ASSESSING THE SERBIAN AND MACEDONIAN ENVIRONMENTAL SUSTAINABILITY VALUE DELIVERY NETWORK PRACTICES

PROCENA SRPSKE I MAKEDONSKE ODRŽIVE EKOLOŠKE MREŽE DODATE VREDNOSTI

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Abstract: *The purpose of this paper is to develop a concept of Environmental Sustainable Value Delivery Network (ESVDN). Therefore, an extensive review of available literature and reports that are directly or indirectly related to the concepts of Environmental Sustainable (ES) and Value Delivery Network (VDN) was performed. In doing so, we identified the drivers and analyzed their mutual influence. In this methodological approach we used a tool named the Environmental Sustainability - adjusted Value Delivery Network Index (ES- adjusted VDNI) in order to measure the extent to which the actors of VDN pursuing environmentally sustainable practices. This tool provides a deeper understanding of key environmental drivers that affect on the VDN productivity of longer term and a sound base for analyses and assesses the quality of Macedonian and Serbian environmental sustainable value delivery practices based on the responsible use and protection of the natural environment. The findings suggest that the Serbian actors in VDN have better environmental practices from Macedonian actors. These findings should help countries and companies perceive the new challenges and the relationship between them to be better understood in order environmental policies and strategies to be adopted and the desired environmental sustainability objectives and progress to be achieved.*

Key words: *Environmental practices, Value Delivery Network drivers, index, actors*

Sadržaj: *Cilj ovog rada je da razvije koncept održive ekološke mreže dodate vrednosti (OEMDV). Iz tog razloga, izvršen je opsežan pregled dostupne literature i izveštaja koji su direktno ili indirektno u vezi sa oba koncepta, ekološka održivost (EO) i mreža isporuke vrednosti (MIV). Na taj način smo identifikovali njihove pokretače i analizirali njihov međusobni uticaj. U ovom metodološkom pristupu koristili smo ekološko održivi - prilagođen indeks mreže isporuke vrednosti (EO-prilagođen MIVI), kako bi se izmerio stepen realizirane ekološki održive prakse od strane aktera MIV-a. Ovaj instrument pruža dublje razumevanje ključnih pokretača produktivnosti MIV-a na duži rok i predstavlja solidnu osnovu za analizu i procenu kvaliteta prakse makedonskog i srpskog MIV-a, zasnovanog na odgovornom korišćenju i zaštiti prirodne sredine. Nalazi ukazuju da srpski MIV akteri imaju bolje ekološke prakse u odnosu na MIV praksu makedonskih aktera. Ovi rezultati mogu pomoći zemljama i kompanijama da uvide nove izazove i da bolje razumeju njihove međusobne odnose, sa ciljem da usvoje ekološke politike i strategije i postignu ekološki održive ciljeve i napredak.*

Ključne reči: *Ekološke prakse, mreža, vrednosne isporuke, pokretači, indeks*

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1. INTRODUCTION

It is now more than 30 years since the Report of WCED, *Our Common Future*, emphasized the need for a sustainable way of life, which not only addresses current environmental challenges but also ensures secure society welfare into the future [2]. The main implication of using this idea is that unsustainable production and consumption by the present society will degrade the ecological, social, and economic basis for future generations, whereas a sustainable development involves ensuring that future generations will have the means to achieve a quality of life equal to or better than the present.

In terms of ecological dimension, increasing consumption coupled with the existing model of business practices has brought about increasing pressure on natural resources such as water, energy, and mineral resources, which are becoming scarcer in the face of rising demand. The fact that natural resources are not renewable and many vital resources, like water, certain minerals and metals are scarce (or are set to become scarce in the near/medium future) it is clear that the wellbeing of present and future generation crucially depends on how society uses its resources. Moreover, the list of undesirable environmental consequences of human activity includes [22]: global warming, acid rain, ozone depletion, air pollution, toxic wastes, loss of biodiversity, and industrial accidents. Together, these adverse changes call into question the feasibility of business activities that does not fully take them into account.

