***ASSOCIAÇÃO DE POLITÉCNICOS DO NORTE* (APNOR)**

INSTITUTO POLITÉCNICO DE BRAGANÇA

"Territorial approach to the solution of environmental problems: the need for a regional approach in modern conditions"

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Final Dissertation submitted to *Instituto Politécnico de Bragança*

To obtain the Master Degree in Management, Specialisation in Business Management

Supervisors:

Prof. Doutora Ana Paula Monte

Prof. Doutora Larisa Charkhifalakyan

Bragança, July, 2019.

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Abstract

The conservation of the natural environment (in Republic of Armenia) is a scientifically sound basis for state, public and international activities aimed at ensuring harmonious interactions between society and nature. Main objectives of the environmental protection include: preservation, restoration, and neutralization of natural environment, reasonable use of natural resources, reduction and prevention of physicochemical, biological and other harmful effects on the environment. At the same time, it is not only environmental, but also a complex of socio-economic, ecological, health, technical, technological, scientific-educational, moral-psychological, natural-cultural and other issues, the solution of which depends on the sustainable and secure development of the world community.

The aim of the research is to propose the implementation of measures to increase the environmental protection efficiency in the Republic of Armenia and, as a goal, measure the economic benefit of these solutions. The framework to achieve these goals is to use the sustainable development theories and circular economy solutions. To start it is intended to make a diagnosis of the environmental impact of the industries located in Armenian ecological-economic regions and identify the measures implemented to manage the wastes produced by these industries. After this mapping of the problem, solutions should be proposed in order to contribute to more sustainable development and efficient environmental protections of these regions. As it can be not feasible for this project to analyze every regions as a whole, the stress should be laid on separate zones and focus on a single one to start. The key emphasis must be placed on production, the environment to avoid harmful waste and secondary waste recycling. Which, in its turn, is an element of recycling economy, will aim to empower the region. In the future, this secondary product will also find its place in the agricultural and industrial markets. One of the goals is to create regional ecological-economic energy system (REEES), and to be guided by the peculiarities of the zones to find solutions to it.

Keywords: Natural enviroment, ecological-economic regions, recycling, cycle economics, regional ecological and economic energy system (REEES).

Resumo

A conservação do ambiente natural (na República da Arménia) é uma base cientificamente sólida para atividades estatais, públicas e internacionais destinadas a assegurar interações harmoniosas entre sociedade e natureza. Os principais objetivos da proteção ambiental incluem: preservação, restauração, neutralização do ambiente natural, uso razoável de recursos naturais, redução e prevenção de efeitos físico-químicos, biológicos e outros efeitos nocivos ao meio ambiente. Ao mesmo tempo, esta não é apenas uma questão ambiental, mas também conjunto complexo de questões socioeconómicas, ecológicas, de saúde, técnicas, tecnológicas, científico-educacionais, morais-psicológicas, naturais-culturais e outras, cuja solução depende do desenvolvimento sustentável e seguro da comunidade mundial.

O objetivo da pesquisa é propor a implementação de medidas para aumentar a eficiência da proteção ambiental na República da Arménia e, como meta, medir o benefício económico dessas soluções. O enquadramento para alcançar esses objetivos assenta nas teorias de desenvolvimento sustentável e soluções de economia circular. Para começar, pretende-se fazer um diagnóstico do impacto ambiental das indústrias localizadas nas regiões ecológicas e económicas da Arménia e identificar as medidas implementadas para gerir os resíduos produzidos por essas indústrias. Após esse mapeamento do problema, soluções devem ser propostas, a fim de contribuir para um desenvolvimento mais sustentável e uma proteção ambiental eficiente dessas regiões. Como não é possível para este projeto analisar todas as regiões como um todo, o enfase deve ser colocado em zonas separadas e focar numa única para começar. A ênfase principal deve ser colocada na produção, o meio ambiente para evitar resíduos nocivos e reciclagem de resíduos secundários. O que, por sua vez, é um elemento da economia de reciclagem, terá como objetivo capacitar a região. No futuro, este produto secundário também encontrará seu lugar nos mercados agrícola e industrial. Um dos objetivos é criar um sistema regional de energia ecológico-económica (SREEE) e ser guiado pelas peculiaridades das zonas para encontrar soluções para isso.

Palavras-chave: Ambiente natural, regiões ecológico-económicas, reciclagem, ciclo económico, sistema regional de energia ecológica e económica (SREEE).

