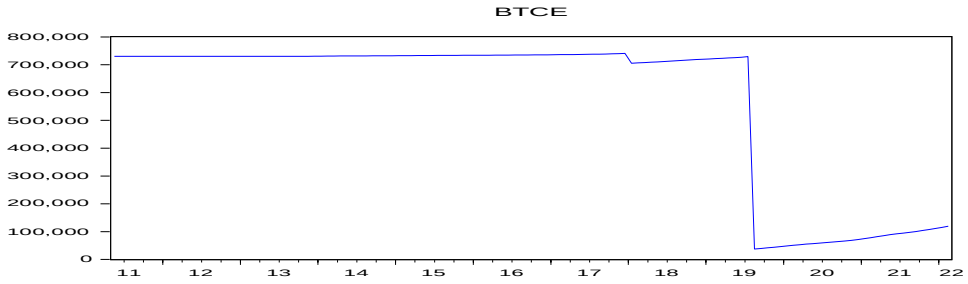
$$y^{+}_{t} = v + A_1 y^{+}_{t-1} + \cdots + A_p y^{+}_{t-1} + u^{+}_{t} \quad (6)$$

Here, y^{+}_{t} is expressed as a 2x1 variable vector, v is a 2x1 constant variable vector, u^{+}_{t} is a 2x1 error term, and A_r is a parameter matrix determined by using 2x2 lag length information criteria in the order "r".

3. RESEARCH FINDINGS

3.1. Time Series Graphs

The time series of BTCE, geopolitical risk and global economic policy uncertainity are presented below.



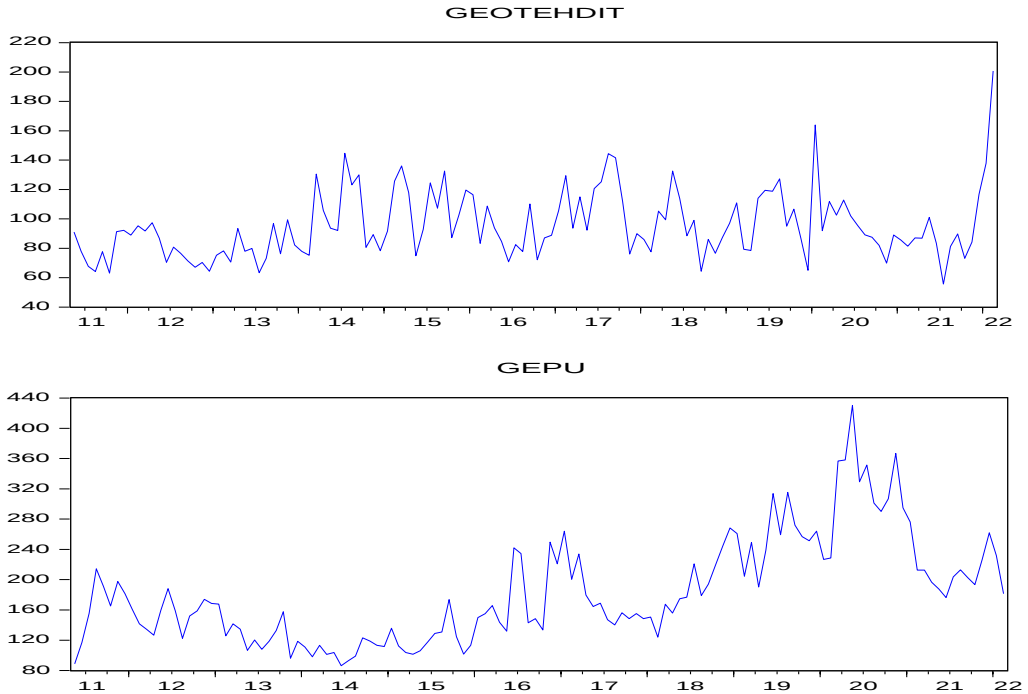


Figure 6. Time series graphs

3.2. Unit Root Test Results

Table 2. Lee- Strazicich Unit Root Test Results

Lee Strazicich (Model C)						
Variable	**Level Test Statistics**	**Level Break Date**	**Critical Value**	**1. Difference Test Statistics**	**Break Date of 1. Difference**	**Critical Value**
BTCE	-3.587320	November 2018	-4.143095	-11.70564*	May 2019	-4.106941
GPRT	-4.715553*	December 2019	-4.062468			
GEPU	-3.940684	March 2019	-4.124324	-9.190871*	November 2019	-4.063198

Upon considering the Lee- Strazicich Unit Root Test Results presented in Table 1, it is seen that GPRT becomes stationary at I(0) level, whereas BTCE and GEPU become stationary at I(1) level. Overall, it is observed that there is a break in the data as of the year 2019.

3.3. Hatemi-J Asymmetric Causality Test Results

In this part of the study, the causality between BTCE and GPRT, and GEPU is analyzed by performing the Hatemi-J (2012) asymmetric causality test. In Table 3, the causality relationship between the variables is analyzed separately for positive and negative shocks.

Table 3. Hatemi-J (2012) Asymmetric Causality Test Result

The direction of the causality	(T) Statistics	Bootstrap Critical Values		
		%1	%5	%10
GPRT (+) > BTCE (+)	22.982*	13.747	9.882	8.016
GPRT (-) > BTCE (-)	98.261*	14.543	10.107	8.142
GEPU (+) > BTCE (+)	15.267*	20.813	6.002	3.886
GEPU (-) > BTCE (-)	15.276*	27.632	5.877	3.637

Note: **: Significant at the 5% level.

Hatemi-J (2012) Asymmetric Causality Test Results of BTCE, GPRT, and GEPU are presented in Table 3 above. In the study, where BTCE is the only dependent variable, it is observed that statistically significant and strong causal relationships exist. Besides, both positive and negative causality relationships are found to exist between the GPRT and GEPU variables and the BTCE variable.

Upon considering the results of the analysis, in which a positive causal relationship running from GPRT to BTCE is tested, the T statistical value (22.982) is seen to exceed the Bootstrap Critical Value (9.882). Here, the equation proves that it is statistically significant at the 5% significance level. On the other hand, a negative causal relationship running from GPRT to BTCE is found to exist. This result is obtained when the T statistical value (98.261) exceeds the Bootstrap Critical Value (10.107). Also, the causality between GPRT and BTCE is more dominant in the negative direction. This result is obtained from the coefficient (98.261) of the equation by which the negative causality is tested.

On the other hand, upon examining the analysis results through which a positive causality from GEPU to BTCE is tested, the T statistical value (15.267) is seen to exceed the Bootstrap Critical Value (6.002). Here, the equation proves the statistical significance at the 5% significance level. On the other hand, it is found that a negative causality running from GEPU to BTCE exists. This result is obtained when the T statistical value (15.276) exceeds the Bootstrap Critical Value (5.877). As for the entire study, the negative impacts of the GPRT and GEPU variables are found to be more dominant on BTCE.

CONCLUSION

Empirical results obtained with the Hatemi-J causality test indicate the existence and direction of the relationships between GPRT and GEPU and BTCE. The causality test results indicate

that both positive and negative relationships running from GPRT, that is, geopolitical risk, to BTCE, that is, Bitcoin energy consumption exist. Nevertheless, the negative impact of GPRT on BTCE is more prominent. Similarly, although both positive and negative relationships running from GEPU to BTCE exist, the negative impact is seen higher here as well.

In general, the research results reveal the existence of relationships between risk and uncertainty and Bitcoin energy consumption. Accordingly, risk and uncertainty factors in the global context are effective on Bitcoin energy consumption. Accordingly, the research results support the opinion that Bitcoin is a different asset class and hedging instrument in case of risk and uncertainty. Risk and uncertainty factors increase the demand for Bitcoin, as well as mining activities and energy consumption. Accordingly, the following policy practices are recommended within the framework of the obtained results and the relevant literature:

Firstly, policymakers should plan alternative new energy resources, taking into account the changes in Bitcoin energy consumption due to risk and uncertainty factors. Therefore, it is crucial for converting electricity generation resources from fossil fuel resources to renewable resources in both industrial and commercial fields.
Secondly, the expansion of renewable energy resources and investments in these areas may contribute to environmental quality by preventing the damage and degradation of the environment due to Bitcoin energy consumption.

Both global and country-specific risks and uncertainties incurred are perceived as important problems by investors, therefore, they accelerate their pursuit of alternatives. Accordingly, global institutions and organizations should take measures to eliminate risk and uncertainty factors. Otherwise, the demand for Bitcoin would persist unabated, and it would cause an increase in energy consumption.

In this research study, the monthly data are utilized and the obtained data are more robust since the monthly data have a high frequency. Therefore, the obtained results are reliable in terms of policymakers and researchers. It is recommended that both researchers and policymakers utilize high-frequency data in order to provide greater benefit in practical analyses.
The main contributions of the research study may be listed as follows: (i) The most recent data are utilized in the research study, (ii) Hatemi-J causality test, which considers both positive and negative shocks, is used. In this context, it differs from research studies that perform Toda-Yamamoto and Granger causality tests, (iii) analyze the asymmetrical relationships between GPRT and GEPU and BTCE.

The research study has several limitations. In the study, only the causality is analyzed and the relationship of BTCE with merely GPRT and GEPU is examined. Nonetheless, there are many macro factors that affect BTCE. In future research studies, other factors affecting BTCE can be included in different econometric models and relationships can be investigated. In this context, a combination of different techniques, including machine learning algorithms, can be employed in future studies.

Author Contributions / Yazar Katkıları:
The author declared that he has contributed to this article alone.
Yazar bu çalışmaya tek başına katkı sağladığını beyan etmiştir.

Conflict of Interest /Çıkar Beyanı:
There is no conflict of interest among the authors and/or any institution.
Yazarlar ya da herhangi bir kurum/kuruluş arasında çıkar çatışması yoktur.

Ethics Statement / Etik Beyanı:
The author(s) declared that the ethical rules are followed in all preparation processes of this study. In the event of a contrary situation, Pamukkale Journal of Eurasian Socioeconomic Studies has no responsibility, and all responsibility belongs to the author(s) of the study.

Bu çalışmanın tüm hazırlanma süreçlerinde etik kurallara uyulduğunu yazar(lar) beyan eder. Aksi bir durumun tespiti halinde Pamukkale Avrasya Sosyoekonomik Çalışmalar Dergisi hiçbir sorumluluğu olmayıp, tüm sorumluluk çalışmanın yazar(lar)ına aittir.

REFERENCES

Abbasi, K. R., Hussain, K., Abbas, J., Adedoyin, F. F., Shaikh, P. A., Yousaf, H., & Muhammad, F. (2021). Analyzing the Role of Industrial Sector's Electricity Consumption, Prices, and GDP: A Modified Empirical Evidence from Pakistan. *Aims Energy*, 9(1), 29-49.

Al Mamun, M., Uddin, G. S., Suleman, M. T., & Kang, S. H. (2020). Geopolitical Risk, Uncertainty and Bitcoin Investment. *Physica A: Statistical Mechanics and its Applications*, *540*, 123107.

Antonakakis, N., Gupta, R., Kollias, C., & Papadamou, S. (2017). Geopolitical Risks and The Oil-Stock Nexus Over 1899–2016. *Finance Research Letters*, *23*, 165-173.

Aysan, A. F., Demir, E., Gozgor, G., & Lau, C. K. M. (2019). Effects of The Geopolitical Risks On Bitcoin Returns and Volatility. *Research in International Business and Finance*, *47*, 511-518.

Baker, S. R., Bloom, N., & Davis, S. J. (2013). Measuring Economic Policy Uncertainty. Retrived from: https://www.policyuncertainty.com/media/EPU_BBD_2013.pdf.

Baker, S. R., Bloom, N., & Davis, S. J. (2016). Measuring Economic Policy Uncertainty. *The quarterly journal of economics*, *131*(4), 1593-1636. doi:10.1093/qje/qjw024.

Bal, D. P., Patra, S. K., & Mohanty, S. (2022). Impact of Sectoral Decompositions of Electricity Consumption on Economic Growth in India: Evidence from SVAR Framework. *Environmental Science and Pollution Research*, 1-13.

BinanceAcademy. (2021). An Overview of Bitcoin Price History. Retrieved from https://academy.binance.com/en/articles/an-overview-of-bitcoin-s-price-history.

Bouri, E., Gupta, R., Tiwari, A. K., & Roubaud, D. (2017). Does Bitcoin hedge global uncertainty? Evidence from wavelet-based quantile-in-quantile regressions. *Finance Research Letters*, *23*, 87-95.

Caldara, D. & Iacoviello, M. (2016). Measuring Geopolitical Risk. working paper, https://www2.bc.edu/matteo-iacoviello/gpr_files/GPR_PAPER.pdf.

Caldara, D., & Iacoviello, M. (2022). Measuring Geopolitical Risk. *American Economic Review*, *112*(4), 1194-1225. doi: 10.1257/aer.20191823.

Corbet, S., Lucey, B. M., & Yarovaya, L. (2019). The Financial Market Effects of Cryptocurrency Energy Usage. *Available at SSRN*. https://doi.org/10.2139/ssrn.3412194.

Corbet, S., Lucey, B., Urquhart, A., & Yarovaya, L. (2019). Cryptocurrencies as a Financial Asset: A Systematic Analysis. *International Review of Financial Analysis, 62,* 182-199.

Das, D., & Dutta, A. (2020). Bitcoin's Energy Consumption: Is It the Achilles Heel to Miner's Revenue? *Economics Letters*, *186*, 108530.

Das, D., Le Roux, C. L., Jana, R. K., & Dutta, A. (2020). Does Bitcoin Hedge Crude Oil Implied Volatility and Structural Shocks? A Comparison with Gold, Commodity and The US Dollar. *Finance Research Letters*, *36*, 101335.

Davis, S. J. (2016). An Index of Global Economic Policy Uncertainty (No. w22740). *National Bureau of Economic Research.*

Dickey, D. A., & Fuller, W. A. (1981). Likelihood Ratio Statistics for Autoregressive Time Series With A Unit Root. *Econometrica: journal of the Econometric Society*, *49*(4), 1057-1072. doi:10.2307/1912517.

Dyhrberg, A.H., Foley, S. & Svec, J. (2018). How investible is Bitcoin? Analyzing the liquidity and transaction costs of Bitcoin markets. *Economic Letters*, *171*, 140-143.

Gallersdörfer, U., Klaaßen, L., & Stoll, C. (2020). Energy Consumption of Cryptocurrencies Beyond Bitcoin. *Joule*, *4*(9), 1843-1846. doi: 10.1016/j.joule.2020.07.013.

Granger, C.W. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica: Journal of the Econometric Society*, 37(3), 424-438.

Gurdgiev, C., & O'Loughlin, D. (2020). Herding and Anchoring in Cryptocurrency Markets: Investor Reaction To Fear And Uncertainty. *Journal of Behavioral and Experimental Finance*, *25*, 100271. doi: 10.1016/j.jbef.2020.100271.

Gürsoy, S. (2021). Küresel Ekonomik Politik Belirsizliğin (Gepu) Döviz Kuru, Enflasyon Ve Borsa Etkisi: Türkiyeden Kanıtlar. *Türkiye Mesleki ve Sosyal Bilimler Dergisi*, (5), 120-131. doi: 10.46236/jovosst.877608

Gürsoy, S., Akkuş, H. T., & Doğan, M. (2022). The Causal Relationship Between Bitcoin Energy Consumption and Cryptocurrency Uncertainty. *Journal of Business Economics and Finance*, 11(1), 58-67. doi:10.17261/Pressacademia.2022.1552

Hatemi-J, A. (2012). Asymmetric Causality Tests with an Application. *Empirical Economics*, *43*(1), 447–456. doi:10.1007/s00181-011-0484-x.

Huh, S., Cho, S., & Kim, S. (2017, February). Managing Iot Devices Using Blockchain Platform. In *2017 19th international conference on advanced communication technology (ICACT)* (pp. 464-467). IEEE.

Huynh, A. N. Q., Duong, D., Burggraf, T., Luong, H. T. T., & Bui, N. H. (2022). Energy Consumption and Bitcoin Market. *Asia-Pacific Financial Markets*, *29*(1), 79-93.

Kartal, M. T. (2022). The Role of Consumption of Energy, Fossil Sources, Nuclear Energy, And Renewable Energy On Environmental Degradation in Top-Five Carbon Producing Countries. *Renewable Energy*, 184, 871-880.

Kılıç, E., Gürsoy, S., & Ergüney, E. B. (2021). Bitcoin Elektrik Tüketimi Ile Enerji Piyasaları Arasında Volatilite Yayılımı: Seçili Ülkelerden Kanıtlar. *Yaşar Üniversitesi E-Dergisi*, *16*(64), 1592-1604. doi:10.19168/jyasar.945644

Khan, M. A., & Salah, K. (2018). IoT security: Review, Blockchain Solutions, And Open Challenges. *Future Generation Computer Systems*, *82*, 395-411. doi.org/10.1016/j.future.2017.11.022.

Krause, M. J., & Tolaymat, T. (2018). Quantification of Energy and Carbon Costs for Mining Cryptocurrencies, *Nat. Sustain.*, 1, 711–718.

Küfeoğlu, S., & Özkuran, M. (2019). Bitcoin Mining: A Global Review of Energy and Power Demand. *Energy Research & Social Science*, *58*, 101273.

Kyriazis, N. A. (2021). The Effects of Geopolitical Uncertainty On Cryptocurrencies and Other Financial Assets. *SN Business & Economics*, *1*(1), 1-14.

Lee, J. & Strazicich, M. C. (2003). Minimum Lagrange Multiplier Unit Root Test with Two Structural Breaks. *Review of Economics and Statistics*, *85*(4), 1082–1089. doi:10.1162/003465303772815961

Lee, J. & Strazicich, M. C. (2004). Minimum LM Unit Root Test with One Structural Break. *Appalachian State University Working Papers*, *4*(17), 1–15.

Nakamoto, S. (2009). Bitcoin: A Peer-To-Peer Electronic Cash System. Technical report, Manubot.

Ng, S. ve Perron, P. (2001). LAG Length Selection and the Construction of Unit Root Tests with Good Size and Power. *Econometrica*, *69*(6), 1519–1554. doi:10.1111/1468-0262.00256

Phillips, P. ve Perron, P. (1988). Testing for A Unit Root In Time Series Regression. *Biometrika*, *75*(2), 335–346. doi:10.1093/biomet/75.2.335.

Rahaman, M., Hossain, M., & Chen, S. (2022). The Impact of Foreign Direct Investment, Tourism, Electricity Consumption, and Economic Development on CO_2 Emissions in Bangladesh. *Environmental Science and Pollution Research*, 29(25), 37344-37358.

Sarkodie, S. A., Ahmed, M. Y., & Leirvik, T. (2022). Trade volume affects bitcoin energy consumption and carbon footprint. *Finance Research Letters*, 102977.

Soytaş, M. A., Ertuğrul, H. M., & Ulussever, T. (2020). Nonlinear Excess Demand Model for Electricity Price Prediction. *Economic Research Forum Working Papers*, No. 1449.

Toda, H.Y. & Yamamoto, T. (1995), "Statistical Inference in Vector Autoregressions with Possibly Integrated Processes", *Journal of Econometrics*, 66(1), 225-250.