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In order to preserve nature resources and "the ability of future generations to meet their own needs" the economies and companies need to apply policies and measures that will ensure efficient use of natural resources as well as adaptation of clean industrial process [24]. The European Union and its Member States have recognized that a shift towards more sustainable economies and lifestyles is necessary. So, in July 2008, the European Commission launched an Action plan on sustainable consumption and production (SCP) and on sustainable industrial policy (SIP) [3] that builds on and strengthens existing policies and puts forward new measures and actions. Measures include ambitious product standards for eco-design, green public procurement, eco-labeling and eco-innovation. Actions address better products and smarter consumption, leaner production and global markets for

sustainable products. This suggested a dynamic frame aims to improve the energy and environmental performance of products, create demand for better products and help consumers make better choices.

Action is needed at all levels of society in order to change current trends, to live within ecological limits and to create more sustainable societies. But, the wealth and national economy grow are created "only by the productivity of its companies" [20]. Industry and its products have an impact on the natural resource base of civilization through the entire cycle of raw materials exploration and extraction, transformation into products, energy consumption, waste generation, and the use and disposal of products by consumers. Therefore changes in industries activities are needed in how natural resources are extracted and the way products are produced, distributed, used and disposed of. As a result of it, some countries have made significant improvement in environmental quality [4]: air quality is improved, waste and industrial pollution better controlled, products are more efficient and consumers are better informed.

The customers' value delivery network (VDN) reflects all business actors which are responsible for applying of the environmental sustainability operating practices and strategy into specific demographic and geographic markets. The framework of customers' VDN is "made up of the company, suppliers, distributors, and ultimately customers who "partner" with each other to improve the performance of the entire system" [15]. Their practices on the environmental sustainability may be positive, enhancing the quality of a resource or extending its uses. Or they may be negative, as a result of process and product pollution and of depletion or degradation of resources.
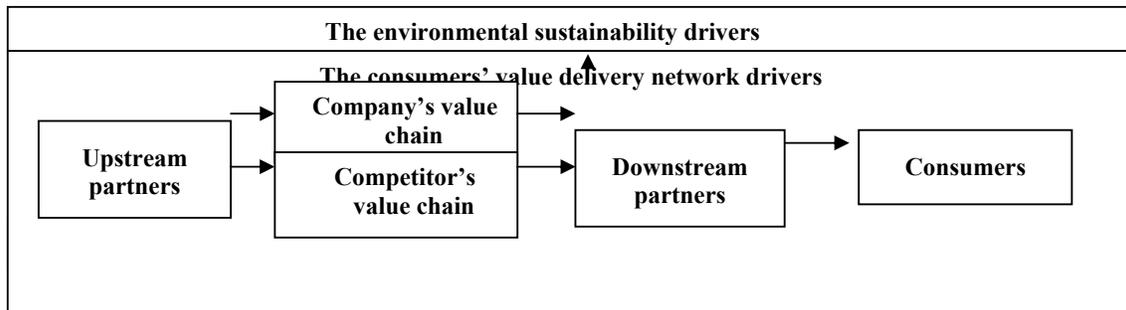

Figure 1: The framework of environmental sustainability value chain network

The purpose of this paper is to create a new conceptual framework named Environmental Sustainability Value Delivery Network (ESVDN). As Figure 1 present the framework of ESVDN is created based on the existing VDN that takes into account environmental factors. The ESVDN will enable a deep understanding of the key environmental drivers that affect on the VDN productivity of longer term and VDN' practices of environmental sustainability. On the other hand its tool called Environmental Sustainability Value Delivery Network Index (ESVDNI) will enable measuring of the ESVDN practices. So, this methodological tool enables analysis and assessment of the environmentally sustainable practices of Serbian and Macedonian value delivery network.

To understand fully the concept of Environmental Sustainability Value Delivery Network, its component and drivers are elaborated in the text below, through three main sections as follow: literature review, methodological approach (two sub titles: framework of the environmental sustainability value delivery network and measuring the environmental sustainability value

delivery network) and finding. Finally, the conclusion suggests directions that the DN actors can adopt for to improve their environmental sustainability practice.