Վերացություն

Բնական միջավայրի պահպանումը (Հայաստանի Հանրապետությունում) հասարակության եւ բնության ներդաշնակ փոխգործակցության ապահովմանն ուղղված պետական, հանրային եւ միջազգային գործունեության գիտական հիմք է: Շրջակա միջավայրի պահպանության հիմնական նպատակներից են `բնական միջավայրի պահպանումը, վերականգնումն ու չեզոքացումը, բնական ռեսուրսների ողջամիտ օգտագործումը, շրջակա միջավայրի վրա ֆիզիկաքիմիական, կենսաբանական եւ այլ վնասակար ազդեցությունների նվազեցումը եւ կանխարգելումը: Միևնույն ժամանակ, դա ոչ միայն բնապահպանական, այլեւ սոցիալ-տնտեսական, էկոլոգիական, առողջապահական, տեխնիկական, տեխնոլոգիական, գիտական, կրթական, բարոյա-հոգեբանական, բնական-մշակութային եւ այլ խնդիրների համալիր է, որի լուծումը կախված է համաշխարհային հանրության կայուն եւ անվտանգ զարգացումից:

Հետազոտությունը նպատակ ունի առաջարկել Հայաստանի Հանրապետությունում շրջակա միջավայրի պաշտպանության արդյունավետության բարձրացմանն ուղղված միջոցառումների իրականացում, նպատակ ունենալով չափել այդ որոշումների տնտեսական ազդեցությունը: Որպես այդ նպատակներին հասնելու հիմք է հանդիսանում կայուն զարգացման եւ շրջանաձեւ տնտեսության լուծումների օգտագործումը: Նախ, նախատեսվում է Հայաստանում տեղակայված արդյունաբերության ոլորտի ձեռնարկությունների կողմից շրջակա միջավայրի վրա ունեցած ազդեցության ախտորոշում և այդ ոլորտների աշխատանքի արդյունքում առաջացած թափոնների հետագա կառավարման միջոցների որոշում: Այս խնդրի քարտեզագրումից հետո պետք է լուծումներ առաջարկվեն, որոնք խթան կհանդիսանան տարածաշրջանի կայուն զարգացման եւ շրջակա միջավայրի արդյունավետ պաշտպանությանը: Քանի որ այս նախագծում հնարավոր չէ վերլուծել բոլոր մարզերը, անհրաժեշտ է կենտրոնանալ անհատական գոտիների վրա եւ կենտրոնանալ մեկի վրա: Կենտրոնացումը պետք է լինի արտադրության վրա, շրջակա միջավայրի վրա՝ խուսափելով վտանգավոր արտանետումներից, և երկրորդական արտադրանքի վերամշակման վրա: Դա, իր հերթին, վերամշակման տնտեսության բաղադրիչ է, որը նպատակաուղղված կլինի տարածաշրջանի հզորացմանը: Ապագայում այս երկրորդական արտադրանքը նույնպես կգտնի իր տեղը գյուղատնտեսական եւ արդյունաբերական շուկաներում: Նպատակներից մեկն է ստեղծել տարածաշրջանային էկոլոգիական և տնտեսական էներգետիկական համակարգ (ՏԷՏԷՀ) եւ գոտիների առանձնահատկություններից առաջնորդելով լուծումներ գտնել:

Հիմնաբառեր : Բնական միջավայր, էկոլոգիական-տնտեսական շրջաններ, կայուն զարգացում, վերամշակում, շրջանային տնտեսություն, տարածաշրջանային էկոլոգիական եւ տնտեսական էներգետիկական համակարգ (ՏԷՏԷՀ):

Acknowledgements

First of all, I would like to deeply thank the supervisor of my thesis, Prof. Doutora Ana Paula Monte, without whom I could not finished it. For her patience, perception, for making perfect environment to work. Whose office was always open and who always found time to answer my questions. She consistently allowed this paper to be my own work, but steered me in the right the direction whenever he thought I needed it. Thank you for your guidance.

Thank you also for the Armenian supervisor of my thesis, Prof. Doutora Larisa Charkhifalakyan, who helped with the collection of source data for the work, which was great contribution to this work.

I would also like to thank Prof. Doutora Paula Odete Fernandes, who, perfectly taught the data analysis subject and shared with us with her knowledge. She was always ready to support and help the students whenever they need that.

I would also like to thank Professors in the Master's Degree program for their impeccable instruction in their relevant academic field: Prof. Doutora Alcina Nunes (Economics), Prof. Doutora Sofia Cardim Barata (Innovation Management), Prof. Catarina Rocha (Human Resource Management) for helping me to develop my background in Management Studies.