Urquhart, A. (2016). The inefficiency of Bitcoin. *Economics Letters*, *148*, 80-82. doi: 10.1016/j.econlet.2016.09.019.

www.policyuncertainty.com (05.05.2022)

https://digiconomist.net/bitcoin-energy-consumption (05.05.2022)

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The Fight Against Drugs and Border Security Policy In Turkey[1]

Türkiye'nin Sınır Güvenliği ve Uyuşturucuyla Mücadele Politikası

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Abstract

Border gates are the main places where the economic and security interests of the countries are protected, and the entrances and exits to the country are kept under control. Governments determine different border policies based on their administrative structures and security threats on their borders. It would be shallow to talk about physical security alone regarding border security. Smuggling activities, terrorism, and the fight against drugs constitute important threat areas within border security. Due to its geopolitical position, Turkey has an important place in the international illegal drug trade. Within the scope of this study, the fight against narcotic crimes at the borders was evaluated in the context of Turkey's border security policy, and the relevant policies were discussed from the perspective of the process analysis approach. As a result of examples and examinations, the issues that cause confusion and weakness in Turkey's border security policy are mentioned.

Keywords: *Border Security, Narcotic, Security Policy, Policy Analysis.*

Jel Codes: *F50; F52*

[1] Yazarlar bu çalışmanın tüm süreçlerinin araştırma ve yayın etiğine uygun olduğunu, etik kurallara ve bilimsel atıf gösterme ilkelerine uyduğunu beyan etmişlerdir. Aksi bir durumda Pamukkale Journal of Eurasian Socioeconomic Studies Dergisi sorumlu değildir. İntihal raporu alınmıştır.
The authors declared that all processes of this study comply with research and publication ethics, and comply with ethical rules and scientific citation principles. Otherwise, Pamukkale Journal of Eurasian Socioeconomic Studies is not responsible. A plagiarism report is received.

INTRODUCTION

The most critical issue emphasized while determining Turkey's border security policies has been security. The aspects of both internal and external factors are discussed with the concept of security. While deciding the policies of Turkey, which is frequently faced with internal and external threats, precautionary mechanisms have been established for the extensions of these threats. The fight against terrorism, one of the leading security elements, is fed from many sources, and drug smuggling comes first and reveals the importance of the fight against drugs at the border gates.

The fight against drugs has become not only a foreign policy but also a domestic issue, especially after the 1990s. The anti-drug policies of the Republic of Turkey have attracted attention both in the national and international arena as they are systematic and functional. Turkey's borders have become strategic points in this struggle, as it is a natural route for the international drug trade due to the effects of its geography. Land border gates, which are under the jurisdiction of the Ministry of Commerce, are of great importance in the fight against drugs due to their geopolitical position. For this reason, the training of competent personnel at border gates and the use of technological tools that enable them to fulfill their duties most effectively are among the main issues within the relevant policies.

In this study, the policies implemented towards the fight against drugs at the border gates of Turkey are examined. In this context, all stages of the policy, from the formation process to the policy actors, are handled with the process model, which is a preferred method in policy analysis processes.

1. NARCOTIC CRIMES AND FIGHT AGAINST DRUGS

Narcotic is a word used for sleep-inducing substances. These substances are generally referred to as drugs. (Turkish Surgery Dictionary, 2021). It is known that the drug has a pleasant and addictive effect and numbs the human body. In terms of production, there are drugs of herbal origin, as well as those consisting of synthetic substances. It affects the central nervous system in the human body and creates a state of physical and mental dependence (Tosun, Şahin, and Aslan: 2021: 104-105).

Although drugs have been used for therapeutic purposes in the historical process, they have turned into an illegal commercial activity due to their addictive effect. Among these substances, which are divided into different classes according to the impact they have on the central nervous system, the properties they carry, and the level of harm they cause to humans and the environment, the most circulating substances are expressed as follows: heroin, cannabis, cocaine, ecstasy, methamphetamine, amphetamine, opium, captagon (Babahanoğlu, 2016: 62-67).

Table 1. Different Drug Types and Their Effects on Human Body

Effect on the Central Nervous system	Type of Substance used	Natura curd Artificial	Physiological Effects
Morphin, Heroin	Opium Derivatives, Morphin, Base Morphine,	Poppy, Morphin	Coffee, Tobacco, Khat
Alcohol, Barbiturate	Heroin, Codein, Meperidine	Codein, Coca	Betel, Campre, Amphetamines, Bromide
Sedative, Tranquilizer	Alcohol, Cocaine, Marijuana	Cocaine, Marijuana	Sulfanol , Praldeyhde , Verenol , Ether
Cocaine, Amphetamine	amphetamines Inhalant, Phencyclidine	Marijuana, Hydromorphine	Chloralhtdrate, Cholorofom, Alcohol, Mescaline , Morphine
LSD, Maskline	Nicotine, Anxolites	Oxymorphine, Heroin	Heroin, Cocaine
Ecgonine, Marijuana	Hallucinogens	Methadone, Tramadol, Meperidine	Opium, Marijuana

(Ateş ve Banazlı, 2020: 66).

Both national and international laws prohibit the production, possession and sale of narcotic substances, and the export and import of these substances are also included in the scope of illegal trade. The international drug trade has had no difficulty reaching new markets with the speed of adapting to the global economy. The crime of drug smuggling has been evaluated within the scope of organized crime and has found the opportunity to occur in many more places due to new technologies and increased international trade volume. Factors such as the formation of new markets and the ease of transportation have also changed the drug smuggling methods and adapted to the new system they have created (Tosun, Şahin, and Aslan, 2021: 106-107).

The expansion of the drug market networks the adaptation to the global economy, the establishment of new trade networks, and the fact that even the countries' annual revenues have whetted the appetite of even the countries have caused groups that carry out illegal or supranational activities to enter into a struggle for shares terrorist organizations to come first among them. It is thought that the PKK's drug revenue in the 1990s was around 300 million dollars a year. According to Turkish Intelligence officials, the drug revenue of the terrorist organization increased significantly after 2001. Today, it is believed that the income the PKK earns from cannabis cultivation is more than 500 million dollars a year (Cengiz, 2017: 8). At the same time, drug smuggling has become an essential source of financing for terrorist organizations. The partnership between terrorism and drug smuggling has become a crucial threat to border security.

Drug trafficking is mostly carried out through cannabis in the world and in Turkey. It is also possible to say that these illegal commercial activities are an essential transit point, mainly due to Turkey's geopolitical position. It is known that Turkey has a central role in terms of ecstasy,

bonsai, and cannabis. It can be seen by the relevant reports that Turkey is an important transit point for cocaine and captagon (Babahanoğlu, 2016: 75). At the same time, Turkey is located on the Balkan Route, which is an essential route in drug trafficking. The Balkan Route covers the road that passes through Iran and Turkey and reaches the Balkan countries, namely Bulgaria, Romania, and Greece, and then to the Middle East and Western European countries. The fact that the Balkan route is one of the most active drug routes places Turkey in a vital position in this sense (Turkey Drug Report, 2019).

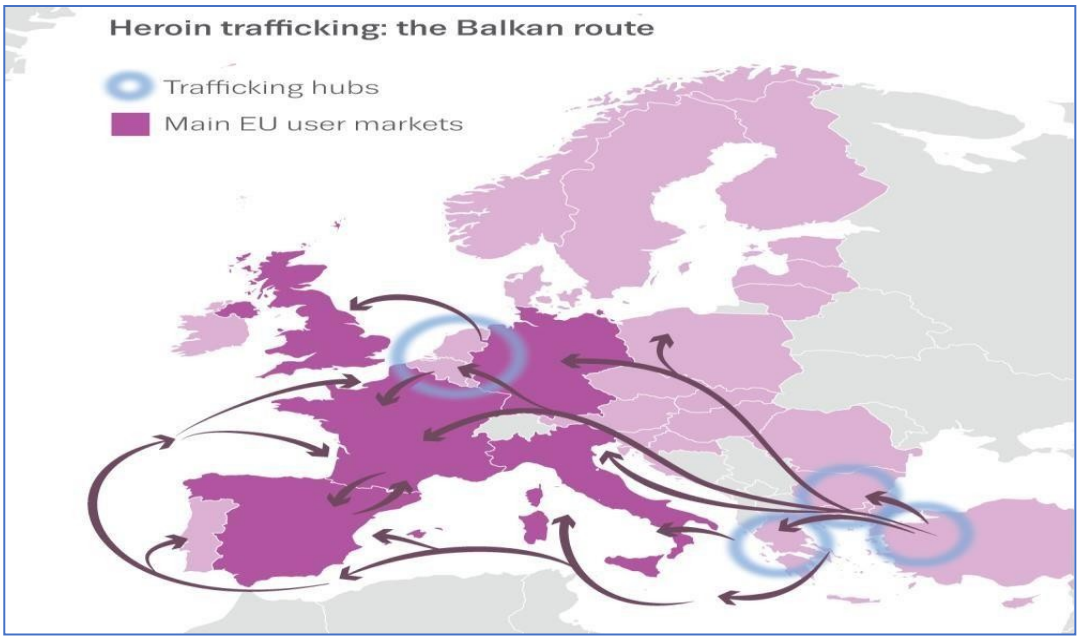

Figure 2. Heroin Traffic

(EMCDDA, 2019).

When we looked at the heroin seizures of the European Union in 2017, a data of 5.4 tons is reached, while it is seen that this amount is 17.4 tons, three times this amount in Turkey data of the same year. In 2018 data, it is seen that the seizure of 18.5 tons of heroin originated from Afghanistan. It is known that heroin originating from Afghanistan, which has made the European market a target according to the data of 2017-2018, is caught in Turkey before it reaches this illegal market. It is thought that these heavy seizures made on the routes known as the Balkan Route in recent years will intensify on the Northern Route in the coming years (Turkey Drug Report, 2019).

While opium is obtained from the opium poppy in Turkey, after the emergence of allegations that Turkey's opium poppy cultivation areas were used in the illegal drug trade, opium cultivation in the country was banned with the decision of the Council of Ministers dated 26/06/1971 to prove that these claims are unfounded (Parliament, 2021). After this ban, drug networks in Europe turned to other sources, and Afghanistan and Pakistan became famous poppy producers. When we look at the drugs originating from Afghanistan, we can say that this drug mostly passes to the border neighbor Iran and is tried to be transferred to Europe via Iran. Turkey is on a natural route for drugs to Europe necessitates international cooperation in the fight against drugs in Europe and Turkey. For this reason, the priority of Turkey's anti-

drug policy is to prevent the supply that may occur through Turkey (Aksu and Ünlü, 2018: 141).

Table 2. Drug Types

DRUGS (kg)	Belgium	France	Greece	Italy	Spanish	Turkey
Heroin	1928	1012	402.7	614	234	20164
Cocaine	65247.68	14599	953,417	8262.6	37868	1634,292
Methamphetamine	25.1	562	211.3	23.1	51.19	1042
Amphetamine	1027	92	9739	10.4	23.3	2800
Opium	1.07	-	0.09	1.52	1.76	1314
Marijuana (Herb)	1153	21949	12508	23632	39861	90579

(UNODC, 2019).

As seen in the table above, apart from the fact that Turkey has a lesser role in the transportation of cocaine to Europe due to its geographical location and originating from South America, Turkey has a higher rate of seizure of drugs in other drug types seen in the table. One of the biggest reasons for this is that opium gum, one of the raw materials of the drug, is of Asian origin, and we are on the transit route to Europe due to our geographical location. As stated above, Turkey is one of the most important transit routes for the Balkan Route.

According to the Afghanistan Drug Report prepared by the United Nations Office on Drugs and Crime (UNODC), as of July 2021, over 6,000 tons of opium have been produced in Afghanistan, and approximately 320 tons of pure heroin can be obtained from the obtained opium to be shipped to illicit markets globally. It is estimated that the revenue generated from the trade in opium derivatives in Afghanistan alone in 2021 constitutes an illegal source of around 1.8 to 2.7 billion dollars. It is evaluated that approximately 85% of global illicit opium production in 2020 was carried out in Afghanistan and that opium produced in this country constitutes a source for about 80% of users worldwide. Therefore, changes in opium cultivation and production in Afghanistan have a significant impact on the global illicit drug market and organized crime (UNODC, 2021: 3).

2. BORDER SECURITY AND SUSTAINABLE SECURITY APPROACH

Nation states use the concept of the border to determine their sovereignty on international platforms. Wars or international agreements usually draw borders. In this context, border security includes practices that prevent entry and exit within its borders, independent of state control. Border security aims to prevent the entry and exit of criminal elements such as weapons, drugs, terrorism, and human smuggling. Therefore, outside the focus of terrorism, it can be said that activities such as smuggling and illegal human trafficking are not ignored in the concept of border security. (Expert, 2016: 137).

In order to ensure border security, soldiers' guard posts were kept at locations designated as military towers. Today, additional measures regarding border security have been added. These measures were regulated within the national security framework and included necessary measures related to immigration and health, especially smuggling. At the beginning of the main tools in ensuring border security, some elements will protect the land border, such as fences, walls, mines, border posts, and border watchtowers, as well as current border security tools such as night vision thermal cameras, border flight aircraft, satellite images, and biometric identification. (Taşkın, 2020: 242).

Since one of the primary purposes of the existence of states is to protect citizens' life rights and property, each country has border policies developed in the context of its administrative structure and historical background. While determining these policies, the countries' experiences in terms of border violations are also considered. For example, it is known that after the September 11 attacks against the USA, border security policies were shaped by more severe measures, especially by the USA, England, France, and Germany. In addition, a fence has been built along its borders by Hungary to prevent human trafficking at the borders. We see an example of border security policies in the Schengen Visa application. It is known that although the citizens of EU member states have the freedom to cross borders, the citizens of different countries do not have such a right. In addition to this decision taken with the Schengen Agreement implemented in 1995, standard policies for border security were also adopted (Taşkın, 2020: 242-244).

While defining the concept of border security within international relations, it was discussed in maintaining ties based on trust. The concept of security Hoffman examines under five headings; Firstly, the willingness of the actors to take the fate of another actor. Secondly, thatthe other party does not harm the established relationship; thirdly, that the security relationship between the actors can be changed in terms of reliability and density perception, fourthly, the trust-based relationships are dynamic for possible future situations, and lastly, trust is constantly maintained by the actors. It is expressed as being re-evaluable. From this point of view, the concept of trust is considered a dynamic process in which risk is constantly re-evaluated on an international scale (Leuprecht et al., 2021: 350).

The emergence of the concept of sustainability is based on the World Nature Charter document accepted by the World Union for Conservation of Nature in 1982. In this document,it is aimed that the resources in the sea, air, land, ecosystem, and atmosphere that people benefit from be used in a way that will achieve optimum sustainability, but that the benefit provided will not endanger the integrity of other living species. Sustainability in its current meaning was made in the report Our Common Future published in 1987 by the World Commission on Environment and Development. According to this report, sustainable development has been defined as providing optimum benefits without ignoring future generations' needs while meeting today's needs (Karakurt, 2009). The understanding of sustainable security that emerged within the sustainable development framework has transformed the concept of sustainability into a principle that shapes public policy processes.Sustainable development has been presented as a solution to the social and inter-communal tensions caused by climate changes, environmental problems, poverty, and the inequality that comes with them (Giovannoni and Fabietti, 2014: 21-40).

While the emphasis is placed on ensuring the physical security of land borders and maintaining them through armament within the scope of the traditional security approach, the concept of human development is emphasized within the new security understanding developed with the idea of sustainability. In this context, it can be said that a holistic security approach has emerged that does not address a single area but also deals with different disciplines. Border security now includes issues such as improving living conditions and having better conditions within its field of activity. The concept of security has created new application areas at the borders with the understanding of sustainability and has provided a reinterpretation of the concept of security in domestic politics (Barbak, 2018: 39-41).

Developing a sustainable security approach ensures that the measures taken, and the actions taken are handled more holistically within public policies. The concept of border security, which we will discuss in our study, can be accepted in this context. As we will discuss in detail in our research, border security is not just about the military protection of borders. Accordingly, the fight against narcotic crimes, which we have examined, is a part of border security.

2.1. Border Security Practices in European Union Countries

Europe has faced a severe migration crisis, especially since 2011, due to the Arab spring, the political crises in the Middle East, and the unrest in North Africa. The inability to track many illegal immigrants has led to humanitarian and security concerns. There were differences of opinion among European countries regarding managing these crises, and these disagreements created an atmosphere of discussion despite the principles of equal burden sharing and solidarity, creating new fields of study such as securitization of immigration, multidimensional examination of the concept of security, with the increase in illegal immigration (Baër, Beeres, and Bollen, 2021: 786). In the border security field, radars, camera surveillance systems, unmanned aerial systems, various sensors and complex technological devices have come to the fore. Therefore, border security emerges as a more complex and complicated structure that includes physical factors and legal regulations (Léonard and Kaunert, 2022: 1419).

While the border security in the countries of the European Union is tried to be protected by the Schengen Borders Law, this law also states that the primary responsibility of border security belongs to the Schengen countries at the land, sea, and airport borders. In this context, the FRONTEX mission seems to be compatible with the European Union's Integrated Border Management concept and consistent with the European Union's fundamental rights. The aim of FRONTEX is the promotion, coordination, and development of the European Border Management. In addition, it is aimed to technically support the joint operations with FRONTEX to the member states with rapid interventions (FRONTEX, 2022).

2.2. Border Security in Turkey

Looking at Turkey's border gates: It is seen that there are a total of 160 border gates, including thirty lands, seven railways, 63 seas, and sixty air. Within these border gates, there are 13 border gates, 3 of which are railways and 10 are highways, on the Turkey-Syria land border line, which has a length of 877 km. Between Turkey and Syria, nine of the border gates were opened permanently and four of them temporarily. While ten of these doors are actively used, 3 of them are currently inactive. There are three active border gates on the land border of

Turkey and Iran, with a length of 560 km. The Turkey-Iraq border is 378 kilometers, and there are four border gates, two of which are in operation and 2 of which are closed. Apart from these, Bulgaria has 269 km, Greece 203, Georgia 276, Armenia 328, and Azerbaijan/Nakhchivan 18 km border length. However, they do not have as important a place as Syria, Iraq, and Iran in our border security policy.

When the institutional structure regarding border security is examined, it is seen that five primary institutions (Land Forces Command, Gendarmerie General Command, Coast Guard Command, General Directorate of Security, and General Directorate of Customs Enforcement) have responsibilities. Many experts have criticized this dispersed institutional structure as it may cause integration and coordination problems among the facilities. Considering the criticisms made, it has been stated that border security should be carried out by preventing crime, not depending on the practice of attack and defense (Kaya, 2013: 10).

There are also different projects planned for Turkey's border security. However, these projects are activated dynamically according to current needs and changing conditions. Regarding physical security, by the TAF, Suggestions such as building a 5-meter-high concrete wall on the borderline and setting up 15-meter watchtowers on the walls were made. Especially considering the civil war situations in our border countries, physical security measures are among the border security measures that should be implemented very quickly (Demir, 2018: 6-8).

When evaluated in the context of border security, it can be said that there are different agendas in each border region of Turkey. The Turkey-Iraq border region is one of the border regions where terrorist activities are most intense. The fact that there is mountainous land on the borderline makes it challenging to control this region. In addition, the Turkey-Iraq border region is used as an essential route for smuggling activities of terrorist organizations due to the characteristics of its geographical structure. The smuggling activities in this region are of critical importance as they also finance terrorist organizations. Since it is a border area where smuggling activities and terrorist organizations feed, there is a significant security threat in this region. For this reason, the fight against smuggling can simultaneously be considered an indispensable policy for border security (Öztürk and Bulut, 2020: 190).