2. LITERATURE REVIEW

As previously noted, the concept of ESVDN is based on the environmental sustainability practices by the actors of VDN (upstream partners, the company's value chain, downstream partners and customers). Upstream and downstream partners are two sides in the supply chain. Upstream from the company is the set of firms that supply the raw materials, expertise needed to create a product or service, while the downstream side of the supply chain such as distribution channels (or wholesalers and retailers), forms a vital connection between the firm and its customers [16]. Optimization of environmental factors has become important to apply to the entire supply chain during production, consumption, customer service and post-disposal temper of the product [17]. More and more researchers believe that Sustainable Supply Chain Management (SSCM) [17] or Green Supply Chain (GSC) [19] also called Environmental Supply Chain Management (ESCM) [12] can be an innovative tool for environmental management.

Green Supply Chains consider the environmental effects of all processes of supply chain from the extraction of raw materials to the final disposal of goods and each player motivates other players to go Green and provide the necessary information, support, and guidance through supplier's development programs or customer support [24]. Holistic green value chain approach is reflected in Zsidisin and Siferd's (p. 69) [28] definition as: *"..the set of supply chain management policies held, actions taken, and relationships formed in response to concerns related to the natural environment with regard to the environment the design, acquisition, production, distribution, use, reuse and disposal of the firm's goods and services"*.

The company's value chain has been used for the last 30 years to understand and analyze the companies [21]. This idea of creating the greatest value with the best possible reduced cost breaks into nine value-creating activities: inbound logistics, operations, outbound logistics, marketing and sales, service, procurement, technology development, human resource management and company's infrastructure. Each department carries out value-creating activities to design, produce, market, deliver, and support the companies' product and work together of adding customer value. Making products available to customer, the companies build relationship not just with customers, but also with different actors as key suppliers (upstream partners) and resellers (downstream partners). Thereby their practices may be positive and will enhance the environmental quality or they may be negative, as a result of process and product pollution and of depletion or degradation of natural resources. Porter and van der Linden [22] argue that pollution is often a waste of resources "incomplete material utilization and poor process controls, which result in unnecessary waste, defects, and stored materials" (p. 122) and that a reduction in pollution may lead to an improvement in the productivity with which resources are used. But the practices, such as developing and using new technologies and operation processes designed by companies can reduce pollution and other adverse environmental impacts while enhancing the competitiveness of firms [23].

On the other hand, the concept environmental sustainability includes "institutions, policies, and factors" that ensure an efficient management of resources to enable prosperity for present and future generations" [18]. The benefits of this concept is an environmentally sustainable system, which "must maintain a stable resource base, avoiding over-exploitation of renewable

resource systems or environmental sink functions, and depleting non-renewable resources only to the extent that investment is made in adequate substitutes [12]. This includes maintenance of biodiversity, atmospheric stability, and other ecosystem functions not ordinarily classed as economic resources.

The Environmental Performance Index (EPI) [6] - a global ranking of 178 countries' environmental results - present how well countries perform on high-priority environmental issues in two broad policy areas: protection of human health from environmental harm and protection of ecosystems. Within these two policy objectives the EPI scores country performance in nine issue areas (climate and energy; biodiversity and habitat, fisheries, forests, agriculture; water resources; water and sanitation; air quality and health impacts) comprised of 20 indicators. Indicators in the EPI measure how close countries are to meeting internationally established targets or, in the absence of agreed-upon targets, how they compare to the range of observed countries. According to EPI 2014 two neighboring countries, Macedonia and Serbia demonstrate positive 10-year trends (Table 1). The table shows that Serbia is ranked as 31st (score 69.13 to a scale of 0 to 100) among 178 countries, while Macedonia has weak performance (score 50.41) at 89th place. Different from these two countries, Slovenia has better ranking performance at 15th place.