A special thank you to the International Credit Mobility Programme, by means of which i came here and recieve the opportunity to continue my studies. Thank you for provided financial assistance, in form of scholarship.

Finally, I must express my very profound gratitude to my parents for providing me with unfailing support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them. Thank you.

Abbreviations and/or Acronyms

CE: Circular Economy

GDP: Gross Domestic Product

RCSCN: Regional Complex Schemes for Conservation of Natural resources of regions

REEES: Regional Ecological and Economic Energy System

NMP: Nature Management Processes

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Introduction

The conservation of the natural environment (in Republic of Armenia) is a scientifically sound basis for state, public and international activities aimed at ensuring harmonious interactions between society and nature .Main objectives of the environmental protection include: preservation, restoration, neutralization of natural environment, reasonable use of natural resources, reduction and prevention of physicochemical, biological and other harmful effects on the environment. At the same time, it is not only environmental, but also a complex of socio-economic, ecological, health, technical, technological, scientific-educational, moral-psychological, natural-cultural and other issues, the solution of which depends on the sustainable and secure development of the world community.

The aim of the research is to propose the implementation of measures to increase the environmental protection efficiency in the Republic of Armenia and, as a goal, measure the economic benefit of these solutions. The framework to achieve these goals is to use the sustainable development theories and circular economy solutions. The emphasis was placed on production, the environment to avoid harmful waste and secondary waste recycling. Which, in its turn, is an element of recycling economy, will aim to empower the region. One of the goals is to create regional ecological-economic energy system (REEES), and to be guided by the peculiarities of the zones to find solutions to it. In addition, try to go deeper in solving practical problems of transportation waste and secondary products, try to minimize the costs. Also attention will be stressed on circular economy as a main core of solution of regional problems, and to reach sustainable development.

The analysis of the interviews was done by purposive sampling method (Hair, 2007), where we choose respondents according some specific objective. Solving the transportation problem was mainly done by experimental assessment methodology, which is common used method in these kind situations.

The experimental assessment methodology is the most commonly used in scientific research and planning tasks that allow for the optimal development of the object being explored and the initial classification of determinable indicators in the problem solving (Mkrtchyan, 1997). We will use this method in solving transportation problems, regardless of territorial circumstances.

The remainder of the dissertation is organized as follows. In Part 1, a representation of theoretical part. The data was presented in Part 2, and in the end of this part results have been collected and presented with the commentary and then the dissertation concludes.

Part 1. Literature Review

1.1 Sustainable development theories and environmental protection

The future of our planet is a matter of great concern. Environmental issues and how man / human communities affect ecosystem concerns have been part of human society from the beginning. Sustainable development has become a recognized goal for human society since the deterioration of environmental conditions in many parts of the world (Bossel, 1999). Therefore, humanity is forced to pay more attention to the environment.

The theory of sustainable development is not very new, but it is constantly evolving, because every year the world faces new problems. The concept of sustainable development emerged at a time when the subject of the environment is at the forefront of political debate. The roots of the concept of sustainable development are rooted in promoting the sustainable use of natural resources. In 1951, the International Union for Conservation of Nature published the first report on the global environment, whose goal is to seek reconciliation between economics and ecology. In 1970, Barbara Mary Ward created the concept of sustainable development. Sustainable development and all three aspects: economic, social and environmental became the political goal of the European Union in the Amsterdam Treaty of 1999 (Duran, 2015).

The relation between economic growth and the protection of the environment is an essential problem in the approaching sustainable development because the approach of economic growth not only by gross domestic product (GDP), without trying a quantification of medium and long term advantages, resulting from environmental protection is only a basic form, unacceptable in sustainable development analysis. The human component in sustainable development has a major role, because the concept of equity incorporate several forms of manifestation in regards of sustainable evolution of human society.

The role of sustainable development of society has been noted since 1992, the Earth Summit in Rio de Janeiro and reiterated at the World Summit Sustainable Development in Johannesburg in 2002 (Baron, Snack, & Neacsu, 2001). Without environmental protection cannot ensure sustainable development. Sustainable development includes environmental protection, while environmental conditions sustainable development. The European Union requires a new approach to global environmental problems linked to environmental effects and pressure of all socio-economic consequences. Realizing the need for continued economic and social development, it is imperative to protect and improve the state of the environment represents the only possibility to create and maintain

the welfare of both the present generation and those to come; this balance was the factor that can and should ensure the development of society as a whole (Glasbergen, 2000).