National legislation on border security management and essential regulations have been made by institutions that carry out studies on border security. At the beginning of these regulations; "Law on the Protection and Security of Land Borders" (1988), "Prime Ministry Circular on Integrated Border Management" (2010/15), and "Regulation on Inter-Agency Cooperation and Coordination in the Field of Border Management" (2016) are coming (Ekmekçioğlu and Yıldız, 2018:337).

The Prime Ministry Circular on Integrated Border Management (2010/15) is a critical study that also took place in the EU accession negotiations. Within the scope of the work carried out in coordination with the Ministry of Interior, one of the actors of the policy transfer process, it is aimed to harmonize the legislation on border management with the EU legislation. At the same time, the regulation of the border security organization as a new organization under the Ministry of Internal Affairs is among the study's aims.

Another legal regulation on border security is the "Regulation on Cooperation and Coordination Between Institutions in the Field of Border Management. The purpose of this regulation is to provide cooperation between all organizations actively involved in the field of border management and to realize the needed organization (Ekmekçioğlu and Yıldız, 2018:338).

Another study carried out within the scope of border security was establishing the European Agency for the Management of Operational Cooperation at External Borders (FRONTEX) in2004 by the Council of the European Union. This agency was established to ensure the coordination of EU member states in terms of border security, creating common education policies, performing risk analyses, and following developments that will increase efficiency in border surveillance.

Within the scope of this agency established by the EU, various harmonization studies are carried out between the relevant institutions and organizations and FRONTEX in Turkey. These harmonization studies are carried out in three main dimensions:

- *Establishment of professional and civilian law enforcement at border crossing points and along the border,*
- *Establishment of an integrated border management system to ensure cooperation and coordination between relevant institutions and organizations*
- *Increasing efficiency in border management through modernization of infrastructure, tools, and staff training*. (Ekmekçioğlu and Yıldız, 2018: 339).

2.3. Combating Narcotic Crimes in Turkey's Border Regions

In this part of our study, terrorist organizations, one of the main threats to border security, andhow the fight against drugs, one of the biggest financing sources of terrorist activities, will be examined on our borders. EGM carries out anti-drug activities in Turkey, Gendarmerie General Command, Coast Guard Command, and General Directorate of Customs Enforcement (Tosun, Şahin, and Aslan, 2021: 121). Duties for the operations carried out for the entry, and the General Directorate of Security carries out the exit of people at the border gates. The units affiliated with the Ministry of Commerce carry out the entry and exit of goods andvehicles (Akman and Kılınç, 2010: 19).

Customs Enforcement units operating under the Ministry of Commerce carry out anti-drug activities at border gates. These activities are carried out with various materials and the training and equipment received by the personnel of the Customs Enforcement, Smuggling,and Intelligence Directorate. Customs Enforcement officers are trained in using X-Ray Detectors, and they inspect the prohibited items and goods by ensuring that the X-Ray Detector inside the customs scans the vehicles within the scope of various risk criteria at bordercrossings. In addition, the training of detector duty dogs is carried out at the Customs Enforcement Dog Training Center. Customs Enforcement personnel, subjected to interview selection tests at the Dog Training Center, become detector dog managers with their training. Detector Dog managers and detector dogs are one of the most critical parts of the drug control mechanism at the border gates. In this context, 142 narcotic detector dogs and 70 X-Ray devicesare operating as of 2020 (Ministry of Trade, 2020).

The aim of "More Effective Fight Against Drugs" in the I. 100-Day Action Plan published in 2018, a new unit was established to carry out comprehensive activities for the fight against drugs. NARKOKİM is a unit specialized in narcotics and fighting methods, consisting of expert personnel to work 24/7 within the scope of the Department of Combating Narcotic Crimes and Van, Kocaeli, Gürbulak, Istanbul, Mersin, and Edirne Smuggling and Intelligence Directorates (KİM) established under the General Directorate of Customs Enforcement. (Customs Enforcement, 2021). Within this unit, 399 NARKOKİM personnel are actively involved (Ministry of Trade, 2020: 139).

Within the Ministry of Commerce, not only in-house studies but also joint studies are carried out. In this context, participation in the work of the High Council on Combating Addiction and the 2018-2023 Strategy Document and Action Plan was ensured in 2020. In addition, the United Nations Office on Drugs and Crime, European Monitoring Center for Drugs and Drug Addiction, WCO, and Southeastern Europe Law Enforcement Center are among the joint activities of the ministry (Ministry of Trade, 2020: 139). According to the statistics published in the 2020 annual report of the Ministry of Commerce, the one-time drug seizures by Customs Enforcement units, which reached record levels, were carried out as follows:

- *160 kg of heroin, 2,080,000 units of ecstasy, 2 tons of 70 kilograms of skunk cannabis at Kapıkule Border Gate*
- *540 kilograms of cocaine at Kocaeli Port*
- *61 kilograms of opium gum, 462.5 kilograms of liquid methamphetamine at the Gürbulak Border Gate*
- *Two hundred fifty-six kilograms of methamphetamine at Dilucu Border Gate* (Ministry of Trade, 2020: 143).

Considering the statistical data, the Customs Enforcement Smuggling Intelligence Directorate, the authorized unit at the border gates, is influential in the fight against drugs. Although the EGM, JGK, Coast Guard, and Land Forces units are effective in the context of border security, these units carry most drug seizures at the border gates since the authorized control unit at the border gates is the Customs Enforcement Smuggling and Intelligence Directorate.

3. DISCUSSION

It is mentioned about a process that is described as everything that exists to describe the analysis of a policy and the evaluation without the use of the policy. It can be said that the most appropriate analysis method is the process analysis of the policies carried out regarding the fight against narcotic crimes. While making this analysis, the stages of enactment, implementation, and evaluation are examined in detail.

The process analysis model is also called the incremental model. It is expressed in this way because the analysis of this policy-making process, in which policy actors are included, is carried out gradually. Evaluations about what the actors do and will do in the policy are also among the stages in the process analysis (Babaoğlu and Yılmaz 2021: 17-19), and the actors of the current policy are primarily evaluated. Alternative policy solutions are then discussed. In

the next stage, the process analysis as enactment, implementation, and evaluation of the implementation was completed.

While more than one institution and organization is active in border security, it is known that Customs Enforcement personnel of the Ministry of Commerce operate at the border gates to fight against narcotic crimes. According to the 4th article of the Law Enforcement Regulation based on TCK 167, the Customs Enforcement Smuggling and Intelligence Directorate personnel are assigned as judicial law enforcement officers. According to Law No. 6815, the authorized judicial and administrative law enforcement unit at the border gates is the Customs Enforcement personnel. While it is seen that there is a concentration of institutions that confuse authority and responsibility regarding border security, it can be said that the activities in the fight against narcotic crimes at the border gates are carried out through a single institution.

Policies regarding Turkey's fight against drugs are not only at the border gates but also throughout the country. In addition, the policies on border security covered not only the fight against narcotic crimes but also physical security or the smuggling of people, goods, and money. For this reason, it is impossible to talk about a single policy area regarding the fight against narcotic crimes at Turkey's border gates. In the 1990s, Turkey was considered a transit point for drug smuggling, and in this context, on April 26, 1996, a recommendation from the MGK to develop a general policy (Akgül and Kaptı, 2010: 87).

As a result of the evaluation of both internal and external factors in the fight against drugs, the "Law on the Protection and Security of Land Boundaries" (1988), "Prime Ministry Circular on Integrated Border Management" (2010/15), and "Border Management" on border security in the process of creating new and inclusive policies Studies on the "Regulation on Cooperation and Coordination between Institutions in the Field" (2016) have emerged. (Ekmekçioğlu and Yıldız,2018). Although these studies are mainly carried out in the context of border security, there are also activities aimed at combating drug smuggling. In addition, within the scope of the "More Efficient Fight Against Drugs" objective included in the I. 100-Day Action Plan published in 2018, a new unit was established under the roof of the General Directorate of Customs Enforcement of the Ministry of Commerce to carry out comprehensive anti-drug activities. NARKOKIM, which consists of personnel who are experts in their fields and will work 24/7, is composed of people who are experts in drugs and methods of struggle, and by this means, a more effective fight against drugs at the border gates is ensured (Customs Guard, 2021).

Statistics show that drug seizures at border gates have increased due to these practices. The sensitivity in the fight against drugs is maintained to the same extent at the border gates. The increase in the international drug trade, which has been integrated into new trade routes and trade systems that have emerged with technological opportunities, has also increased the number of drugs seized at the Turkish border gates. Despite the latest methods, due to Turkey's determined struggle, drug seizures got ahead of Europe and did not turn a blind eye to dirty traders. The increase in drug seizures from the annual reports published by the Ministry of Commerce proves the successful results of these policies (Ministry of Commerce, 2021).

CONCLUSION

Based on the evaluations in the article, Turkey's border security policy is based not only on physical security but also on issues such as combating smuggling, drug trafficking, and human smuggling. Due to Turkey's geopolitical position, being on important drug trafficking routes requires keeping the border security policies up to date in this direction.

In the context of Turkey's border security policies, two issues that cause security weakness to stand out: are the confusion of authority and responsibility. This complexity covers each twenty-eight institutions considered within the secondary, rather than the primary, the mandate of border security. While the Turkish Land Forces determine national security as the primary target in border security policies, it does not prioritize issues such as smuggling. In addition, customs directorates working under the Ministry of Trade are primarily concerned with import and export activities. However, as a secondary task, the Ministry of Commerce gave an assignment for ensuring border security. In addition, it is seen that the police officers whose primary duty is to maintain order in the city are also on duty at the border gates. It can be said that there is a very complex institutional structure within the borders of Turkey, which is not under a single institution, unlike Europe (Öztürk and Bulut, 2020: 192).

The main objectives in ensuring border security are preventing illegal human, animal, and product smuggling and the effective continuation of entry and exit controls for terrorist and drug activities. For this reason, the security forces must protect the borders first. However, in addition to these security measures provided by law enforcement, factors such as smuggling and illegal migration are the main problems at the walls, and regulations should be made with appropriate principles (Uzman, 2016: 139).

Within the scope of the National Action Plan for the implementation of Turkey's Integrated Border Management Strategy, "*Border agreements generally include it is aimed to ensure that the other state is innocent of all kinds of attacks, that the people living along the border do not violate the border security, and that all kinds of smuggling, gangsterism, and theft at the borders are prevented by cooperation*. In this context, it is stated that border security should be ensured by walls or technological tools and agreements with bordering countries (Öztürk and Bulut, 2020: 193).

When border security policies are examined in the context of drug smuggling, it is seen that this field is an area that requires a significant level of professionalism. Especially understanding the phenomenon of stimulants and knowing that the drug trade is a power that finances criminal organizations requires a holistic evaluation. For this reason, it can be said that the units fighting against drug trafficking and the field personnel of these units are among the essential requirements to specialize in the field (Çopur, 2014: 107).

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REFERENCES

Akgul A., & Kapti A. (2010). Turkey's Drug Enforcement Policy: Policy Process Analysis. Transnational Crime from Local to Global. S. Özeren, M., A., Mehmet and Ö. Iron (Ed.). *Local to Global in Virtual Maps* (pp. 75–59). Ankara: UTSAM Publications.

Akman A., & Kilinc I. (2010). Development of Integrated Border Management in the EU and Turkey's Transition Studies to Integrated Border Management in the EU Process. *Turkish Journal of Administration. 9-31.*

Ateş, H., & Banazlı , A.M (2020). Struggling with Drug Addiction in Turkey: An Analysis on the Reports of the Department of Combating Narcotic Crimes. *Journal of Civilization Studies* , *5* (1): 63-80.

Babahanoğlu , V. (2016). *Social Perception in Turkey's Anti-Drug Policies* . (Master's thesis). Necmettin Erbakan University: Konya

Babaoglu C., & Yilmaz F. H. (2021). *Public Policy Analysis Methods and Techniques*. Nobel Publishing House: Ankara.

Barbak A. (2018). A Conceptual Analysis on the Relationship between Sustainable Security Approach and Public Administration. *Afyon Kocatepe University Journal of the Faculty of Economics and Administrative Sciences.20* (2). 37-50.

Baysal, B., Karakaş, U., & Lüleci-Sula, Ç. (2019). International Political Sociology and Security: Examples of Global Terrorism, Border Security and Citizenship. *Ankara University Journal of SBF* , 74 (4), 1203-1231.

Baër S., Beeres R., & Bollen, M. (2021). Border Sharing –A Quantitative Analysis of Contributions to FRONTEX 2012–2018. *Defense and peace Economics* , *32* (7), 786-799.

Cengiz, M., (2017). Amped in Ankara: Drug Trade and Drug Policy in Turkey from the 1950s Through Today. 1-20. https://www.brookings.edu/wp-content/uploads/2017/04/fp_201704_turkey_drug_policy.pdf Access Date: 26.06.2022

Copur, İ. (2014). *Problems Encountered in Combating Customs Smuggling and Their Solutions: A Study on Turkish Customs* . (Master's thesis). Gumushane University.

Deniz, T., (2020). Borders, Border Security and Border People under the "Limitless World" Discourses. *Journal of Eastern Geography. 25* (44). 235-252

Ekmekçioğlu A., & Yıldız, M. (2018). Wall Construction and Arbitration Policies in Border Security. *Public Policy Analysis: Turkey Applications.* Gazi Bookstore: Ankara. p.331-366.

EMCDDA. (2019). https://www.emcdda.europa.eu/media-library/map-heroin-trafficking-balkan-route_en Access Date: 26.06.2022

FRONTEX. (2022). https://frontex.europa.eu/we-support/roles-responsibilities/ Accessed on 26.06.2022

Giovannoni , E., & Fabietti G. (2014). What is Sustainability ? A Review of the concept and its Applications. *Integrated Reportig* . 21-40

Customs Enforcement. (2019). http://gumrukmuhafaza.org.tr/narkokimler-2019a-hizli-basladi/ Access Date: 01.01.2022

Customs Enforcement. (2021). https://muhafaza.ticaret.gov.tr/haberler/kacakcilikla-mucadele/gumruk-muhafaza-ekipnizice-gurbulak-gumruk-kapisinda-rekor-uyusturucu-yakalama Access Date: 01.01.2022

Department of Combating Narcotic Crimes, General Directorate of Security, Ministry of Interior. (2019). *Turkey Drug Report.* chrome - extension://efaidnbmnnnibpcajpcglclefindmkaj/viewer.html?pdfurl=http%3A%2F%2Fwww.narkotik.pol.tr%2Fkurumlar%2Fnarkotik.pol.tr%2FTUB%25C4%25B0M%2FUnational%25%2520B1% 2F2019-TURKIYE- Sleeping-Report.pdf&clen=4634283&chunk=true Access Date: 01.01.2022

Karakurt T., E. (2009). The Concept of Sustainability and Its Effects on Urban Structure. *PARADOX, Journal of Economics, Sociology and Politics.* 5(2). https://www.researchgate.net/publication/338448336_SURDURULEBILIRLIK_OLGUSU_VE_KENTSEL_YAPIYA_ETKILERI Access Date: 24.07.2022

Kaya A. (2013). Change in Border Security Paradigms and Analysis of Turkey's Border Security Structure . *Journal of International Security and Terrorism* . *4* (2). 1-12.

Küçükşahin, A. (2005). Reasons Preparing Eastern and Southeastern Anatolia for PKK Terrorism. *Journal of Security Strategies. 1* (2). 1-94.

Leuprecht C., Brunet-Jailly E., Hataley T., & Legrand , T. (2021). Patterns in Nascent , Ascendant and mature Border Security: Regional Comparisons in Transgovernmental Coordination , Cooperation , and Collaboration. *Commonwealth & Comparative Politics* , *59* (4), 349-375.

Leonard S., & Kaunert C. (2022). The Securitization of Migration İn The European Union : Frontex And İts Progress Security Practice . *Journal of Ethnic and Migration Studies* , *48* (6), 1417-1429.

Ozturk, B., & Bulut, I. (2020). Border Security of States in a Globalizing World: The Example of Uludere Border. *Changing the Nature of the State: The Limits of Security.* Tasam Publications: Istanbul. p.189-208.

TR Ministry of Commerce (2020). 2020 *Annual Report.* chrome - extension://efaidnbmnnnibpcajpcglclefindmkaj/viewer.html?pdfurl=https%3A%2F%2Fticaret.gov.tr%2Fdata%2F603918f113b876467cca2101%2FT%25C4%25B0CARET%2520BAKANLI%25%25%C20%IBAKANLI%25%25%C204%I 25B0YET%2520REPORT%252026.02.2021.pdf&clen=10180234&chunk=true Access Date: 01.01.2022

Tosun B., Şahin S., & Aslan G. (2021). Effects of Drug Smuggling on Turkish Economy and Evaluation of Turkey's Fighting Methods. *Accra Culture, Art and Literature Magazine. 25* (9). 103-129.

Minutes of the General Assembly of the Turkish Grand National Assembly, 24th Term, 3rd Legislative Year. (2021). https://www5.tbmm.gov.tr//develop/owa/Tutanak_B_SD.birlesim_baslangic?P4=21231&P5=H&page1=28&page2=28 Access Date: 01.01.2022.

Turkish Surgical Dictionary (2021). https://www.turkcerrahi.com/tip-sozlugu/narkotik/ Access Date: 01.01.2022.

The National Security Policies of the Republic of Turkey and the Development of Security Strategies Lecture Note. Department of Education, Ministry of Justice. (2021). http://edb.adalet.gov.tr/Resimler/SayfaDokuman/12520201430363-ULUSALG%C3%9CVENL%C4%B0Kxxx.pdf Access Date: 14.11.2021.

UN ODC. (2019). https://www.unodc.org/unodc/en/data-and-analysis/wdr2021_annex.html Access Date: 26.06.2022.

UNODC. (2021). https://www.unodc.org/unodc/en/data-and-analysis/wdr-2021_booklet-1.html Access Date: 01.01.2022.

Specialist N. (2016). The Issue of Syrian Refugees in Turkey's Border Security. *Journal of Education and Society in the 21st Century. 5* (15). 135-158.

Ünlü A., & Aksu G. (2018). A Contemporary Evaluation of Turkish Drug Control Policy. *Drugs : Education, Prevention and policy. 25* (2). 138-147.

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Occupational Health and Safety Practises in The Industry 4.0 Process[1]

Endüstri 4.0 Sürecinde İş Sağlığı ve Güvenliği Uygulamaları

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Abstract

Significant advances are experienced in the area of occupational health and safety (OHS) practices as a result of technological developments and emerging new technics in the Industry 4.0 Process. Innovative production methods, and factors such as advances in software and programming, simulation and augmented reality, internet of things, smart production systems, Big Data, cyber-physical systems, which are all along the fundamental elements of the Industry 4.0 process, bring new problems in the area of occupational health and safety. Based on this foresight, the latest developments, problems, challenges, and solutions in the field of OHS are being reviewed and evaluated in this study by utilising the previous literature.

Keywords: *Occupational Health and Safety, Work Accidents, Industry 4.0, Risk Analysis, Cobots.*

JEL codes: *J 89, J 28, D 81, L 16, L 69*

INTRODUCTION

The concept of the Industry 4.0 was first introduced in Germany in the year 2011 as a suggestion for the creation of a new economic policy concept based on high-tech strategies that could combine all elements in and around the production process towards a highly integrated value chain (MacDougall, 2014). The need for a production method that is environmentally friendly, resource-saving, as well as sustainable, and the increasing global demand of diversified consumer goods has accelerated the transition to the fourth stage of industrialization, which is being coined as the Industry 4.0 phenomenon (MESI, 2016). In this context, it has been emphasized that the aim of the Industry 4.0 is to advance production and service performance as to achieve autonomous and flexible output through higher levels of automation and digitalized systems (Lasi et al., 2014).