Environmental Performance Index (EPI) 2014			
Country	Rank (out of 178)	Score (the best 100)	10-yr
Serbia	31	69.13	+
Macedonia	89	50.41	+
Slovenia	15	76.43	+

Table 1: Environmental performance index rankings
Note: Country Improvement in Performance is denoted by +
Source: EPI 2014, Yale Center for Environmental Law & Policy, p. 10

3. METHODOLOGICAL APPROACH

The analysis that follows is based on the data from the Global Competitiveness Reports (GCR) published by the World Economic Forum (WEF) for period between 2012 [7], [8] and 2014 [9]. In 2011, WEF developed now a tool called Sustainable Competitiveness Index (SCI) [10] with that the countries are assessed for their ability to generate prosperity for their citizens in a sustainable way. The SCI is composed by almost all variables already captured by the Forum's index (12 pillars) for measuring competitiveness, the Global Competitiveness Index (GCI), important from short- to- medium term and a number of *new sustainable variables*- social and environmentally - important over the longer term. So, the GCI which measures the business community perception of many competitiveness factors on a scale of 1 (worst) to 7 (best) is adjusted by factors that encompass social and environmental sustainability. In doing so, the two areas of sustainability— social and environmental—are treated as independent adjustments to each country's performance in the GCI. The WEF' survey sustainability indicators are also transformed into 1-to-7 scale in order to align them with the Executive Opinion Survey results. The survey is conducted in a large number of countries, with identical set of questions and clearly defined sample which is a good basis to achieve the objective of this article.

Table 2 shows the scores of the GCI and Environmental sustainability –adjusted GCI (ES-adjusted GCI) of Macedonia (MK) and Serbia (RS) as developing countries and Slovenia (SL) as developed EU country in a period between 2012 and 2014. Table presents that their GCI is changing in terms of ES- adjusted GCI when it integrates environmental elements. Due to these changes countries belong to different groups of countries. For example, Macedonia belongs in the group of countries with GCI score change from –5% to –15%. Serbia has stable score of GCI and belongs in the group of countries with stable GCI score between +5% and –5% while Slovenia belongs to group of countries with changes GCI from +5% to +15%. Slovenia leads in ranking of the Environmental sustainability – adjusted GCI due to implementation of best environmental policies, well managed renewable resources, effective use of resources in economy. The countries with strong environmental sustainability performance have positive changes of GCI versus countries with poor environmental stewardship. So, an upward arrow shows that environmental sustainability results drive a better score than the GCI itself, as in the case of Slovenia; a downward arrow points to a situation of vulnerability in terms of environmental sustainability that lowers the GCI score, as in the case with Macedonia, and a horizontal arrow indicates that GCI results do not change once environmental sustainability indicators are taken into account, as in the case of Serbia.

	2012				2013				2014			
	GCI (out of 144 counties)		Environmental sustainability –adjusted GCI		GCI (out of 148 counties)		Environmental sustainability – adjusted GCI		GCI (out of 144 counties)		Environmental sustainability – adjusted GCI	
	Rank	Score	Rank	Direction	Rank	Score	Score	Direction	Rank	Score	Score	Direction
RS*	95	3.87	3.71	→	101	3.77	3.74	→	94	3.9	3.9	→
MK*	80	4.04	3.64	↘	73	4.14	3.83	↘	63	4.3	3.66	↘
SL	56	4.43	4.56	↗	62	4.25	4.60	↗	70	4.22	4.78	↗

Key

⇑ GCI score changes by > +15% to +20%   ↘ GCI score changes by –5% to –15%

↗ GCI score changes by +5% to +15%   ⇓ GCI score changes by < –15% to –20%

⇒ GCI score remains stable between +5% and –5%

Source: GCR, WEF 2012, p.59; GCE, WEF 2013, p. 69 and GCR, WEF 2014, p. 68
Table 2: Adjustment to the GCI scores by environmental sustainability indicators

The ES- adjusted GCI is obtained so that each indicator in GCI is converted with an "adjustment coefficient" with a range of 0.8 to 1.2. [11]. The "adjustment coefficient" reflects the extent to which economies have instituted the types of policies necessary to protect the environment from degradation and how it is implement by their industries. The "adjustment coefficient" of the three countries for 2014 is shown in Table 3.

GCI 2014 (out of 144 counties)			Environmental sustainability – adjusted GCI 2014	
Country	Rank	Score	Score	"coefficient of adjustment"
RS*	94	3.9	3.9	1
MK*	63	4.3	3.66	0.86
SL	70	4.22	4.78	1.13

Source: adjusted according to the Global Competitiveness Report 2014- 2015, p. 68-69, WEF, 2014,
Table 3: Coefficient of adjustment of GCI

As Table 2 shows the score of Slovenian GCI is 4.22 but due to the adoption of environmental practices its score of ES- adjusted GCI increases of 4.65 which mean that "coefficient of adjustment" is 1.13. Different from this country, the score of Macedonian GCI is 4.3 but under influence of the environmental factors the score of ES- adjusted GCI falls on 3.66 which means that "coefficient of adjustment" is 0,86. In the case of the Serbian GCI and ES-adjusted GCI scores are same, 3.9 because "coefficient of adjustment" is 1.

3. 1. The framework of Environmental Sustainability Value Delivery Network

Based on above background the frame of Environmental Sustainability Value Delivery Network (ESVDN) is build by both concepts the Value Delivery Network (VDN) and Environmentally Sustainable (ES). The structure of the VDN concept includes 16 indicators captures from the GCI, which are important for increasing the company's' productivity in the short and medium term. In Table 2, the four pillars of VDN and its corresponding indicators are listed: (1) Upstream partners, (2) Value chain, (3) Downstream partners and (4) Consumers. The actors in the VDN are not independent and have tend to reinforce each other, so a weakness in one area often has a negative impact in others and it reflects the quality of the overall VDN practices.

VALUE DELIVERY NETWORK			
Upstream partners pillar	**Value chain pillar**	**Downstream partners pillar**	**Consumers pillar**
− Local supplier quantity	− Nature of competitive advantage	− Control of international distribution	− Degree of customer orientation
− Local supplier quality	− Production process sophistication	− Quality of overall infrastructure	− Buyer sophistication
	− Value chain breadth		
	− Extent of marketing		
	− Willingness to delegate authority		
	− Capacity for innovation		

− Company spending on R&D	
− Gov't procurement of advanced tech products	
− Extent of staff training	
− Firm-level technology absorption	

Table 2: The framework of value delivery network

The WEF′ environmental sustainability concept relies on three most relevant aspects of environmental stewardship and provides a deeper understanding of key environmental drivers that affect on the VDN productivity of longer term. In Table 3 are listed nine factors placed in the three pillars such as (1) environmental policy, (2) use of renewable resources and (3) degradation of the environment.

ENVIRONMENTAL STEWARDSHIP		
Environmental policy	**Use of renewable resources**	**Degradation of the environment**
− Environmental regulations (stringency and enforcement)	− Agricultural water intensity	− Level of particulate matter concentration
− Number of ratified international environmental treaties	− Forest cover change	− Quality of the natural environment
− Terrestrial biome protection	− Fish stocks' overexploitation	− CO2 intensity

Source: GCR 2013-2014, WEF, 2013, p. 63
Table 3: The framework of environmental stewardship

The first pillar, *environmental policy* is composed by (a) the stringency and enforcement of environmental regulation which reflects country's commitment to protect natural capital; (b) terrestrial biome protection which reflects official protection of land area of each habitat type and (c) number of key international environmental treaties which reflects the country's level of engagement with environmental issues and thus its willingness to become involved in international efforts toward addressing global environmental challenges. Indicator of this group of factors reflects the extent to which the country has the political will to respond to environmental issues of a consistent way and to show it in their government agenda.

The second pillar, *use of renewable resources* also includes three factors such as: (a) agricultural water intensity (its indicator reflects efficient using of water in agriculture sector); (b) forest depletion (its indicator reflect change in forest cover and forest loss) and (c) exploitation of fishing grounds. These resources are critical for survival of the country and its good management should be guided by the aim to ensure the need of future generations.