The Industry 4.0 system provides optimisation of business processes and product qualities as to achieve real-time controls over the input and output. In addition, the system in question can reduce production costs by minimizing energy consumption and stocks by accelerating production with the use of resource assets. Thus, the expansion of smart factories, as well as, smart products, which have a significant impact on global economies, is supported through digital technology-based systems that can be adjusted according to personal preferences (Badri et al., 2018).

From this point of view, besides its economically calculable and quantifiable features, the cost-effective development of the Industry 4.0 applications, its social, economic, and environmental consequences, and its impact on the future of business making and workforce, including OHS issues, have also been needed to be taken into consideration. This new industrial roadmap inevitably leads to a new organization of work and the implementation of different methods of performing work tasks that can ensure the OHS of workers. Indeed, automation technologies can make production more adaptable, healthier, energetic, safer, and more socially inclusive through the use of new production systems, robots, and sensors to support workers in shared tasks (Frey and Osborne, 2013). The way of the Industry 4.0 to create a more sustainable industrial value is on the one hand for the economic, environmental, and social sustainability, but, on the other hand, for the improvement of the OHS situation of all parties involved in the working life. When evaluated in this context, the OHS system in the Industry 4.0 process gains utmost importance in terms of work organization, legislative framework, OHS organisation, and management of occupational risks.

1. TECHNICAL FEATURES OF THE INDUSTRY 4.0 PRODUCTION SYSTEM

Industry 4.0 can be described as a production revolution where jobs that require unskilled labour are carried out by robots and skilled labour with high added value specializes in order to be more productive. In this respect, the Industry 4.0 system deeply affects the qualifications of the job, the identity of the employee and the employee-employer relations (Kurt, 2019).

Industry 4.0 develops great adaptability and superior standards in engineering, operative and logistics production practices (Lu, 2017: 7). The main characteristics of the Industry 4.0 are its digitisation and automation of business procedures based on automatic flow of data with help of the information technologies, internet of things and services, cyber-physical systems, and

cloud-formed data integration (Schmidt et al., 2015: 18). These multifaceted, active and real-time optimised networks assist enterprises in the integration of information at different hierarchical levels of a value creation modules (vertical integration), through intelligent cross-linking of data in-house (horizontal integration), as well as, by digitizing information throughout the product lifecycle (end-to-end engineering) (Stock and Seliger, 2016: 538).

In smart factories where the Industry 4.0 system is applied, products can be produced flexibly and efficiently, and less production errors occur by managing their complexity in a decentralised manner (Acatech, 2013). This autonomous system is realized thanks to production systems and production networks consisting of robots that can respond to different situations, and which are self-controlling, self-operating, data-based, sensor-equipped, spatially distributed and which have predictive modelling and execution systems (Roblek et al., 2013). As a result, personalised products with customer-specific features can be produced profitably within this model (Ferrera et al., 2017: 627). Intelligent products and devices, which are part of the Industry 4.0 system, are intended to offer instantaneous communication between machines, production resources and people, to create a basis for the implementation of new production processes and semi-autonomous control of individual stages of production (Tupa et al., 2017: 1226). The information of this system, which has a feedback loop communication, can dynamically affect the real-time design of business processes by self-optimisation (Schlechtendahl, 2015: 146).

2. OCCUPATIONAL HEALTH AND SAFETY IN THE INDUSTRY 4.0 PROCESS

With the First Industrial Revolution, OHS measures and management systems have developed rapidly along with emerging and changing production methods. In its most general definition and within the scope of World Health Organisation (WHO) and International Labour Organisation (ILO) principles; OHS is to maximize the physical, mental, and social safety and welfare of all employees, regardless of their working style in the workplace, to protect continuity of this situation and to create working environments that protect workplace conditions, the environment, the goods and services produced, and the mental and physical health of employees. (Bingöl, 2014: 584). The right to OHS is expressed as the demand of employees to make their workplaces suitable for OHS conditions (Süzek, 2019: 864). In order for the OHS system to work as an effective system, it is utmost important to ensure participation of the primary social partners as workers, employers, and the state. These partners have responsibilities in forming protective (re-active) and preventive (pro-active) policies regarding OHS, ensuring the creation of an OHS culture, effective and efficient evaluation of notification, education and audit results, realization of theoretical and practical training, and enforcement of legal rules and sanctions. (Bilir and Yıldız, 2013: 8 -10). In this context, OHS, in a broad sense, can be considered as the studies aimed at revealing, eliminating, or reducing the dangers and risk factors that are affecting the wellbeing of employees, employees of subcontractors and temporary employers, visitors of the workplace, customers, and the people living in and around the production area (Kılkış, 2022: 5-6; Kabakçı, 2009: 82). Especially in the current age, working in a job has become statistically three and a half times more dangerous than wars. In addition, although many innovations have emerged with the Industry 4.0 process, new problems also arise within the framework of human-machine interaction.

The Fourth Industrial Revolution enables the digitization of production by providing full automation to enterprises by implementing self-controlled, IT-based, and sensor-equipped equipment and machines that improves production through automatic optimisation and autonomous decision-making (Rüßmann et al., 2018). Within this system, the fundamental features of business organisation are changing, and workers are starting to play a key role in the knowledge-centred production model, containing decentralised decision-making and continuous assessment of the quality of productive processes (Sanders et al., 2016: 17). This means that in this process employees have the opportunity to work more autonomously and develop themselves by qualitatively enriching their jobs by participating in higher value-added activities and reducing routine tasks (ERPS, 2015). More importantly, as greater organisational complication is inherent in the Industry 4.0 system, this process requires more flexible work environments that can offer employees greater adaptability to their job necessities in their personal lives, to establish a work-life balance and continuing their professional development processes.

In addition, the flow of information in the production contours is expected to make business management better organised and more transparent. Thus, the Industry 4.0 process can transform the work into a safer and healthier situation through hierarchical pressure on the workforce, smart security technologies and nonstop risk analysis based on virtual engineering (Lira and Borsato, 2016: 888). Wearable technologies (i.e., sensor-embedded helmets, wrist bands, digital watches) and tracking technologies are helping employees keep their safety in hazardous working environments where they might have exposed to extended OHS risk such as extreme heat, harmful objects, toxic gases, and chemical contaminants. This system enables it to continuously monitor the health condition of the employee (i.e., risk of heart attack, changes in blood pressure, sudden abnormalities such as falls or changes in stress level), as well as the state of machinery, equipment, and the enterprise (EU-OSHA, 2017). Such technologies can provide real-time alerts that preventive measures must be taken, can be designed to monitor workers, can be used to stop the work in a dangerous behaviour, can help to apply activate safety procedures, can be used to involve in preventing injuries and accidents, and can be utilised for enabling an injured worker to get help (Malinovski et al., 2015).

In addition, robots which are self-aware and self-learning, and which are equipped with an advanced analysis system, can predict dangerous circumstances during the execution of work and use different OHS management algorithms to anticipate unwanted situations. In this process these machines would be interpreting the data obtained as a result of technological monitoring and would decide on choosing the most appropriate action with the help of AI. Thus, the risk of accidents, illness, or occupational disease of workers in the production area and outside the production area are prevented more greatly with the Industry 4.0 advances (Lee et al., 2014: 5).

Industry 4.0 system's technological capabilities, together with cognitive analytics, can increase their abilities by supporting the safety and well-being of employees (Murashov et al., 2016: 66). Industry 4.0 process is benefiting from robotic power, aiming to create functional industrial robots for complex tasks such as assembly, cleaning, welding, painting, and disassembly activities that will be improved with durability and precision (ISO, 2011). In this manner, by increasing the amount and quality of the output, employees can be protected from

health situations such as traumatic or fatal injuries, musculoskeletal disorders, occupational diseases, as well as product and service expenses can be lessened (Huen et al., 2015). In addition, the wellbeing of employees can be protected by using specialised machines and robots instead of humans, for example, during dangerous operations in disaster areas (NIOSH, 2014). Such robots usually interact one-way with the human operator controlling the robot, which feedbacks information about the environment and the execution (Thrun, 2004: 12). Collaborative robots (*henceforth* cobots) have been established to co-operate directly with human employees who are equipped with performance-enhancing robotic devices, as those we see in car manufacturing and automobile waterproofing enterprises. In such a interdependent human-robot association, human handiness, agility, and problem-solving skills to be extended with robotic features (Vasic and Billard, 2013: 200). In addition, robotic exoskeletons that can be dressed on the human body can perform the role of support, while performing the tasks of workers such as lifting weights, thus, potentially increasing the stamina of human workers. They have also been developed to reduce adverse health effects and the possibility of injury, while simultaneously increasing productivity and employee well-being. (Leso et al., 2018: 330). Therefore, these tools can provide a more flexible and socially inclusive work environment for employees with age, gender, and cultural differences, as well as for workers who are injured while the course of work (Reinert, 2016: 391).

3. PROBLEMS OF OCCUPATIONAL HEALTH AND SAFETY IN THE INDUSTRY 4.0 PROCESS

On the other hand, the Industry 4.0 process can be a source of OHS risk for employees from many aspects. First of all, psychological risks caused by mental overload and workload caused by more flexible and dynamic production activities can lead to more negative phycological consequences for employees than physical risks in the workplace. In monitoring equipment working with automated systems, in dispersed decision-making, as well as in end-to-end engineering practices, employees need to be able to act more ergonomically on their own initiative and are required to have outstanding interaction abilities (Thoben et al., 2014: 2), which, as a direct result, may cause additional OHS risks.

In the Industry 4.0 process, skilled workers are more needed than unskilled workers, as workers will need to use, manage, and intervene when necessary. Older workers also face the risk of unemployment as lifelong learning becomes a prerequisite for employability due to industrial automation for semi-skilled workers as a result of the potential difficulties of working in complex tasks (Acatech, 2013). In addition, the usage of digital surveillance apparatus to uninterruptedly screen the worker's behaviour, routine, performance and productivity can create an environment of uncertainty, violation of personal privacy, as well as, psychological pressure in the workplace for the continuation of existing occupations. Moreover, advanced technology can weaken relationships between common employees and executive and managerial level employees. This situation can create the ambiguous workplace environment by increasing the work-related stress of the employees and causing the health of the employees to deteriorate in the long term (EU-OSHA, 2017). As the larger flexibility and virtual accessibility enables employees to work in distance from anywhere at any time, the individual's work-life balance can potentially be disrupted as to be against the employee's own interests (Ben-Ner and Urtasun, 2013: 230). As another point, the innovative technologies that make up the cobots possibly might lead to a novel type of accident risk due to the lack of standards on correct usage. Automatic devices can create electromagnetic, mechanical, and thermal OHS risks alongside the hazard sources of radiation, noise, vibration, and chemical

exposures (ISO, 2011). Manufacturing errors caused by engineering, human errors or incorrect programming of peripheral equipment and interface errors can cause injury to those working around robots (Vasic and Billard, 2013: 200). Finally, with augmented reality technologies operating in workplaces, employees may experience increased tension when they experience a mismatch between the virtual world and the real world (Lorenz et al., 2015). Due to the gradual automation of work processes, when employees feel that their profession and expertise are insufficient, and also when they work excessively, there may be decreases in their individual creativity and productivity and this might lead to additional OHS risks.

In this context, research on the properties of the Industry 4.0 process over OHS have revealed some important results. IT innovations, internet of things, cyber-physical systems, Big Data, AI, simulation, and collaborative robotic technologies, which are defined as the elements or technological categories of the Industry 4.0 process, are increasingly being used by a wide variety of smart personal protective devices. The use of such smart devices changes the way the workers work and making production processes more complex. As a solution to emerging these new problems, a more dynamic OHS management system based on a more personalised and vigorous risk management paradigm is proposed in different research (Podgórski et al., 2017: 11).

In an environment where advanced production procedures might create new OHS risks, but systems that perform traditional risk analysis are insufficient to identify emerging risks, the application of new risk analysis models that can monitor both traditional and emerging OHS risks seems to be an effective solution (Fernández and Pérez, 2008, 2015). Meanwhile, it has been seen that enterprises can adapt to the changing environmental conditions of industrial systems by benefiting from cyber-physical systems, and thanks to the autonomous decision- making process. In industrial process automation, it is emphasized that a cyber-physical system should be defined in advanced standards such as IEC 61508 in order to better adapt to these restrictions, taking into account the security limitations that reduce the technical risks to an acceptable level (Kuschnerus et al., 2015: 431). Upon this background, emphasizing the importance of creating safety-aware robots/cobots that can detect actions that may cause injury or threaten employee's safety and to support difficult and dangerous tasks, it has been argued that for safe and effective interaction with humans, such robots should be equipped with complex codes-of-conduct, policies and software that allow human workers to understand their intentions (Beetz et al., 2015: 6530).

It has been seen that wireless communication has an important role in improving working conditions, and well-designed and properly integrated wireless sensor networks with technological support avoid accidents in self-directed and smart manufacturing systems (Palazon et al., 2013: 546). In the same vein, it is argued that information technologies and wireless communication will be able to detect workplace hazards continuously. For ensuring the consistency of such systems, common technological platforms that can monitor the operation and efficiency of all networks and remotely control and connect sensors are required to be put into practice. It has been suggested that such platforms can also reduce occupational risks by facilitating the integration of effective surveillance practices (Gisbert et al., 2014: 240). It is also rightfully being stated that it is not possible today to detect new OHS risks that may arise due to innovative production methods with traditional risk analysis techniques (Fernández and Perez, 2015).

A well-attended survey on the OHS system reveals that businesses cannot be considered as fully

prepared for the implementation of the Industry 4.0. Only 20% of the respondents evaluated themselves as equipped and ready for the full implementation of new production models. It has been observed that the level of preparedness for the uncertainty of the boundaries between industries is 17%, and the level of readiness for the integration of smart and autonomous technologies is 15%. It has been determined that only 22% of manufacturers understand how new technologies change their workforce and organizational structure, and again 22% are aware of the impact over the output based on new technologies are presented by them. Only 16% of manufacturers knew how to integrate their solutions with external infrastructure, while only 8% claimed they had concrete business foundations for the implementation of new technologies (Deloitte, 2018). In the period of insufficient preparation and transition for profiting from these new technologies, it is predicted that the deterioration in work quality, injuries, accidents, and other human errors may increase, as a side error (Kagermann et al., 2013).

Due to the content of the job (i.e., diversity, complexity, skills, uncertainty, exposure), the organization of the work (such as team planning, overtime, fast orders), the management styles (i.e., tasks, communication, roles, relationship, problem solving) and other organizational factors (i.e., promotions, wage increases, OHS, social value of work), which all important in the Industry 4.0 Production Systems, may interact as to have important consequences and these interactions may increase psychosocial risks over the workforce in particular. This situation has also revealed the fact that the prevention of psychosocial risks in terms of OHS legislation and management systems is considered quite challenging (Leso et al., 2018). It is emphasized that employees who monitor smart machines and robots or participate in decentralized decision-making and complex engineering projects are required to act more on their own, to have perfect information and digital skills, and to take utmost responsibility by organising their own way of doing the work (Kagermann et al., 2013).

Unfortunately, many research findings indicate an acute scarcity of qualified personnel and extremely short levels of digital culture accumulation, particularly among the elderly sections of the workforce, migrants and disabled workers (Lorenz et al., 2015). Therefore, employees will have to be more flexible and adopt lifelong learning in order to collaborate more effectively in this new economic model (Moniri et al., 2016: 240). This situation has the potential to lead to a decrease in the qualified workforce, and, as a result, increase in excessive fatigue, absenteeism due to illness, and number of accidents. Information and communication technologies (ICT), which is becoming increasingly important in the Industry 4.0 system, increases both the qualification gap in the general workforce and specifically the qualification gap between youth who have newly gained their qualifications and senior employees (Moniri et al., 2017: 239). Due to the decreasing share of blue-collar workers and the growing share of intellectual work in the production process, low-wage workers without additional training and abilities will be at risk of losing their jobs at an immense scale (Wrobel-Lachowska et al., 2018: 605).

As an important argument, technologies that monitor employee health is expected to increase several concerns, and this is often seen as a violation of individual's privacy and protection of personal data, which is experienced as a source of stress for employees (Kagermann et al., 2013). More widespread use of technologies that monitor employee health, if used appropriately and legally, should ensure a more accurate evaluation of employee data.

The fact that the AI lacks contextual self-awareness so far, which is preventing it from understanding reality, is seen as the most serious limitation on machine learning (Szulevski,

2018: 635). Innovative technologies reveal new hazards of mechanical, electrical, thermal and chemical origin. In addition, new accidents may occur due to disproportionate guidelines and standards regarding their proper design and implementation. However, the rapid inadequacy of technological solutions hinders the development of new standards. In this context, regulatory frameworks and standards fall short of protecting all employees from the OHS costs of implementing new technological production systems based on autonomous, intelligent, interconnected machines (Jones, 2017). In addition, the rapid increase in the number of devices with internet connection, widespread data processing over the net has the potential to increase the threat of cyber-attacks that may pose extra risks to the safety and health of employees (Pontarollo, 2016: 377).

It has been argued that in the transition phase to the Industry 4.0 system, there may be inadequacy of OHS systems, including OHS standards and other regulations, and this may also lead to the loss of the proactive approach in the OHS systems which already established in industrialized countries.

In the context of Industry 4.0, some basic suggestions have been made to maintain or improve the OHS level in production (Kagermann, 2013, Rojko, 2017: 80, Badri et al., 2018: 409-410). Accordingly, these proposed solutions existing in the literature can be summarised as follows:

1) In order to advance the incorporation of human action and intelligent solutions, the engineering and arrangements of intelligent machines should focus on human physical, social, mental, and cognitive abilities.

2) Further studies should be conducted on the psychosocial risks posed by new work organization models.

3) Research on cobots should be continued as to provide a higher safety net and increase the physiological and intellectual ability of the employee.

4) Novel global standards are required to be developed, or existing standards to be revised as to aim more precisely to guard employees against the threats originating from new technologies.

5) Collaboration with trade unions should be made on the possibility of application of technologies for continuous supervision of worker welfare and performance, such as employing robots instead of humans and using AI technologies.

6) A socio-technical approach in the implementation of Industry 4.0 solutions needs to be adopted. It should be ensured that technological innovation, business organization models and professional development are coordinated in accordance with economic and social conditions.

7) Applicable augmented reality techniques should be used in the prototype validation phase through simulation technics in order to disseminate a proactive approach to safety risk assessment which is already in the design phase or in the early stages of implementing Industry 4.0 innovation.

8) More research should be done to make personal protective equipment devices more effective, using smart technologies and to create innovative devices for continuous monitoring of employees' well-being.

9) OHS safety experts and occupational physicians are to be ensured of reaching to opportunities for continuing professional development and training as to adapt emerging new technics to their profession.

10) Lifelong learning and continuing professional development should be encouraged for all employees, especially towards emerging the new abilities.

11) Employees should be provided with the use of virtual reality and augmented reality tools during their OHS training.

12) Good practice platforms should be established that showcase examples of integrating OHS into production within the context of Industry 4.0.

13) Protection against illegal access to corporate secrets, business data and cyber threats should be offered principally via systems (data encryption) and corporate security architecture.

4. POLICIES ON OCCUPATIONAL HEALTH AND SAFETY PRACTICES IN THE INDUSTRY 4.0 PROCESS

Policies that are being offered to be implemented within the scope of OHS in the Industry 4.0 process are outlined below:

4.1. Making Plans for the New Business Organization

The complexity of the Industry 4.0 production systems is continuously increasing (Waschneck et al., 2017, Block et al., 2015: 658). This complexity causes problems especially in terms of the content of the job, the possibility of employees being exposed to risks, the organisational structure of the workplace, the working hours, the management and production systems and the personnel transactions (Leka and Jain, 2010: 136). Engineers and designers of advanced manufacturing systems frequently oversee such risks, which can become a significant risk to manage in this process. In particular, the definition and monitoring of psycho-social risks has already become a main test in terms of OHS management systems (Sanders et al., 2016: 817).

Another important issue facing businesses that implement Industry 4.0 processes is to recruit new employees who are better prepared to train and learn from existing employees (Lorenz et al., 2015, EU Commission, 2013: 117). To be able to work efficiently in the Industry 4.0 system through employees with newer skills, employees need to obtain a variety of specific skills and combine their expertise in traditional tasks with computing skills (Lorenz et al., 2015, EU Commission, 2013: 117). Effectively adapted planning and organizational models offer new solutions for the management of this increasing complexity (Waschneck et al., 2017; Kress et al., 2016: 21; Toro et al., 2015: 365).

The basis of Industry 4.0 is to reveal the most appropriate forms of sharing tasks within the framework of increased interfacing and cooperation between humans and machines (Christiernin and Augustsson, 2016: 311). Thus, to evade generating unanticipated hazards in the production environment, tasks need to be planned more carefully, and each employee's job descriptions and work-related limitations need to be precisely clarified and defined.

4.2. Failure of Existing Regulations to Guide New Practices

All regulations regarding OHS are aiming to support the successful implementation of safety and health management in the workplace (MacEachen et al., 2016: 6). Several of the measures implemented are aiming to force businesses to assess risks, apply standardised business procedures, and deliver guidance that reduces the frequency of work accidents and occupational diseases (Badri et al., 2018: 406).

From a legal point of view, an audit system based on various judicial or administrative

penalties or court processes comes into play if the employer does not comply with its OHS obligations. However, the legislation does not regulate mechanisms to eliminate the source of threats to OHS practices and management systems originating from the Industry 4.0 systems. In addition, standard procedures are insufficient in terms of reducing new risks. The current regulations do not contain any framework or guidance on how the OHS system will be integrated into operations for above mentioned new risks (Jones, 2017). Despite the swift progress of the technologies used in smart production, it is seen that the current old-school OHS legislation will be implemented as it is regulated in the coming years and classical problems will continue.

4.3. Necessity of Redesigning Occupational Health and Safety Management Systems

A number of OHS management systems such as OHSAS 18001, CSAZ 1000-06, Z1002-12 have been developed to guide practices in working life. The main source of these systems is primarily related to the concept of management of total quality. This model established a general guideline for the management of accident and disease prevention, education, emergencies, and regulatory requirements regarding the work. By definition, these systems founded on the continuous upgrading model should be arranged more flexibly and be more suitable to catch up with the deviations brought by the Industry 4.0 system (Badri et al., 2018: 408).

Experience shows that OHS integration can increase productivity and reduce costs (Van Holland et al., 2015: 399). It has also been proven that there is a positive correlation between productivity and the better implementation of OHS measures. Increasing the efficiency of the industrial system, which is the goal of the Industry 4.0, does not seem to be in any essential contradiction with the implementation or maintenance of OHS management systems. OHS management systems, which will be developed in accordance with the Industry 4.0 processes, will help manufacturers to seamlessly implement autonomous and smart systems in their workplaces. This will help remove faults in prioritising risks and barriers to regulating preventive action in new management and production systems. In addition, it is claimed that the agile nature of these systems comes to the fore in order to make OHS management systems adjustable to progressively multifaceted, flexible, and autonomous industrial processes (Mızrak, 2020: 237-238).

4.4. The Necessity of Reorganizing Occupational Risk Management

OHS risk management, which includes identification, analysis, and evaluation stages, is used as a decision-making tool to improve the determinatio of risks that may have an impact on currently implemented workplace objectives and controls (Badri et al., 2012: 193). Process errors appear to be eliminated as new controllers, online data analysis, and the Internet of Things continue to make machines and industrial systems increasingly autonomous (Yaqiong and Danping, 2017: 750). With the comprehensive and full automated factories, it becomes possible to reduce both OHS risks and deficiencies in the value chain (ABB, 2014; Lira and Borsato, 2016: 888). Costs and errors can be reduced as a result of evaluating the processes more accurately with the simulation method before the production system is established. In case the production can be adjusted to meet the actual demand rather than the anticipated demand; work-related stress, occupational injuries, work accidents and occupational diseases are expected to be reduced (Shibin et al., 2016: 2876).

In the Industry 4.0 process, overcoming the difficulties in the correct definition of risk factors and maintaining the presence and participation of OHS safety specialists and workplace physicians, who will take part in production less and less, becomes one of the most controversial issues. However, with the concept of real-time risk management, identifying many potential risks and reducing risks will become very effective in dynamic industrial environments (Podgórski et al., 2017: 11).

5. RISK ASSESSMENT IN THE INDUSTRY 4.0 PROCESS

In the Industry 4.0 process, risk assessment focuses on recognising operative risks related to all stages of the production, from management of data to maintenance of information flow, from operation methods to tools used, quality and suitability of materials, human errors, machinery, and technologies of production (Tupa et al., 2017: 1225). This will result in a system in which OHS risk assessment and management procedures will change, and risk information becomes more important as to be continually evaluated and improved. Therefore, it is recommended to adopt a preventive risk management approach to ensure the supportable development of innovations of the Industry 4.0 system (Badri et al., 2018: 406).

In this perspective, one of the most appropriate ways to prevent and control occupational risks, injuries, diseases, and fatalities in emerging technologies is to design or minimize hazards and risks at the design or implementation stages (NIOSH, 2014). In these development stages, it is necessary for employers, employees, stakeholders and relevant occupational safety experts, occupational physicians, and other health personnel to focus on the characteristics of beneficial applications of Industry 4.0 and their possible effects on employment and occupational safety within the scope of a common action plan. This method will enable the active participation of employees in the risk assessment process and the effective adoption of practical protective systems (Niesen et al., 2016).

From an organisational point of view, considering that this new approach takes into account the diverse characteristics of workers (skilled or unskilled, technical, or academic qualifications, age differences, education levels, life experience or cultural background), the employees are more likely to be assigned tasks appropriate to their skills and capacity. Employees with managerial and supervisory duties need to be supported with broad-based training and work organization models that support lifelong learning and continual professional development (Zhou et al., 2015).

The Industry 4.0 process has both positive and negative effects on employees in terms of OHS. Thanks to the elements of the Industry 4.0, occupational diseases caused by physical labour use and repetitive actions can be reduced. With wearable devices and AI supported workplace applications, the mental and physical condition of the employee can be monitored and the easier adaptation of the employee to the workplace environment can be achieved. Digital systems can call back operators by voice or other data to establish a code of conduct and terminate their operations when employees engage in non-standard and insecure activities. This reduces physical workload factors, among others, such as manual lifting and carrying, repetitive work, working with screen equipment, and difficult or static working positions, but more skilled workers are needed to produce these designs. Studies evaluating the effects of Industry 4.0 on the production or in office environments have revealed that advanced technology complements the skilled workforce (Pavon et al., 2018: 448).

It is emphasized that technological changes based on skills cause structural changes in

employment and new threats in terms of OHS as the demand for these skills increases. The use of digital tools to monitor the behaviour, productivity and performance of employees can create an environment of psychological pressure, with the emergence of issues related to employee privacy and the feeling that employees are constantly being watched (Ben-Ner et al., 2013: 240). This situation can also increase conflicts among employees by increasing work-related stress and causing negative health effects in the long run (EU-OSHA, 2017).

The most positive effects of the Industry 4.0 process on production are the reduction of quality problems and repetitive actions of employees. On the other hand, the most negative aspect of the Industry 4.0 system is that it causes new OHS problems. Some of these problems are eye-related disorders, mental fatigue, disorders caused by static working position, exposure to unknown dangerous particles as a result of cooperation with robots, and psychological pressure arising from problems of adaptation to tasks that require creativity (Adem et al., 2020).

Another challenge faced by enterprises implementing the Industry 4.0 system is that more careful planning of activities has become necessary to prevent the development of undesirable hazards in the production process. In this case, in extremely complex production environments, the idea of real-time risk management often becomes valid (Podgorski et al., 2017: 11). The use of AI-based applications in the workplace can play an important role by encouraging effective decision-making processes and reducing the risks that will arise due to the complexity of the new work environment (Percy, 2017).

While Industry 4.0 production transformations, which are rapidly and globally spreading, can provide the labour with a wide range of advanced digital tools and practical solutions to support their tasks, they can also lead to new OHS risks that can affect almost all economic sectors. This requires a proactive approach to risk assessment in the design or early stage of investment and the adoption of appropriate management strategies for employee protection (Schulte et al., 2010: 7).

6. OPPORTUNITIES AND BENEFITS FOR OCCUPATIONAL HEALTH AND SAFETY IN THE INDUSTRY 4.0 PROCESS

Due to the production style in dark factories, employees increasingly have to monitor digital systems and equipment, integrate into the decentralized decision-making process, and also participate in engineering activities as a part of end-to-end engineering (Stock and Seliger, 2016: 538). This integration enables employees to participate in more value-added activities and to have opportunities to improve themselves by leaving routine tasks (Kagermann et al., 2013).

The blurring of workplace boundaries, the increasing flexibility of working hours, and the rapid spread of distant/ remote work, especially with the COVID-19 Pandemic Period, have been evaluated differently in the literature. Many researchers underline that increased working time flexibility is expected to tolerate the worker to establish a greater work-life balance. (Mas-Machuca et al., 2016; Aybas, 2021: 246). The transformed and diversified work environment allows employees to organize their own working hours. The fact that the Industry 4.0 system includes elements such as smart security technologies, virtual engineering, Big Data, and the internet of things can make employees safer and healthier through continuous risk analysis and management policies in the workplaces (ABB Group, 2014). Accidents and occupational diseases can be prevented in autonomous and smart industrial environments with wireless

sensor networks and via properly designed and integrated technical support (Palazon et al., 2013: 545). Machines equipped with technical tools to monitor all parameters that have any impact on the process are better suited to respond appropriately as soon as any dysfunction occurs (Mattson et al., 2016: 232).

Newer systems might be also capable of sending information to companies' headquarters, which will increasingly monitor themselves and their environment and determine whether further intervention is needed. In order to ensure the reliability of these systems, it is necessary to establish common technological platforms that can monitor the operation and performance of all networks and connect sensors to remote control centres (Gisbert et al., 2014: 240). These platforms might be able to reduce occupational risks by facilitating the integration of general surveillance practices, which will be complemented by appropriate risk management.

In addition, a new risk management system called a smart work environment in terms of OHS can be implemented by using new technologies and solutions developed for the needs of safety-related workspaces (Graetz et al., 2015). This approach, which is based on the spread of smart workplace management, is based on new technologies and solutions where some tasks related to OHS are determined. These tasks can be summarised as monitoring the health of the employee, oversight of the machinery and technologies, scrutinising personal protective equipment in the working environment, warning the employees, and facilitating a timely information flow regarding the OHS implementation.

In addition, decision-making systems and virtual 3D simulations have an important place in the risk management hierarchy in terms of fulfilling these enlisted tasks. This approach, based on organizational risk management, enables real-time solutions to changes in work environment factors and final analysis of risk assessment for individual employee profiles, including psychosocial risk factors, work environment factors in the workplace, and their position in relation to machines (including robots and cobots) (Graets and Michaels, 2015).

It has been revealed that the production of a wide variety of personal protective devices using smart technologies can help employees stay safe in extremely dangerous workplace environments where they may be exposed to excessive noise, heat, toxic gases, chemicals, and harmful elements (Wang et al., 2016: 10). Similarly, technologies that monitor the health of workers (i.e., heart rate, emotions, activity, temperature) may satisfy the need for preventive measures designed to stop dangerous behaviours, update safety procedures, prevent accidents and injuries, and to enable an injured worker to get help as soon as possible (Mattson et al., 2016: 524).

Over top of all these, machines that are self-learning and configuring, capable of programming with advanced analysis capabilities, compatible with sensors and cameras will be able to predict potential workplace hazards and manage unexpected conditions that will facilitate the prevention of accidents that employees are exposed to (Kagerman et al., 2013: 23). In this proactive approach, the main aim is to prevent undesired events before they occur. With the emergence of Industry 4.0 systems, more and more industrial robots are used in digital factories, which replace humans, especially in performing tasks that are dangerous, that have high musculoskeletal load and that are requiring excessive physical strength (Beetz et al., 2015:6530). With the development of machines with AI, thanks to special sensors and control methods, cobots autonomously and actively increase awareness of their environment and analyse activities to eliminate atypical situations. This way of working becomes indispensable

especially for the safe interaction of cobots with humans. In this way, productivity and product quality can be increased, while occupational health complaints and diseases, injuries and accidents can be prevented (Chiabert et al., 2018: 22).

According to the German Federal Institute for OHS, musculoskeletal injuries are the cause of 23% of sick leave days in Germany, causing an estimated 17 Billion Euros in production loss per year. The situation is almost the same for any other European country. These problems mainly occur in work that requires lifting and carrying and cause muscle, ligament, bone, and cartilage damage. In some cases, common static aids such as forklifts and lifting devices may not be available or not flexible enough. In the event of such OHS risks, it is beneficial to design mechanical exoskeletons that can be worn on the human body to reduce the stress/compression force on the back, shoulders, elbows, and wrists, to protect against injuries in the musculoskeletal system of the human employees (Bogue, 2015: 7). The design of exoskeletons is based on micromechanical elements and an ultra-light ergonomic system. In the future, this exoskeleton models are expected to be strengthened with a sensory data transmission system. This will enable machine learning and AI to be introduced to the exoskeleton controller (Szulevski, 2108: 633). Therefore, these devices will be able to provide safer and more ergonomic working conditions for an increasingly diverse workforce in terms of age, gender, cultural background, and level of fitness. (Reinert, 2016: 390 29).

CONCLUSION

This research analyses the emerging OHS risks within the Industry 4.0 Process. In the context of the Industry 4.0, as new OHS risks and opportunities has emerged, it has become necessary to take various measures to improve OHS policies. Extensive further research should be conducted specifically on the psychosocial risks associated with the consequences on the work organization, focusing on occupational risks and work accidents at all levels of production, designing the enterprises and workplace, and utilising from information technologies. There is a need to develop new standards or update existing standards to adapt OHS systems to the Industry 4.0 Process and improve the use of new technologies. All relevant tunable physical and cognitive factors must be taken into account when allocating tasks between human workers and automation systems and smart devices such as cobots. Employee expertise and motivation is required to be strengthened to foster secure collaboration between the human workforce and cobots and to make new technologies safer for the humans in the working environment. Future OHS integration systems should be combined with virtual task analysis, dynamic assessment of occupational risks, cognitive analysis of workload, and skills management tools. Adaptive interfaces and emotion sensors should be developed to monitor employees and ensure their safety continuously. It is a necessity to analyse extensively overlapping and emerging risks of the Industry 4.0 over the OHS systems in terms of modelling human behaviour, intentions, reactions to stress, difficulty, and uncertainty. It has become imperative to constantly renew the OHS systems against unauthorized access to the recorded data and information in a production system, as well as against cyber-attacks. Since these technologies that drive the Industry 4.0 are developed in laboratories and smart factories, human-machine harmony should be at the forefront in this challenging mission.

While the trend of continuous and globally pervasive transformations of the Industry 4.0 can provide solutions to support to the workforce in terms of advanced digital infrastructure, it can also lead to new and additional occupational health and safety risks. This requires a proactive

approach to risk assessment in the design or development of innovative practices and necessitates adoption of appropriate management strategies to protect employees in this new process. The impact of Industry 4.0 on the occupational health and safety management system, especially the risk assessment that is carried out by occupational physicians, should focus on identifying new risks occurring at all stages of the production process such as data management, maintenance, operation methods, tools used, materials, human errors, machines, and production technologies. This policy also means that risk assessment processes and management procedures will change, and risk information will become more important in terms of occupational health and safety. In addition, this has to be noted that it is very challenging task to implement these policies in an evolving flexible factory system.

At this stage, a precautionary risk management approach should be adopted to ensure the sustainable development of Industry 4.0 innovations. In this perspective, one of the most appropriate ways to prevent and control occupational risks, injuries, diseases, and deaths in emerging technologies is to "design" or minimize hazards and risks at the design process or during the implementation stages. In these development stages, employers, employees, stakeholders and all relevant occupational health and safety professionals should focus on identifying the characteristics of their applications developed within the scope of Industry 4.0 and their probable effects over work practices, employment, and occupational safety.

From an organizational perspective, job design should take into account the different characteristics of employees (unskilled and skilled, technical qualifications, age differences, education, life experience or cultural background). Employees who have the authority to make policy and oversee the system need to be supported by broad-based training and work organization models are to be based upon lifelong learning and continuous professional development. In the context of rapid technological changes, an employee-centred approach can be implemented in smart factories by applying appropriate training strategies.

In this context, more research is required to evaluate the comparative effectiveness of distance education and vocational education within the context of Industry 4.0. As an example, virtual reality applications can help to identify potential work accidents virtually, and workers can be trained using this technology. Targeted seminars aiming for such innovative applications make it possible to share existing knowledge and experience so that Industry 4.0 can be applied correctly. In addition, special training should be given rather than general training on occupational health and safety, especially before starting work or after a change in the workplace, work task, work equipment or equipment devices, and when new technologies are adopted. It will also be a challenge to encourage the implementation of preventive policies to protect the safety and health of workers, as automation technologies will support new forms of employment such as on-demand work.

In this regard, occupational health and safety professionals should be encouraged to take a proactive approach when creating risk profiles that may arise during the industry 4.0 process and developing international standards designed to protect workers from all potential risks. Workplace safety standards should be defined in relation to machine maintenance, operation and interaction between humans and robots. In addition, companies, stakeholders, and employees should evaluate the global applicability of these preventive and protective measures.

Last of all, policies for designing Industry 4.0 processes and operational working environments should come to the agenda. Regarding the ethical impact of Industry 4.0, a socio-technical approach should be adopted so that technological innovations, work organization models and continuous professional development can offer solutions in close connection with economic and social conditions. It should be ensured that these new developments achieve a realistic work-life balance in the whole production process, where a more flexible production, labour-oriented and unemployment-reducing organizational design, worker rights and educational opportunities are taken into account simultaneously.

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REFERENCES

ABB Group. (2014). Connecting the world – Industry 4.0. URL: http://new.abb.com/docs/librariesprovider20/Contact-magazine/contact_middle-east-industry-4-0-dec2014.pdf, Access Dated: 04.12.2018.

Acatech – National Academy of Science and Engineering. (2013). Securing The Future of German Manufacturing Industry Recommendations For Implementing The Strategic Initiative Industrie 4.0. Final Report of The Industrie 4.0 Working Group. URL: http://www.acatech.de/fileadmin/user_upload/Baumstruktur_nach_Website/Acatech/root/de/Material_fuer_Sonderseiten/Industrie_4.0/Final_report___Industrie_4.0_accessible.pdf, Access Dated: 25.02.2018

Adem, A., Çakıt, E., & Dağdeviren, M. (2020). An Investigation of The New Occupational Risks Posed by Industry 4.0. URL: https://www.researchgate.net/publication/340966752_Occupational_health_and_safety_risk_assessment_in_the_domain_of_Industry_4.0, Access Dated::15.04.2021.