The third pillar, *degradation of the environment* includes the drives which can cause serious damage to human health while destroying the ecosystem as: (a) the level of particular matter concentration, should be constantly monitored by local authorities in many countries because reflects air pollution; (b) the quality of the natural environment, which reflects the behavior of companies to local environment, and (3) CO_2 intensity which reflect the efficiency of energy use in relation to the emissions it produces. Appendix A provides detailed review of all environmental sustainability indicators.

3.2. Measuring the Environmental Sustainability Value Delivery Network performance

Following the logic of WEF′ methodology the Environmental Sustainability - adjusted Value Delivery Network Index (ES- adjusted VDNI) is obtained with adjusting the V*alue Delivery Network Index* (VDNI) by the *environmental sustainability "coefficient of adjustment"*. As noted earlier environmental sustainability "coefficient of adjustment" (CA) for Macedonia is 0.86 and for Serbia is 1. As Figure 2 show the VDNI measure four different the quality aspects of VDN through four sub-indexes, such as: (1) upstream partners (UP) subindex, (2) company's value chain (VC) subindex, (3) downstream partners (DP) subindex and (4) costumer (C) subindex. Each sub-index is composed of individual variables that were already discussed above. The score of VDNI is simple average by its four sub-indexes.
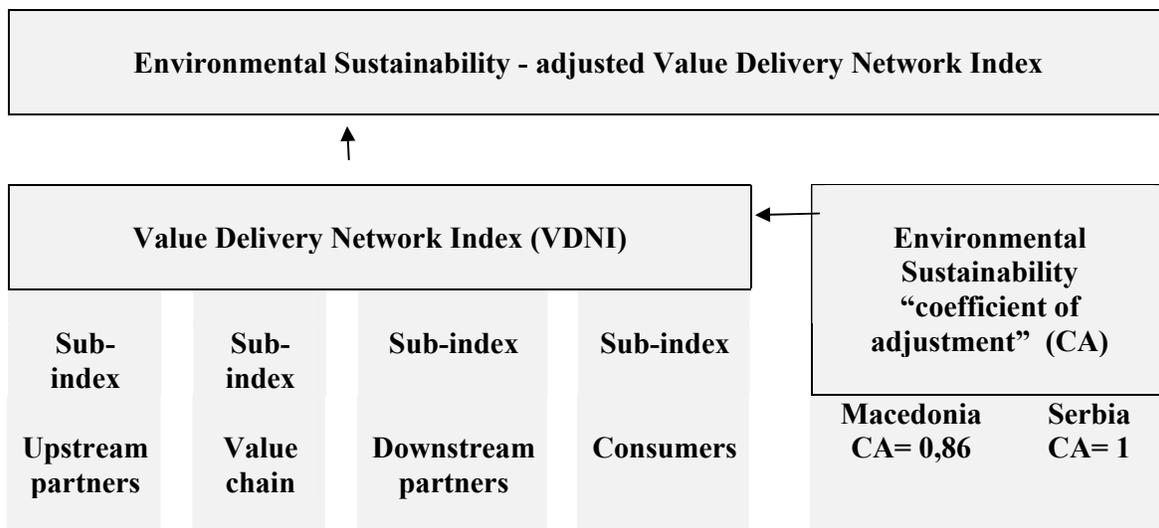

Figure 2: The framework of value delivery network index

As a result of relationship among the performances of the VDN and ES "coefficient of adjustment", the ES- adjusted VDNI go beyond mere economic performance and *measure the extent to which the actors of VDN pursuing environmentally sustainable practices.* Hence, this tool provides a sound base for analyses and assessing the quality of Macedonian and Serbian environmental sustainable value delivery practices and performance.

4. FINDING

The Table 5 presents the results of the VDNI and Environmental sustainability – adjusted VDNI (ES- adjusted VDNI) of the Macedonian and Serbian VDN actors for 2014. Appendix B provides detailed review of all individual indicators and their scores of both the VDN and ES- adjusted VDNI.

From the table it can be seen that the score of Macedonian VDNI (3.94) is better from Serbian VDNI (3.37) because it has better individual performance by upstream partners (MK, 4.55 vs. RS 4.05), company's value chain (MK 3.58 vs. RS 2.96), downstream partners (score 3.90 vs. 3.35) and consumers (score 3.75 vs. 3.15).