Ahmar, M. (2017). AI Can Play a Big Role In Smarter Decision Making. URL: https ://www.cxoto day.com/story /ai-can-play-a-big-role-insmart er-decis ion-making/. Access dated:10.07.2019.

Aybas, M. (2021). Covid-19'un Çalışma Psikolojisi Üzerindeki Etkileri, Abdülhalim Çelik (Ed.) Covid-19 Sürecinde Türkiye'de Sosyal Politika Içinde (243-258). Ankara : Orion Kitabevi.

Badri, A., Gbodossou, A., & Nadeau, S. (2012). Occupational health and safety risks: Towards the integration into project management. *Safety Science*, 50 (2), 190-198.

Badri, A., Boudreau-Trudel B., & Souissi, A. S. (2018). Occupational health and safety in the industry 4.0 era: A cause for major concern?. *Safety Science*, 109, 403–411.

Beetz, M., Bartels, G., AlbuSchaffer, A., BalintBenczedi, F., Belder, R., Bebler, D., Haddadin, S., Maldonado, A., Mansfeld, N., Wiedemeyer, T., Weitschat, R., & Worch, J. H. (2015). Robotic agents capable of natural and safe physical interaction with human co-workers. *IEEE International Conference on Intelligent Robots and Systems*, 6528-6535.

Ben-Ner, A., & Urtasun, A. (2013). Computerization And Skill Bifurcation: The Role Of Task Complexity In Creating Skill Gains And Losses, *ILR Review*, 66 (1), 225–267.

Bilir, A. & Yıldız. A. N. (2013). *İş Sağlığı ve Güvenliği*. Ankara: Hacettepe Üniversitesi Yayınları

Bingöl, D. (2014). *İnsan Kaynakları Yönetimi*. İstanbul: Beta Yayınları

Block, C., Freith, S., Kreggenfeld, N., Morlock, F., Prinz, Ch., Kreimeier, D., & Kuhlenkötter, B. (2015). Industry 4.0 As A Socio-Technical Aarea of Tension - Holistic View Of Technology, Organization And Personnel. *Zeitschrift fuer Wirtschaftlichen Fabrikbetrieb*, 110 (10), 657-660.

Bogue, R. (2015). Robotic exoskeletons: A review of recent progress. *Industrial Robotics of International Journal*, 42, 5-10.

Chiabert, P., D'Antonio, G., & Maida, L. (2018). Industry 4.0: Technologies and Occupational Safety And Health Implications. *Geoingeneering Envimonrent and Mining*, 154 (2), 21-26.

Christiernin, L.G., & Augustsson, S. (2016). Interacting With Industrial Robots-A Motion Based Interface, *Procedia Workshop Advancement Visual Interfaces*, 310-311.

Deloitte (2018). The Fourth Industrial Revolution Is Here – Are You Ready?. URL: https://www2.deloitte.com/content/dam/Deloitte/tr/Documents/manufacturing/Industry4–0_Are-youready_Report.pdf. Acess dated: 08.12.2018.

European Parliamentary Research Service (ERPS) (2015). Industry 4.0 - Digitalisation for productivity and growth. URL: http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568337/EPRS_BRI (2015)568337_EN.pdf, , Access Dated: 25.12.2018.

European Agency for Safety and Health at Work (EU-OSHA). (2017). Monitoring Technology: The 21. Century's Pursuit Of Well-Being?, URL: https://osha.europa.eu/en/tools-and-publications/publications/monitoring-technology-workplace/view, Access Dated: 15.06.2018.

European Commission (2013). Factories of the Future - Multi-Annual Roadmap For The Contractual PPP Under Horizon 2020. Prepared by European Factories of the Future Research Association (EFFRA), 1-136.

Fernández. F. B., & Pérez, M Á S. (2015). Analysis And Modeling of New And Emerging Occupational Risks In The Context Of Advanced Manufacturing Processes. *Procedia Engineering*, Science Direct, URL: https://www.daaam.info/Downloads/Pdfs/proceedings/proceedings_2014/143.pdf, Access Dated: 20.06.2019.

Ferrera, E., Rossini, R., Baptista, A J., Campana, G., Howlett, R., Setchi, R., & Cimatti, B. (2017). Toward Industry 4.0: Efficient and Sustainable Manufacturing Leveraging MAESTRI Total Efficiency Framework. Sustainable Design and Manufacturing. *Smart Innovation, Systems and Technologies*, 68, 624-633.

Frey, C. B., & Osborne M. A. (2013). The Future of Employment: How Susceptible Are Jobs to Computerisation?,URL:https://www.oxfordmartin.ox.ac.uk/downloads/academic/The _Future_of_Empl oyment.pdf, Access Dated: 30.08.2018.

Gisbert, J.R., Palau, C., Uriarte, M., Prieto, G., Palazón, J.A., Esteve, M., López, O., Correas, J., Lucas Estañ, M.C., Giménez, P., Moyano, A., Collantes, L., Gozálvez, J., Molina, B., Lázaro, O., & González, A. (2014). Integrated System for Control And Monitoring Industrial Wireless Networks For Labor Risk Prevention. *Journal of Network Computer Applications*, 39 (1), 233-252.

Graetz, G., & Michaels, G. (2015). Robots at Work, CEPR Discussion Paper No: DP10477. URL:http://cep.lse.ac.uk/pubs/download/dp1335.pdf, Acess Dated: 25.04.2018.

Huen, D., Liu, J., & Lo, B. (2015). The IEEE Life Sciences Newsletter. New York: IEEE. Assistive Wearable Robotics: Healthcare's New Clothes. URL:http://www.lifesciences.ieee.org/publications/newsletter/may-2015/648-assistive-wearable-robotics-healthcare-s-new-clothes, Acess Dated:Erişim tarihi: 26.02.2018.

International Organization for Standardization (ISO). (2011). Safety Requirements For Industrial Robots - Part 1: Robots. Geneva, Switzerland. URL: https://www.iso.org/ics/25.040.30/x/d, Access Dated:01.02.2012.

International Organization for Standardization (ISO). (2012). Robots and Robotic Devices – Vocabulary. Geneva, Switzerland. URL:https://www.iso.org/ics/25.040.30/x/d, Access Dated:01.02.2013.

Jilcha, K., & Kitaw, D. (2017). Industrial Occupational Safety and Health Innovation For Sustainable Development. *Engineering Science and Technology International Journal*, 20, 372-380.

Jones, D. (2017). With The IEC/ISO 17305 Safety Standard Delay, What's The Next?. Rockwell Automation,URL:https://www.rockwellautomation.com/en-us/company/news/blogs/unified-safety-standard-iec-iso-17305-is-cancelled.html, Access Dated: 02.02.2020.

Kabakçı, M. (2009). *Avrupa Birliği Iş Hukukunda Işverenin Isg Ile Ilgili Temel Yükümlülükleri Ve Türk Mevzuatının Uyumu*. İstanbul: Beta Yayınları

Kagermann, H., Wahlster, W., & Helbig, J. (2013). Recommendations For Implementing the Strategic Initiative Industrie 4.0 Final Report of The Industrie 4.0 Working Group. Acatech, Germany, URL: https://www.din.de/blob/76902/e8cac883f42bf28536e7e8165993f1fd/recommendations-for-implementing-industry-4-0-data.pdf, Access Dated: 01.07.2018.

Kılkış, İ. (2022). *İş Sağlığı ve Güvenliği*. Bursa: Dora Basım Yayın Ltd. Şti

Kress, P., Pflaum, A., & Lowen, U. (2016). Ecosystems in the Manufacturing Industry, *IEEE International Conference on Emerging Technologies and Factory Automation*. 7733621, 1-28.

Kurt, R. (2019). Industry 4.0 In Terms of Industrial Relations and Its Impacts on Labour Life. *3rd World Conference on Technology, Innovation and Entrepreneurship (WOCTINE). Procedia Computer Science*, 158, 590–601,

Kuschnerus, D., Bilgic, A., Bruns, F., & Musch, T. (2015). A hierarchical dDomain model for safety-critical cyber-physical systems in process automation. *IEEE International Conference on Industrial Informatics*, Art. No. 7281773, 430-436

Lasi, H., Fettke, P., & Feld, T. (2014). Industry 4.0. *Business Information System Engineering*, 6, 239-242.

Lee, J., Kao, H. A., & Yang, S. (2014). Product Services Systems and Value Creation. *Proceedings of The 6. CIRP Conference on Industrial Product-Service Systems*. Service İnnovation and Smart Analytics for Industry 4.0 and Big Data Environment. Procedia CIRP, 16, 3-8.

Lu, Y. (2017). Industry 4.0: A Survey on Technologies, Applications and Open Research Issues. *Journal of Industrial Information Integration*, 6, 1-10.

Leka, S., & Jain, A. (2010). Health Impact of Psychosocial Hazards At Work: An Overview. World Health Organization. Geneva, 110-136.

Leso, V., Fontana, L., & Iavicoli, I. (2018). The Occupational Health and Safety Dimension of Industry 4.0. *La Medical*. 110 (5),327–338.

Lira, D.N., & Borsato, M. (2016). Dependability Modeling for The Failure Prognostics In Smart Manufacturing. *Transdisciplinary Engineering*, 4, 885–894.

Lorenz, M., Rüßmann, M., Strack, R., Lueth, K. L., & Bolle, M. (2015). Man and Machine in Industry 4.0: How Will Technology Transform The Industrial Workforce Through 2025?. The Boston Consulting Group. URL: https://www.bcg.com/publications/2015/technology-business-transformation-engineered-products-infrastructure-man-machine-industry-4, Access Dated: 10.12.2019.

MacDougall, W. (2014). Industrie 4.0: Smart Manufacturing for The Future. Germany Trade & invest (GTAI), URL: https://www.gtai.de/GTAI/Content/EN/Invest/_SharedDocs/Downloads/GTAI/Brochures/Industries/industrie4.0-smart-manufacturing-for-thefuture-en.pdf, Access Dated: 10.02.2021.

MacEachen, E., Kosny, A., Ståhl, C., O'Hagan, F., Redgrift, L., Sanford, S., Carrasco, C., Tompa, E., & Mahood, Q. (2016). Systematic Review of Qualitative Literature on Occupational Health And Safety Legislation And Regulatory Enforcement Planning And Implementation. *Scandinavian Journal of Work Environmental Health*, 42 (1), 3-16.

Malinowski, M L., Beling, P A., Haimes, Y Y,. La Viers, A., Marvel, J.A., & Weiss, B A. (2015). System Interdependency Modeling in The Design Of Prognostic And Health Management Systems In Smart Manufacturing. Proceedings of the Annual Conference of the Prognostics and Health Management Society, URL: (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5486229/, Access Dated: 01.06.2021.

Mas-Machuca, M., Jasmina Berbegal-Mirabent, J.B., & Ines, A. (2016). Work-Life Balance and Its Relationship with Organizational Pride and Job Satisfaction. *Journal of Management of Psychology*, 31(2), 586-602.

Mattsson, S., Partini, J., & Fast-Berglund, A. (2016). Evaluating Four Devices That Present Operator Emotions in Real-Time. *Procedia CIRP*, 50, 524-528.

Mızrakçı, K. C. (2020). Agile Occupational Safety Management System Model and Evaluation of the Proposed Model in an Automotive Company. *International Journal of Management and Administration*, 4 (8), 228-244.

Ministry of Economy, Science and Innovation, Québec (MESI). (2016). Plan d'action en economie numérique: feuille de route industrie 4.0. URL: https://www.economie.gouv.qc.ca/fileadmin/contenu/documents_soutien/gestion_entreprises/industrie_4_0/feuille_route_industrie_4_0.pdf, Access Dated: 18.07.2017.

Moniri, M M., Valcarcel, F A E., Merkel, D. and Sonntag, D. (2016). Human Gaze and Focus Of-Attention in Dual Reality Human-Robot Collaboration. *12th International Conference on Intelligent Environments*, 238-241.

Murashov, V., Hearl, F., & Howard, J. (2016). Working Safely with Robot Workers: Recommendations for the New Workplace. *Journal of Occupational Environmental Hyge*,, 13,61-71.

National Institute for Occupational Safety and Health, U.S, (NIOSH): (2014). The State of the National Initiative on Prevention Through Design. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, DHHS (NIOSH) Publication No: 2014-123. URL: https://www.cdc.gov/niosh/docs/2014-123/pdfs/2014-123_v2.pdf?id=10.26616/NIOSHPUB2014123, Access Dated: 11.07.2018.

Niesen, T., Houy, C., Fettke, P., & Loos, P. (2016). Towards an Integrative Big Data Analysis Framework for Data-Driven Risk Management in Industry 4.0. *Proceedings of the Annual Hawaii International Conference on System Sciences.* URL: https://csdl-downloads.ieeecomputer.org/proceedings/hicss/2016/5670/00/5670f065.pdf?7427814, Access Dated: 15.05.2021.

Palazon, J.A., Gozalvez, J., Maestre, J.L., & Gisbert, J.R. (2013). Wireless Solutions for Improving Health and Safety Working Conditions in Industrial Environments. *IEEE 15. International Conference on Health Networking, Applications and Services*. Healthcom, 544-548.

Pavón, I., Sigcha, L.F., Arezes, P.M., Costa de Arcas G., & Lopez Navarro, J.M. (2018). Wearable Technology for Occupational Risk Assessment: Potential Avenues for Applications. *Occupational Safety and Hygiene.* 6, 447-452.

Percy, S. (2017). Artificial Intelligence: The Role of Evolution in Decision-Making. URL: https ://www.teleg raph.co.uk/busin ess/digital-leade rs/horiz ons/artifi cial intel ligen ce-role-of-evolu tion-indecis ion-making/. Access Dated: 20.06.2019.

Podgórski, D., Majchrzycka, K., Dąbrowska, A., Gralewicz, G., & Okrasa, M. (2017). Towards A Conceptual Framework of OSH Risk Management in Smart Working Environments Based On Smart PPE. Ambient Intelligence and the Internet of Things Technologies. *International Journal of Occupational Safety Ergonomics*, 23 (1), 1-20.

Pontarollo, E. (2016). Industry 4.0: A New Approach to Industrial Policy. *Industria*. 37 (3), 375-381

Reinert D. (2016). The Future of OSH: A Wealth of Chances and Risks. *Industrial Health*, 54, 387-388.

Roblek, V., Meško, M., & Krapež, A. A. (2016). *Complex view of industry 4.0*. SAGE Open, URL: https://journals.sagepub.com/doi/full/10.1177/2158244016653987 2016, Acess Dated: 10.10.2018.

Rojko, A. (2017). Industry 4.0 Concept: Background and Overview. *International Journal of Interactions Mobile Technology*, 11 (5), 77-90.

Rüßmann, M., Lorenz, M., Gerbert, P., Waldner, M., Justus, J., Engel, P., & Harnisch, M. (2015). *Industry 4.0: The Future of Productivity and Growth In Manufacturing Industries*. Boston Consulting Group.

Sanders, A., Elangeswaran, C., & Wulfsberg, J. (2016). Industry 4.0 Implies Lean Manufacturing: Research Activities in Industry 4.0 Function as Enablers for Lean Manufacturing. *Journal of Industrial Engineering Management*, 9, 811-833.

Schlechtendahl, J., Keinert, M., & Kretschmer, F. (2015). Making Existing Production Systems Industry 4.0-Ready. *Production Engineering*, 9,143-148.

Schmidt, R., Möhring, M., & Härting, R. C. (2015). Industry 4.0-Potentials for Creating Smart Products: Empirical Research Results, International Conference on Business Information Systems. *Springer International Publishing*, 16-27.

Schulte, P A., & Salamanca-Buentello F. (2007). Ethical and Scientific Issues of Nanotechnology in The Workplace. *Environmental Health Perspectives*, 115,5-12.

Shibin, KT., Gunasekaran, A., Papadopoulos, T., Childe, S., Dubey, R., & Singh, S. (2016). Energy Sustainability in Operations: An Optimization Study. *International Journal of Advanced Manufacturing Technology*, 86, 2873–2884.

Stock, T., & Seliger, G. (2016). Opportunities of Sustainable Manufacturing in Industry 4.0. Global Conference on Sustainable Manufacturing - Decoupling Growth from Resource Use. *Procedia CIRP*, 40, 536-541.

Süzek, S. (2019). *İş Hukuku*. İstanbul: Beta Yayınları.

Szulewski, P. (2018). IT Integration is a Spirit of the Industry 4.0 Manufacturing Environment. *Mechanic*, 91:(8-9); 630-636.

Thoben, K.D., Busse, M. and Denkena B. (2014). System-integrated intelligence-new challenges for product and production engineering in the context of industry 4.0. Procedia Technology, 15,1-4.

Thrun, S. (2004). Toward a Framework for Human-Robot Interactions. *Human-Computer Interaction*, 19,9-24.

Toro, C., Barandiaran, I., & Posada, J. (2015). A Perspective on Knowledge Based And Intelligent Systems Implementation In Industrie 4.0. *Procedia Computer Science*. 60 (1), 362–370.

Tupa, J., Simota, J., & Steiner, F. (2017). Aspects f Risk Management Implementation For Industry 4.0. 27th International Conference on Flexible Automation and Intelligent Manufacturing-FAIM, Italy. *Procedia Manufacturing*, 11,1223-1230.

Van Holland, B.J., Soer, R., de Boer, M.R., Reneman, M.F., & Brouwer, S. (2015). Preventive Occupational Health Interventions in the Meat Processing Industry in Upper-Middle and High-Income Countries: A Systematic Review on Their Effectiveness. *International Architecture Occupational Environmental Health*, 88 (4), 389-402.

Vasic, M., & Billard, A. (2013). Safety Issues in Human-Robot Interactions. *IEEE International Conference Robotics Automation (ICRA)*. Germany, 197-204

Wang, S., Wan, J., Li, D., & Zhang, C. (2016). Implementing Smart Factory of Industrie 4.0: An Outlook. *International Journal of Distribution Sense Network*, 3, 1-10

Waschneck, B., Altenmüller, T., Bauernhansl, T., & Kyek, A. (2017). Production Scheduling in Complex Job Shops from an Industrie 4.0 Perspective: A Review and Challenges in the Semiconductor Industry. CEUR Workshop Proceedings 1793, URL: http://ceur-ws.org/Vol-1793/paper3.pdf, Access Dated: 10.06.2020.

Wrobel-Lachowska, M., Wisniewski, Z., Polak-Sopinska A., & Lachowski, R. (2018). ICT in Logistics As a Challenge For Mature Workers. Knowledge Management Role in Information Society. Goossens, R. (eds.) Advances in Social & Occupational Ergonomics, AHFE, Advances in Intelligent Systems and Computing, 605.

Yaqiong, Lv., & Danping, L. (2017). Design an Intelligent Real-Time Operation Planning System In Distributed Manufacturing Network. *Industrial Management Data System*, 117 (4), 742–753

Zhou, K., Liu, T., & Zhou, L. (2015). Industry 4.0: Towards Future Industrial Opportunities and Challenges. *12th International Conference on Fuzzy Systems and Knowledge Discovery (FSKD)*, URL: http://or.nsfc.gov.cn/bitstream/00001903-5/157049/1/1000014061825.pdf., Access Dated: 26.02.2018.

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Contemporaneity of Primitive Accumulation in Understanding Current Trends in Capitalism and Capitalist State [1*]

Kapitalizm ve Kapitalist Devletteki Güncel Eğilimleri Anlamada İlkel Birikimin Çağdaşlığı

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Abstract

Today the social functions of the state and commons, which have been able to escape capital's transformative effect so far, are under attack around the world. Discussions around the concept of primitive accumulation are attempts to understand the reasons, mechanisms and results of such attacks. Primitive accumulation in historical sense refers to a precapitalist separation of peasants from the means of production, which creates the necessary conditions for capitalist development. On the other hand, many scholars since Luxemburg argue that primitive accumulation is a continuous process throughout capitalism's history and it is intertwined with capitalist accumulation. Bringing primitive accumulation from precapitalism to contemporary era has created theoretical problems. Since the state is traditionally the perpetrator of primitive accumulation, the proposed way to solve them is to revisit the capitalist state debate and to scrutinize its role in contemporary developments, such as land, water and resource grabbing, simultaneously happening around the world.

Keywords: *Primitive Accumulation, Capitalism, Accumulation by Dispossession, Capitalist State*

JEL Codes: *P16; P18; Q20; Q30*

[1]. Yazarlar bu çalışmanın tüm süreçlerinin araştırma ve yayın etiğine uygun olduğunu, etik kurallara ve bilimsel atıf gösterme ilkelerine uyduğunu beyan etmişlerdir. Aksi bir durumda Pamukkale Journal of Eurasian Socioeconomic Studies Dergisi sorumlu değildir. İntihal raporu alınmıştır.
The authors declared that all processes of this study comply with research and publication ethics, and comply with ethical rules and scientific citation principles. Otherwise, Pamukkale Journal of Eurasian Socioeconomic Studies is not responsible. A plagiarism report is received.

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INTRODUCTION

Since the beginning of neoliberal attack to the state and its functions, which guard the society from market failures, many societies either in north or south have more and more faced with the harsh market conditions with cuts in social securities, educational and healthcare services, unemployment wages and pensions, agricultural subsidies or any other social net that protects societies from the market. Societies also witness impacts of privatization and deregulation in many aspects of their lives, violent expropriations, land, water and natural resource grabbing. As the enclosures in Britain, theft and plunder in the colonies in the past created a resistance to the "new" way of business, people all around the world are resisting such violent attacks on their lifestyles. These have been so common around the world that many scholars have turned their eyes on them in order to understand the nature of capitalism today. Reintroduction of primitive accumulation[2] or a renewed version of it, is one of those theoretical attempts.

Since Marx, many scholars have interpreted the concept of primitive accumulation in many different ways and for many different purposes. The main axis of these Marxist debates has always been on the contemporaneity of the concept. While some of them argue that primitive accumulation has its theoretical significance in the prehistory of capitalism explaining the origins of capital, others propose that it is actually an on-going process throughout the history of capitalism and side by side with capitalist accumulation. Especially after the invasion of Iraq, which also marked the beginning of a "new imperialism debate", David Harvey (2003, 2004), in relation to his imperialism arguments, made an attempt to reinvent a 'new primitive accumulation', by not only highlighting the continuous character of primitive accumulation, but also expanding its original meaning.

Especially with Harvey's attempt to reinvent a 'new primitive accumulation', bringing primitive accumulation from prehistory of capital in order to explain today's capitalism eventually led to a significant distortion in the meaning and the explanatory value of the concept. Despite primitive accumulation and capitalist accumulation are originally separate, but complementary processes with significant explanatory power, they ended up referring identical processes. This paper suggests that in order to escape such unproductive unity of two accumulations, the role of the state as the perpetrator of primitive accumulation has to be highlighted with a special interest in the profound differences between the precapitalist state and capitalist state.

This paper is composed of four sections. First section attempts to explore Marx's writings on primitive accumulation. Second section evaluates the contours of contemporaneity of primitive accumulation debate. Third section discusses the novelty of Harvey's 'Accumulation by Dispossession' and its shortcomings. The last section aims to provide suggestions for the

[2] Derivations of the term due to use of different adjectives, such as original, previous, or primary, exist in many texts either as mistranslations or theoretical preferences. I will employ "primitive accumulation" as in the first translation of Marx's Capital to English.

resolution of theoretical problems stemming from bringing primitive accumulation from precapitalism to today.

1. PRIMITIVE ACCUMULATION IN MARX

The concept of primitive accumulation is originally derived from Adam Smith's assumption that "the accumulation of stock must, in the nature of things, be previous to the division of labour, so labour can be more and more subdivided in proportion only as stock is previously more and more accumulated" (Smith, 1977: 361). This stock is understood as stock of goods, which has to be produced beforehand and made ready to be traded in the market for the producers' other needs since the modern industrial society necessitates a division of labour. Following this initial stock, division of labour is introduced and leads to an increasing accumulation of stock, which is eventually transformed to capital. Here the concept of previous accumulation in its practice has a methodological value since Smith utilizes it for explaining the origins of capital. However, it is detached from history and does not really say anything about the social developments that lead to the formation of capital.

Marx, on the other hand, criticizes Smith from that very point and called it "the so-called primitive accumulation" and reintroduced it with a deeper historical significance in the development of capitalism (Marx, 1887: 508). Therefore, he devotes the last part of Capital Volume I to the concept of primitive accumulation and defines it as "the historical process of divorcing the producer from the means of production [and] ... it forms the prehistoric stage of capital and of the mode of production corresponding with it" (Marx, 1887: 508).

Since the capitalist system presupposes a complete separation of peasants from the means of production so that they are free to sell their labour in the market, the primitive accumulation is the means to achieve this. When capitalist production sets in, "it not only maintains this separation, but reproduces it on a continually extending scale" (Marx, 1887:507). In other words,

> "The process [of primitive accumulation], therefore, that clears the way for the capitalist system, can be none other than the process which takes away from the labourer the possession of his means of production; a process that transforms, on the one hand, the social means of subsistence and of production into capital, on the other, the immediate producers into wage labourers" (Marx, 1887: 507-8).

According to Marx, therefore, the process of primitive accumulation as the separation of peasants from the means of production is significant for the capital accumulation in two ways: Firstly, it creates a labour force free from land, a wage labourer, so he can travel wherever there is a market for his labour. As well, he is also free from guilds of old order, which have strict regulations for labour. Secondly, the emancipation of labour from old ball and chains could be enough for a bourgeois historian, he claims, but the path to being a free labourer necessitates being "robbed of all their means of production, and of all the guarantees of existence afforded by the old feudal arrangements" which will be transformed into capital

(Marx, 1887: 507-508). Like the separation of an atom into small pieces and releasing energy, practices of primitive accumulation separates the peasants from the means of production and this process leads to the creation of capital and, consequently, to the accumulation of it.

In other words, from other way around, from the end to the beginning, "the accumulation of capital presupposes surplus-value; surplus-value presupposes capitalistic production; capitalistic production presupposes the pre-existence of considerable masses of capital and of labour power in the hands of producers of commodities" (Marx, 1887: 507). These presuppositions need one more to escape this "vicious circle": a primitive accumulation "preceding capitalistic accumulation which does not depend on capitalistic mode of production" (Marx, 1887: 507).

Marx clearly exemplifies this process of separation of peasants from the means of production, and how it was a bloody one. He calls the Acts for Enclosures of Commons, beginning as early as 17th century, as "robbery", "a parliamentary coup d'etat", "bloody legislation against the expropriated" (Marx, 1887: 507-522). Landlords were robbing the land, which was previously common, transforming communal property into private property. Here the landlords are the real perpetrators of primitive accumulation through utilization of state and laws, not the protocapitalists. Protocapitalists mainly benefited from this new class of expropriated free workers and privatized property, which are crucial for capitalist accumulation. When labourer is free to sell his labour in the market, he becomes the sole creator of surplus value, which eventually transforms into capital and reinvested in production leading to capitalist accumulation. Rather than private property as a concept for itself, this transformation of peasants into wageworkers and the process of losing their direct access to the means of production becomes the core of the argument because without it the capitalist accumulation would not be possible.

While analysing the English case in detail, Marx also reminds that there is not one single form of primitive accumulation. The expropriation of the peasant from the soil, from the means of production as well of the means of subsistence, is not specific to the development of capitalism in England. He claims "the history of this expropriation, in different countries, assumes different aspects, and runs through its various phases in different orders of succession, and at different periods. In England alone… has it the classic form" (Marx, 1887: 508).

From Marx's handling of the concept of primitive accumulation, there appears three conclusions. Firstly, primitive accumulation is a process of creating a free work force and private property. Secondly, the perpetrator of primitive accumulation is a class, aristocratic class in this sense, and it is pursued by the use of state power. Therefore, there is a need to define the relations between classes or class fractions and the state. Thirdly, it seems relatively clear in Marx's writings that spatial variations of primitive accumulation in different regions exist. Considering the expansion of capitalism into other countries and into other modes of production did not have a strict time frame, primitive accumulation has occurred in different regions at different times. Later scholarship, therefore, disagrees on these variations across time, and discusses whether it is a phenomenon of the past or a contemporary one.

2. LOOKING AT THE LITERATURE ON CONTINUITY OF PRIMITIVE ACCUMULATION

Considering the continuity of the primitive accumulation two positions have developed since Marx. The scholars in the first position argue that primitive accumulation refers to a specific moment in the past, a part of precapitalist history, and sometimes a specific geography, England. Therefore, the utilization of primitive accumulation as a tool in understanding contemporary capitalism becomes impossible. The second position, on the other hand, claims that the primitive accumulation is not only precapitalist setting for creating the conditions for capital accumulation, but also an inherent and continuous process of capitalism. De Angelis (2001: 3-4) names these two traditions as "historical primitive accumulation" and "inherent-continuous primitive accumulation" respectively.

Vladimir Lenin can be considered as the earlier figures of historical reading of primitive accumulation based on the understanding of primitive accumulation in his work 'The Development of Capitalism in Russia' (Lenin, 1974). In this work, primitive accumulation is understood as a process amid feudal and capitalist modes of production. The utilization of the concept in his book manifests itself as the classical divorcing of people from the means of production, from which the capitalist accumulation flourishes. He strongly stood at that position in order to challenge the Narodnik claiming that the absence of a developed market would hinder capitalist development in Russia. Lenin argued that the feudal relations of production were already in the process of dissolution, local markets were being replaced by a national market, production moved beyond subsistence and a class division had already occurred in the rural between landowners and agrarian workers. Therefore, the setting for capitalist development and accumulation were already at its place. Here, Lenin defines and utilizes primitive accumulation as a precursory phenomenon for capitalist development.

There are successive scholars who follow this path to highlight the precapitalist history of primitive accumulation and utilize it as a tool to explain transition from feudalism to capitalism.[3] Dobb, for instance, makes a distinction between "accumulation of means of production themselves", capitalist accumulation, and "an accumulation of claims or titles to wealth, capable of being converted into instruments of production although they are not themselves productive agents", primitive accumulation (Dobb, 1946: 177). Accumulation of means of production is hardly specific to precapitalist history since there is no reason for capitalists to stock machines or raw materials until a future point where they will be enough for initiating production; they are also able to provide any means of production during the capitalist production. Therefore, what is called primitive accumulation as "in prior in time" has to be understood as "an accumulation of capital claims – of titles to existing assets which are accumulated primarily for speculative reasons" and the class that holds these assets has to be capable of transforming this stock of wealth into the means of production. "In other words, when one speak of accumulation in an historical sense, one must be referring to the ownership of assets, and to a transfer of ownership, and not to the quantity of tangible instruments of production in existence" (Dobb, 1946: 178). Even though there are differences among their

[3] The main contours of the debate can be found in Hilton, Rodney. (ed). (1978). *The Transition from Feudalism to Capitalism.* London: Verso.

ideas, many scholars from Paul Sweezy (1950; 1986) to Robert Brenner[4] and later on others (Gottlieb, 1984; Leibman, 1984; McLennon, 1986) have shown interest in the issue of primitive accumulation as an important part of the transition from feudalism to capitalism and abstained from extending it to a period when capitalist (expanded) production had achieved its dominance on other types of production.

The second tradition of "inherent-continuous primitive accumulation", on the other hand, stands that primitive accumulation has a continuous character. This point flourished from Rosa Luxemburg's approach to primitive accumulation. Luxemburg in 'The Accumulation of Capital' (2003) accepts historical primitive accumulation as discussed above, that is a process of transition between modes of production, but her theoretical position is to give primitive accumulation a continuous character and intertwine it with capitalist development. In her words, "the accumulation of capital, seen as an historical process, employs force as a permanent weapon, not only at its genesis, but further on down to the present day" (Luxemburg, 2003: 351). This coincides with her efforts to explain the violence of colonialism, militarism and imperialism at her times. Luxemburg argues that primitive accumulation, in this sense, can be both a part of the past and today and the future of capitalism.

But how and why primitive accumulation is a continuous and inherent feature of capitalism? In order to answer this question, firstly, I have to explain the difference that Marx drew between simple and expanded production. According to Marx, simple production is where the revenue gathered from selling the products (realization of surplus value) is not invested or hoarded by capitalist, but consumed periodically (Marx, 1887: 401). Capitalists spend some of the surplus value to renew the machinery and labour force for the sake of the continuous process of production and keeping the levels of subsistence for both workers and themselves without investing in new means of production or more labour in order to increase production levels. In this case, therefore, there is no accumulation of capital. Expanded production, on the other hand, necessitates that at least some portion of the surplus value is transformed into new capital to be reinvested. This new capital can be utilized by purchasing labour power, fixed capital or raw materials. A capitalist economy is similar to the latter. Transformation of surplus value into new capital occurs because of the pressure of competition, which drives capitalists to produce more and/or more efficiently (Callinicos, 2009: 37). Thus, expanded production is increasingly producing more and consuming more and it necessitates an ever-expanding market. In both models, production is in balance with consumption, even in the latter it is assumed that increasing production is met with increasing consumption. Therefore, in expanded production accumulation of capital is assumed infinite.

Luxemburg questions Marx's model of expanded production with two classes, capitalists and workers, and argues that expanded production is impossible in a purely capitalist economy (Brewer, 1989: 60). A part of the commodities is sold in order to renew the means of production and to keep the level of subsistence of workers and capitalists in simple and expanded production models. This part does not create a problem for her analysis since all

[4] Brenner's arguments were collected in Aston, T.H. & Philpin, C. (eds). (1985). *The Brenner Debate: Agrarian Class Structure and Economic Development in Early Modern Europe*. Cambridge: Cambridge University Press.

consumption is met for the continuation of the production. However, the demand for rest of the commodities, which are surplus to be transformed into capital to be reinvested, is not met. Her question is: who buys these commodities?

Since capitalists consuming each other's commodities cannot be the definitive feature of a capitalist system, she presupposes that there has to be non-capitalist buyers for these commodities, a third party outside capitalist production. "The decisive fact is that the surplus value cannot be realized by sale either to workers or to capitalists, but only if it is sold to such social organisations or strata whose own mode of production is not capitalistic" (Luxemburg, 2003: 332). Without their existence, accumulation cannot be achieved since the production is ever increasing and there are only capitalists and workers in this model of society, shortage of effective demand will inevitably occur (Tarbuck, 1972: 21-22). She contends that this shortage has to be met with non-capitalist buyers, either within the national economy or as a non-capitalist country. Thus, accumulation is "more than an internal relationship between the branches of capitalist economy; it is primarily a relationship between capital and a non-capitalist environment" (Luxemburg, 2003: 398).

Marx presupposes that consumption is only met by capitalists and workers and that there is "the universal and exclusive domination of the capitalist mode of production", however, "real life has never known a self-sufficient capitalist society under the exclusive domination of the capitalist mode of production" (Luxemburg, 2003: 328). Luxemburg argues that not only capitalist accumulation necessitates non-capitalist buyers (or societies), but also it transforms them. Non-capitalist countries, which trade commodities with capitalist countries, eventually will be broken up (Brewer, 1989: 58-59). Their natural economies will be substituted by simple commodity economies since the ultimate aim of the accumulative process is "to establish the exclusive and universal domination of capitalist production in all countries and for all branches of industry" (Luxemburg, 2003: 397).

To summarize, "the capitalist process of accumulation is inherently dependent on dominating a non-capitalist 'other'" (Callinicos, 2009: 36) and it is inescapable since it is rooted in the dynamics of capitalist reproduction. In other words, "capitalism necessarily and always creates its own 'other' which is paramount for the stabilization of capitalism" (Harvey, 2003: 141), without which the dynamics of capitalist expansion is imperilled.

Similar to Luxemburg, world-systems (Wallerstein, 1979) and dependency school theorists also highlight the continuous character of primitive accumulation. For instance, Amin suggests that while wealth from primitive accumulation is essential for development of capitalism in core countries, it is also the reason for underdevelopment in the periphery (Amin, 1974: 22). For Amin, primitive accumulation is not a part of the past, it is structural and contemporary, and it is the essence of relations between a capitalist and a pre-capitalist modes of production (Amin, 1974: 3).

Highlighting primitive accumulation's continuous character and intertwining it with capitalist accumulation brought its own problems, which will be discussed below. The historical and inherent-continuous versions of primitive accumulation dominated the discussion of the

concept in the 20th century. However, the 21st century discussion is more based on whether or not to transform the concept in a way to explain the widespread atrocities of neoliberal capitalism.

3. A NEW PRIMITIVE ACCUMULATION?: EVALUATING HARVEY'S CONTRIBUTION TO THE DEBATE

After the invasion of Iraq 2003, many scholars suggested that it was the beginning of a new era for global capitalism. 'The New Imperialism' is one of these approaches, which became popular after the identically named book of David Harvey in 2003, published right aftermath the invasion[5]. By the turn of the 21st century, the events highlighted the debate around state and capitalism within the Marxist tradition in social sciences. What was new at that time in world politics is the shift from a hegemony based on multilateralism to unilateralism of the US. Despite the arguments on the demise of the state power, the 21st century began with a demonstration of state power. This part includes Harvey's main arguments about imperialism and accumulation by dispossession[6], how he associates them to understand contemporary global capitalism and criticisms towards his concept of 'accumulation by dispossession'.

David Harvey in 'The New Imperialism' defines "capitalist imperialism" as "a contradictory fusion of 'the politics of state and empire'… and 'the molecular processes of capital accumulation in space and time'" (Harvey, 2003: 26). Following Arrighi, he differentiates between two logics of power: territorial and capitalist, the former representing the state and the latter representing the capital. Despite the previous approaches to imperialism, which assumes a rather easy correlation and coordination between the state and the capitalists, these two logics are contradictory. Although it is hard to achieve, the intertwining of these two logics in a dialectical sense is the core of his argument on imperialism (Harvey, 2003: 29-30). It is important to mention that he also differentiates capitalist imperialism from other conceptions of empire. In capitalist imperialism, he argues, there is the domination of capitalist logic over the territorial logic, with exceptions (for example, Vietnam War) (Harvey, 2003: 30-33). Thus, while assuming the contradictory fusion of these to separate logics, he is criticised for not providing a distinctive territorial logic and even sometimes reducing territorial logic to the capitalist one in his analysis (Brenner, 2006: 81-82).