		VDNI 2014		Environmental sustainability – adjusted VDNI 2014	
		Macedonia	Serbia	Macedonia **CA=0,86**	Serbia **CA=1**
		Score	Score	Score	Score
	VDNI	3.94	3.37	3.26	3.37
	SUB-INDEX				
1	Upstream partners	4.55	4.05	3.91	4.05
2	Value chain	3.58	2.96	3.13	2.96
3	Downstream partners	3.90	3.35	3.35	3.35
4	Consumers	3.75	3.15	3.22	3.15

Table 5: Environmental sustainability – adjusted VDNI for 2014

Findings also indicate that environmental practices of Macedonian VDN actors are weaker compared to the environmental sustainability performance of the Serbian VDN. So, the MK′ score of ES- adjusted VDNI falls, 3.26, in relation to the VDN score, while the RS′ score of ES- adjusted VDNI, is unchanged, 3.37 in relation to their the VDN score. This means that the actors of **Serbian VDN pursue better environmental sustainability strategies and operating processes based on responsible use and protection of the natural environment through conservation and sustainable practices.** Here it should be noted that the VDN actors of **the two countries need to practice proactive environmental management**. It requires changes in routines and operations [1] and is clearly an organizational competency [5], [14], since it requires the complex coordination of human and technical skills in order to reduce environmental impacts and simultaneously maintain or increase the productivities of the VDN.

CONCLUSION

The purpose of this article was to measure and compare the environmental practices of the Macedonian and Serbian VDN actors. For this purpose an extensive literature and reports are reviewed. Based on the outlined background of the examined materials the framework of Environmental Sustainable Value Delivery Network (ESVDN) was created, methodological tool, Environmental Sustainable Value Delivery Network Index (ESVDNI) for measuring the quality of the environmental practices of VDN actors was developed and the quality of Macedonian and Serbian VDN practices were measured and compared.

Newly created tool, ESVDI provides a deeper understanding of key environmental sustainability drivers that affect the productivity of longer term as well as key VDN drivers which can have a negative impact on the environment. This useful tool helps to *measure the extent to which the actors of VDN pursuing environmentally sustainable practices.* Hence,

this tool provides a sound base for analyses and assessing the quality of Macedonian and Serbian environmental sustainable value delivery practices and performance.

According to the findings the score of Macedonian VDNI (3.94) is better from Serbian VDNI (3.37) because it has better individual performance by the VDN actors as: upstream partners, company's value chain, downstream partners and consumers. But, the score of ES- adjusted VDNI show that *environmental practices of Macedonian VDN actors are weaker compared of the environmental performance of the Serbian VDN actors*. It is because MK′ score of ES- adjusted VDNI falls in terms of the score of their VDN performance while the RS′ score of ES- adjusted VDNI is stable. This means that the Serbian *VDN actors pursue better environmental sustainability strategies and operating processes than Macedonian VDN actors, and that they are based on responsible use and protection of the natural environment through conservation and sustainable practices*. However, the VDN actors of both countries are not doing enough to maintain or increase productivity in the long term and compete with environmental practices and performance. Therefore, the VDN actors of two countries need to take action in order to create more environmental sustainable practices and societies by the complex coordination of human and technical skills and simultaneously maintain or increase the productivities of the VDN.

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this tool provides a sound base for analyses and assessing the quality of Macedonian and Serbian environmental sustainable value delivery practices and performance.

According to the findings the score of Macedonian VDNI (3.94) is better from Serbian VDNI (3.37) because it has better individual performance by the VDN actors as: upstream partners, company's value chain, downstream partners and consumers. But, the score of ES- adjusted VDNI show that *environmental practices of Macedonian VDN actors are weaker compared of the environmental performance of the Serbian VDN actors*. It is because MK′ score of ES-adjusted VDNI falls in terms of the score of their VDN performance while the RS′ score of ES- adjusted VDNI is stable. This means that the Serbian *VDN actors pursue better environmental sustainability strategies and operating processes than Macedonian VDN actors, and that they are based on responsible use and protection of the natural environment through conservation and sustainable practices*. However, the VDN actors of both countries are not doing enough to maintain or increase productivity in the long term and compete with environmental practices and performance. Therefore, the VDN actors of two countries need to take action in order to create more environmental sustainable practices and societies by the complex coordination of human and technical skills and simultaneously maintain or increase the productivities of the VDN.