Harvey argues that the imperialist expansion is driven by the problem of overaccumulation, which creates periodic crises and pressure to outlet the abundant capital and labour (Harvey, 2003: 109). In other words, in accordance with Marx's theory of falling rate of profit, capitalism produces crises of overaccumulation of capital, which can be absorbed by:

[5] There are previous work on the novelty of imperialism, such as Panitch, L. (2000). The New Imperial State. *New Left Review*, 2(2), 5-20; Gowan, P., Panitch, L. & Shaw, M. (2001). The State, Globalisation and the New Imperialism: A Round Table Discussion. *Historical Materialism*, 9, 3-38; Amin, S. (2001). Imperialism and Globalisation. *Monthly Review*, 53(2), 6-24.

[6] He claims that he did not want to use the term primitive accumulation because it is not a part of the past, but an ongoing process (Harvey, 2004: 74). In other article, he claims that "an shift in language can be far more politically effective" (Harvey, 2006: 158).

> "*(a)* temporal displacement through investment in long-term capital projects or social expenditures (such as education and research) that defer the re-entry of capital values into circulation into the future, (b) spatial displacements through opening up new markets, new production capacities, and new resource, social, and labour possibilities elsewhere, or *(c)* some combination of *(a)* and *(b)"* (Harvey, 2003: 109).

In this sense, for instance, while the post-World War II welfare state period corresponds greatly to a temporal displacement, imperialist periods such as period from late 19th century to end of World War II and new imperialism in neoliberal era mostly correspond to spatial displacement of capital. Either the overaccumulation is absorbed with opening up more spaces for export of capital, nevertheless not without crises of deindustrialization or devaluation, or global competition intensifies into trade or currency wars, even into military conflicts (Harvey, 2003: 122-124).

As the imperialism becomes new, in Harvey, primitive accumulation has also become a new concept, which he names 'accumulation by dispossession' , which is "the heart of what contemporary imperialist practice is about" (Harvey, 2003: 182). He argues that Marx excludes primitive accumulation from his general theory of capital accumulation (Harvey, 2004: 73). Primitive accumulation is precapitalist practices, which could only be possible with the active involvement of the state "with its monopoly of power and definitions of legality", such as the commodification and privatization of land, commodification of labour power, conversion of various forms of property rights into exclusive private property rights; imperial policies to appropriate natural resources in other countries etc. (Harvey, 2004: 74). Today, Harvey sees similar processes of "predation, fraud and thievery" around the world which has become central features of capitalism, especially in finance, such as:

> "Stock promotions, ponzi schemes, structured asset destruction through inflation, asset stripping through mergers and acquisitions, the promotion of levels of debt encumbrancy that reduce whole populations, even in the advanced capitalist countries, to debt peonage, to say nothing of corporate fraud, dispossession of assets (the raiding of pension funds and their decimation by stock and corporate collapses) by credit and stock manipulations" (Harvey, 2004: 74-75).

There are also new mechanisms for accumulation by dispossession: "escalating depletion of the global environmental commons (land, air, water) and proliferating habitat degradations that preclude anything but capital-intensive modes of agricultural production", "the patenting and licensing of genetic material, seed plasma", "the commodification of cultural forms, histories and intellectual creativity", "corporatization and privatization of hitherto public assets (such as universities)… the wave of privatization (of water and public utilities of all kinds) that has swept the world, indicate a new wave of 'enclosing the commons'"(Harvey, 2003: 147-148).

Harvey also utilizes Luxemburg's idea that "capitalism must perpetually have something 'outside of itself' in order to stabilize itself" (Harvey, 2003: 140). Therefore, accumulation by dispossession means an on-going process of primitive accumulation around the world; i.e. promoting privatization of public goods by international institutions, accessing cheap raw materials and labour power, speculating in financial markets, etc.; in order to provide profitable outlets for overaccumulation of capital. In his own words, in a crisis of overaccumulation "what accumulation by dispossession does is to release a set of assets (including labour power) at very low (and in some instances zero) cost. Overaccumulated capital can seize hold of such assets and immediately turn them to profitable use" (Harvey, 2003: 149).

In Marx, state and the landlords were the perpetrators of primitive accumulation. In several occasions, Harvey agrees that state "with its monopoly of violence and definitions of legality" achieved the precapitalist separation of peasants from the means of production "even against popular will" (Harvey, 2004: 75). Today state is "rolling back of its own laws that protect labour and the environment from degradation", reversing of common property rights such as "the right to a state pension, to welfare, to national health care to the private domain" (Harvey, 2003: 148). Even in some contexts, the state "decides" that certain industries not in private hands be privatized or close (as in China) (Harvey, 2003, 154; Das, 2017: 595). To sum up, Harvey's theory of accumulation by dispossession, similar to other scholars of inherent-continuous primitive accumulation camp, proposes that primitive accumulation is not only a phase which set the conditions on which capitalism is thrived and from which it moves on to expanded reproduction, but also a continuing process.

The main problem with the intertwining of capitalist and primitive accumulation is that it becomes hard to understand where capitalist accumulation (or reproduction) begins and ends. Harvey is criticized for extending the scope of accumulation by dispossession and treating capitalist accumulation and accumulation by dispossession as the same thing by putting "workers' loss of employment through their firm's bankruptcy, which is a standard result of a well-established process of capital accumulation, and the expropriation of peasants from their land – in the English enclosures of the eighteenth century ... – which is about creating the conditions for capital accumulation" (Brenner, 2006: 101) in the same bag. His examples of accumulation of dispossession are so wide that it eventually means everything and nothing. From lost pensions in Enron's collapse to intellectual property rights in TRIPS agreement, from degradation of environment to commodification of cultural forms, from privatization of universities to attacks on national health care (Harvey, 2004: 75), he exemplifies many processes as accumulation by dispossession and, eventually, the new term loses its explanatory power since it becomes the logic behind every process that is associated with capitalism. Even in 2010 he claimed that "the extraction of surplus-value is, after all, a specific form of accumulation by dispossession of the laborer's capacity to produce value in the labour process" (Harvey, 2010: 311). In the end, even extraction of surplus value, the basis of capitalist accumulation and exploitation, has become a part of accumulation by dispossession.
In addition, he dismisses all kinds of difference among these processes of accumulation. For example, "privatization of village common property which was of use to peasants working on their own land should be seen as different from the privatization of the government-funded

education which reproduces what is already a wage-labor class that existed before such privatization took place" (Das, 2017: 600).

Secondly, some of the processes that the concept of accumulation by dispossession refers are actually the processes of capitalist exploitation and production, which are already covered in Marx's theory of capitalism. For instance, he suggests that whenever there is a crisis of overaccumulation, accumulation by dispossession processes come to rescue capital from the diminished profits. However, for imperialist activities in the South, one can also expect that since:

> "imperialism is (increasingly) a system of exploitation –and indeed, super-exploitation- of workers of imperialized countries, by capital of the imperialist countries, with the aid of their militarized states, and complicity of pliant states and capital in the periphery, ... such system of exploitation in the periphery, by putting pressure on wages in imperialist countries, increases the rate of exploitation in these countries as well" (Das, 2017: 602).

Harvey would call it, too, a process of accumulation by dispossession since he came to use the term interchangeably with capitalism even though it is how labour market in capitalism served this purpose throughout centuries.

Thirdly, Harvey borrows from Luxemburg the idea that capitalism needs 'others' outside of the capitalist system in order to maintain its continuity. However, he mistakenly identifies it with not only precapitalist structures wherever it prevailed around the world, but also proposes that the state is non-capitalist in the sense that privatization of state enterprises facilitate capitalist accumulation as a response to the problem of overaccumulation. However, it has to be asked: "how can the state in capitalist societies be an outside of capitalism?" (Das, 2017: 603). Marxist debate on the state has eventually reached a general definition that state provides and sustains the conditions for capitalist development. It is integrated in capitalist system; whether this integration may be instrumentalist, parasitical, developmental or relatively autonomous etc. depends on positions of scholars. However, in Harvey's writings, sometimes state or a strong state is the perpetrator of accumulation by dispossession, other times, it is the victim of it. This ambiguity surrounding the position of the capitalist state has to be addressed properly.

The concept of accumulation by dispossession has these shortcomings and ambiguities waiting to be discussed. The continuity debate originally does not necessitate such an expansion in the meaning and scope of primitive accumulation. Yet, Harvey undertook such a task, which only led to the conclusion that accumulation by dispossession became a concept not only for the explanation of primitive accumulation practices today, but also for already explained capitalist accumulation processes.

4. SUGGESSTIONS FOR FURTHER RESEARCH

As it can be seen in the previous section, intertwining capitalist and primitive accumulation is a slippery road that it may end up with many theoretical complications. Yet, considering capitalism today, it is hard to limit the explanatory power of primitive accumulation to a precapitalist history. The world has become predominantly capitalist since then. However,

this does not necessarily mean that other modes of productions have disappeared or there is not a single group of farmers who owns or shares means of production. Thus, the concept of primitive accumulation has still much to offer. Still, there are several points that have to be made to escape any complications stemming from bringing the primitive accumulation from precapitalism to capitalism.

First of all, there is the problem of state. Every scholar I mentioned in this article is convinced that state is the perpetrator of primitive accumulation. This is its fundamental distinction from capitalist accumulation. However, throughout texts, scholars forget about the state and its agency and tend to treat state from an instrumentalist perspective. There is an absolute need for actively reintegrate a Marxist state approach and also class conflict to the core of the theory in order to reveal not only the core differences between primitive and capitalist accumulations, but also how they are linked to one another.

Instrumentalist state is "an essentially repressive instrument which is manipulable exclusively and at will by a single, economically dominant, unitary class subject" (Poulantzas cited in Jessop, 1985: 54); such as Lenin's description of the state as "bureaucratic and military machinery". This definition reduces state or political to economy and/or to the interests of the dominant class and dismiss the constitutive element of class conflict in the establishment of state and in its functions. As Gramsci would put, "when the administrative, executive, and coercive apparatus of government was in effect constrained by the leading class of a whole social formation, it became meaningless to limit the definition of state to those elements of government" (Gramsci cited in Cox & Sinclair, 1996: 126).

Secondly, one has to bear in mind that the precapitalist state and the state in the expanded (capitalist) production are significantly different from each other due to different class structures, conditionings towards then proto-capitalists and today's capitalists, functions and tools available to them for executing these functions. Today the workings of capitalism are not transparent. Even if we acknowledge the transfer of surplus value from labour to capitalists, from periphery to core, due to the fact that coercion is hidden in the operations of markets it becomes hard to detect the relations of exploitation (Wood, 2003: 1-3). In other words, extra-economic force – political, military, and judicial; which is supplied primarily by the state – becomes detached from economic force of capital leading to an understanding of neutrality of the state (Wood, 2003: 4-5). It is important that the detachment of economic power from political power is specific to capitalist mode of production or expanded production. Since market has its own power, which is imposed on capitalists and labour alike, social relations are regulated by the impersonal laws of the market (Wood, 2003: 28). However, this does not necessarily pave the way for an assumption of decline of the state power or instrumentalization of it. State preserves its indispensible functions for "maintaining the system of property [and property lessness] and social order, least of all the function of coercion that underlies all others" within the national borders (Wood, 2003: 20). In other words, the state is the provider of necessary conditions for capital accumulation. Although capitalism reaches far beyond the boundaries of the nation state, it still requires coercive power of the state since no other entity possesses such a power of guaranteeing "the regularity and predictability that capital needs in its daily transactions" and "compensate for its own

disruptive tendencies" (Wood, 2003: 24-25). Due to the detachment of economic power from extra-economic power, capital was able to globalize. On the other hand, because of this detachment capital depends on the nation-state even more. Therefore, unveiling the contemporary nature of the relationship between extra-economic force and economic force, the state and the capital, becomes crucial in understanding capitalism today.

Lastly, beyond theoretical work, in order to understand how state and capital come together for primitive accumulation there is a need for more empirical studies. For example, since the mid-2000's the increase in the prices of primary commodities led to a rush of capital to extraction of natural resources, food production and other raw material productions. This rush has been discussed through several conceptualizations such as land grabbing, water grabbing, green grabbing, neo-extractivism, new extractivism, extractive imperialism etc.[7] The horror of and resistance to vast expropriations of land, water and resources have come to draw attention. Such a phenomenon can provide us with a palette where one can observe and analyse different processes of expropriations in different countries and how state and capital are positioned in the making of these processes.

CONCLUSION

Since the 1970's attacks to the social functions of the state and commons like land, water and natural resources, privatizations and deregulations of markets have become modus operandi of contemporary capitalism. Among scholars, these developments occurring simultaneously around the world have created the need to understand and explain them. This led to the revitalization of the primitive accumulation debate, specifically of its continuous character and its position vis-à-vis capitalist accumulation. It is highly likely that the contemporaneity of primitive accumulation debate will continue in the near future. Critical scholars will continue to discuss concepts like primitive accumulation or develop new ones like accumulation by dispossession in order to explain contemporary capitalism and even offer a political strategy to deal with them.

The historical understanding of primitive accumulation as a definitive part of transition from feudalism to capitalism has become shadowed by this need to explain this contemporary phenomenon. On the other hand, the continuous-inherent understanding of primitive accumulation has become widespread. Especially with Harvey's concept of accumulation by dispossession it draws much attention to the discussion of primitive accumulation. However, while bringing the concept of primitive accumulation from precapitalism to capitalism today, highlighting its continuous character, there appeared several theoretical shortcomings.

[7] Veltmeyer, H. (2013). The political economy of natural resource extraction: a new model or extractive imperialism? *Canadian Journal of Development Studies*, 34(1), 79–95; Borras Jr., S. M., Kay, C., Gómez, S. & Wilkinson, J. (2012) Land grabbing and global capitalist accumulation: key features in Latin America. *Canadian Journal of Development Studies*,. 33(4), 402-416; Brand, U., Dietz, K. & Lang, M. (2016). Neo-Extractivism in Latin America: One Side of a New Phase of Global Capitalist Dynamics. *Ciencia Política*, 11(21), 125-159; Gudynas, E. (2010). The New Extractivism in South America: Ten Urgent Theses about Extractivism in Relation to Current South American Progressivism. Accessed in 15 June 2021, URL: http://postdevelopment.net/wp-content/uploads/2016/10/NewExtractivism10ThesesGudynas10.pdf; Sosa, M. & Zwarteveen, M. (2012). Exploring the Politics of Water Grabbing: The Case of Large Mining Operations in the Peruvian Andes. *Water Alternatives*, 5(2), 360–375.

The essence of primitive accumulation lies in accumulation by extra-economic forces, mainly by the state. Thus, this article highlights the necessity in the debate for a more comprehensive and clear understanding of state in capitalism today. In addition, further research in case studies; i.e. the reasons, workings and results of global rush of capital to land, water and resource grabbing, may provide us an empirical cradle from which such an approach can flourish.

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REFERENCES

Amin, S. (1974). *Accumulation on a World Scale: A Critique of the Theory of Underdevelopment (Vol.1).* Monthly Review Press.

Amin, S. (2001). Imperialism and Globalization. *Monthly Review*, 53(2), 6-24.

Aston, T.H., & Philpin, C. (eds). 1985. *The Brenner Debate: Agrarian Class Structure and Economic Development in Early Modern Europe*. Cambridge: Cambridge University Press.

Borras Jr., S. M., Kay, C., Gómez, S., & Wilkinson, J. (2012). Land Grabbing and Global Capitalist Accumulation: Key Features in Latin America. *Canadian Journal of Development Studies*, 33(4), 402-416.

Brand, U., Dietz, K. & Lang, M. (2016). Neo-Extractivism in Latin America: One Side of a New Phase of Global Capitalist Dynamics. *Ciencia Política*, 11(21), 125-159.

Brenner, R. (2006). What Is, and What Is Not, Imperialism?. *Historical Materialism*, 14(4), 79-105.

Brewer, A. (1989). *Marxist Theories of Imperialism: A Critical Survey*. London & New York: Routledge.

Callinicos, A. (2009). *Imperialism and Global Political Economy*. UK: Polity Press.

Cox, R. W., & Sinclair, T. J. (1996). *Approaches to World Order*. Cambridge University Press.

Das, R. (2017). David Harvey's Theory of Accumulation by Dispossession: A Marxist Critique. *World Review of Political Economy*, 8/4 (Winter), 590-616.

De Angelis, M. (2001). Marx and primitive accumulation: The countinuous character of capital's "enclosures". *The Commoner*. Accessed in 14 December 2022, URL: https://thecommoner.org/wp-content/uploads/2019/10/Marx-and-primitive-accumulation-deAngelis.pdf

Dobb, M. (1946). *Studies in Development of Capitalism*. London: G. Routledge and Sons.

Gottlieb, R.S. (1984). Feudalism and Historical Materialism: a Critique and a Synthesis. *Science and Society*, 48(1), 1-37.

Gowan, P., Shaw, M., & Panitch, L. (2001). The State, Globalisation and the New Imperialism: A Roundtable Discussion. *Historical Materialism*, 9(1), 3-38.

Gudynas, E. (2010). The New Extractivism in South America: Ten Urgent Theses about Extractivism in Relation to Current South American Progressivism. Accessed in 15 June 2021, URL: http://postdevelopment.net/wp-content/uploads/2016/10/NewExtractivism10ThesesGudynas10.pdf

Harvey, D. (2003). *The New Imperialism*. Oxford: Oxford University Press.

Harvey, D. (2004). The 'New' Imperialism: Accumulation by Dispossession. *Socialist Register*, 40, 63-87.

Harvey, D. (2006). Comment on Commentaries. *Historical Materialism*, 14 (4), 157–166.

Harvey, D. (2010). *A Companion to Marx's Capital*. London: Verso.

Hilton, R. (ed.) (1978). *The Transition from Feudalism to Capitalism*. London: Verso.

Panitch, L. (2000). *The New Imperial State.* New Left Review, 2(2), 5-20.

Tarbuck, K. (ed). (1972). *The Accumulation of Capital – An Anti-Critique by Rosa Luxemburg / Imperialism and the Accumulation of Capital by Nikolai Bukharin.* (14-43). New York & London: Monthly Review Press.

Jessop, B. (1985). *Nicos Poulantzas: Marxist Theory and Political Strategy.* London: Macmillan.

Leibman, D. (1984). Modes of Production and Theories of Transition. *Science and Society*, 48(3), 257-294.

Lenin, V. I. (1974). *Collected Works Volume 3: The Development of Capitalism in Russia.* Moscow: Progress Publishers.

Luxemburg, R. (2003). *The Accumulation of Capital.* London & New York: Routledge.

Marx, K. (1887). *Capital: a Critique of Political Economy Volume I.* Moscow: Progress Publishers.

McLennon, G. (1986). Marxist Theory and Historical Research: Between the Hard and Soft Opinions. *Science and Society*, 50(1), 157-165.

Roberts, W. C. (2020). What Is Primitive Accumulation? Reconstructing The Origin of a Critical Concept. *European Journal of Political Theory,* 19(4), 532-552.

Smith, A. (1977). *An Inquiry into the Nature and Causes of the Wealth of Nations.* University of Chicago Press.

Sosa, M., & Zwarteveen, M. (2012). Exploring the Politics of Water Grabbing: The Case of Large Mining Operations in the Peruvian Andes. *Water Alternatives*, 5(2), 360–375.

Sweezy, P. M., & Dobb, M. (1950). The Transition from Feudalism to Capitalism. *Science and Society*, 14(2), 134 - 167.

Sweezy, P. M. (1986). Feudalism to Capitalism Revisited. *Science and Society*, 50(1), 81-95.

Veltmeyer, H. (2013). The political economy of natural resource extraction: a new model or extractive imperialism?. *Canadian Journal of Development Studies*, 34 (1), 79–95.

Wallerstein, I. (1979). *The Capitalist World-Economy.* Cambridge: Cambridge University Press.