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Appendix A: Detailed review of environmental sustainability indicators.

Environmental policy	**Stringency of environmental regulation** How would you assess the stringency of your country's environmental regulations? [1 = very lax; 7 = among the world's most stringent]
	Enforcement of environmental regulation How would you assess the enforcement of environmental regulations in your country? [1 = very lax; 7 = among the world's most rigorous]
	Terrestrial biome protection Degree to which a country achieves the target of protecting 17 percent of each terrestrial biome within its borders | 2010 or most recent year available
	No. of ratified international environmental treaties Total number of ratified environmental treaties | 2010
Use of renewable resources	**Agricultural water intensity** Agricultural water withdrawal as a percent of total renewable water resources
	Fish stocks overexploited Fraction of country's exclusive economic zone with overexploited and collapsed stocks
	Forest cover change Percent change in forest area over the period 1990–10
	Forest loss Forest cover lost over the period 2000–10 based on satellite data |
Degradation of the environment	**Particulate matter (2.5) concentration** Population-weighted exposure to PM2.5 in micrograms per cubic meter, based on satellite data
	CO² intensity CO² intensity (kilograms of CO² per kilogram of oil equivalent energy use)
	Quality of the natural environment How would you assess the quality of the natural environment in your country? [1 = extremely poor; 7 = among the world's most pristine

Source: World Economic Forum, Executive Opinion Survey, 2011 and 2012 editions

Appendix B: The score of individual indicators of both the VDN and ES- adjusted VDNI

	Variables	VDNI scores 2014 (out of 144)				Environmental sustainability – adjusted VDNI 2014	
		Macedonia		Serbia		Macedonia	Serbia
		Value	Rank	Value	Rank	CA=0,86	CA=1
	VDNI	**3.94**		**3.37**		**3.26**	**3.37**
1.	Local supplier quantity	4.7	49	4.1	110	4.04	4.1
2.	Local supplier quality	4.4	71	4.0	98	3.78	4.0
	Subindex UP partners	**4.55**		**4.05**		**3.91**	**4.05**
3.	Nature of competitive advantage	2.6	132	2.4	141	2.23	2.4
4.	Value chain breadth	3.7	72	3.1	128	3.18	3.1
5.	Production process sophistication	3.8	73	2.8	133	3.27	2.8
6.	Extent of marketing	4.1	78	3.1	131	3.53	3.1
7.	Willingness to delegate authority	3.3	113	2.9	136	2.84	2.9
8.	Capacity for innovation	3.5	.91	3.0	130	3.01	3.0
9.	Company spending on R&D	3.1	67	2.5	125	2.67	2.5
10.	Gov't procurement of advanced tech products	3.6	56	2.9	122	3.6	2.9
11.	Extent of staff training	3.9	81	3.1	134	3.35	3.1
12.	Firm-level technology absorption	4.2	105	3.8	127	3.61	3.8
	subindex VC	**3.58**		**2.96**		**3.13**	**2.96**
13.	Control of international distribution	3.9	81	3.4	122	3.35	3.4
14.	Quality of overall infrastructure	3.9	84	3.3	111	3.35	3.3
	subindex DU partners	**3.9**		**3.35**		**3.35**	**3.35**
15.	Degree of customer orientation	4.7	54	3.9	116	4.04	3.9
16.	Buyer sophistication	2.8	118	2.4	137	2.41	2.4
	subindex C	**3.75**		**3.15**		**3.22**	**3.15**

Source: The Global Competitiveness Report 2014- 2015, Country/Economy Profiles: Macedonia, p. 255 and Serbia, p. 329, World Economic Forum, 2014