This is the key issue of sustainable development. In the last century, economic and technical progress has led to the neglect and deterioration of natural resources systems. The global economy, however, is now structured and non-renewable resources with a strong impact on the environment, exceeding the capacity of different ecosystems. Examples are the decimation of forest areas, reducing the area of farmland per person, reduction of drinking water, global warming, melting glaciers and extinction of animal and plant species. Environmental issues and how man / human communities affect ecosystem concerns have been part of human society from the beginning (Popescu, 2001).

In this context, sustainable development is of fundamental importance because:

- The use of renewable resources does not exceed their rate of regeneration with emphasis on preservation of natural resources. In this eco-centric approach, natural resources are assigned an intrinsic value, independently of their usefulness to human beings. It is a romantic vision that sees nature as an antidote to industrialized society.
- The use of renewable resources cannot exceed the replacement rate. In this case, the emphasis is on conservation of natural resources. This approach is deeply anthropocentric - nature has value to the extent that sustains life and human activity is prevalent even today.
- The release of harmful substances shall not exceed the capacity of natural systems to absorb and compensate. In this case, the general welfare of the ecosystem should be the first priority, and human aspirations and needs to be resized and re-evaluated by the fact that they are not a priority, but a small element among many other items.

Environment development can be defined as the ability to hold while the three basic functions of the environment: the power function of resources, waste receptor function and the direct utility (Wardle & Giller, 1996). By its complexity, ecological component of sustainable development captures not only the actual economic development in relation to the environment, but the entire development. Ecological development is closely correlated growth and interrelation with environmental laws, the ecological balance. Wheeler (2004) says that currently witnessing a transition from an economic perspective toward an environmental perspective. This dimension is oriented towards satisfying specific practical requirements, and long, proposing harmony and complexity, excluding unilateral orientation to a branch or another of the industry. In other words, in an area environmental development is the capacity to grow and to bring the environment and its peculiarities, while ensuring the protection and renewal of natural resources and environmental heritage. Environmental protection is considering physical and biological system stability, developing their capacity to adapt to change and less conservation status considered ideal (Bran, 1991). Assuming a complex structure, diversified term eco-development is characterized by greater capacity according to the requirements of a stage and some major goals. It requires caution in ecologically; stimulates the development of knowledge based on consumption, but subordinate

planning opportunities; expected a harmonious development, cautious, in full agreement with the possibilities at a time and in a particular place. Thus, economic growth should not affect the environment in order to talk about sustainable development. International organizations have proposed environmental policy, but there are a lot of people who do not like the actions targeting the environment, on the issue as a political commonplace. As said above ecological development is an objective of developing countries that stretches over a long period.

1.2 Circular economy system and contribution to sustainable environment and social development

Environmental problems are the results of unsustainable patterns of consumption and production. Since then, both research and practice revealed that the prevailing linear economic system accumulates waste, while it depletes natural resources. In our anthropogenic era, social sustainability is the ultimate aim, environmental sustainability is the context and the economy is the “vehicle”. Circular Economy is a mode of economic development whose purpose is to protect the environment and prevent pollution, thus facilitating sustainable economic development (Ma, Wen, & Chen, 2014).

In 1992 in Agenda 21 it was stated that “the major cause of the continued deterioration of the global environment is the unsustainable pattern of consumption and production” (paragraph 4.3). In other words, our dominant economic system is the abuser of Nature and this, in turn, affects the society in multiple negative ways. In June 2012, at the RIO+20 UN Global Conference on Sustainable Development, it was re-affirmed that sustainable development is the only viable solution for addressing the world’s growing environmental, social and economic problems. Today it is recognized that growth without limits has caused severe environmental and social problems.

In order to create comprehensive circular economy model of indicators all stakeholders should satisfied all they needs. It also illustrates a comprehensive framework for Circular Economy (CE) based on these three perspectives: environ-mental impact, economic benefit and resource scarcity, including their relationships (Lieder & Rashid, 2016):

1. Economic benefits in circular economy mean that each individual company strives for gaining economic benefits in order to secure profitability and competitiveness. This requires an integrative approach from business models selection and product design to supply chain design and choice of materials;
2. Resource scarcity in circular economy, it is social prosperity, which depends on planet earth‘s finite resource supplies. It makes regenerative use of resources mandatory for circular economy realization. The main factors in this context concern circularity of resources, material criticality and volatility of resources in the light of the globally increasing number of industrial activities;

3. Environmental impact in circular economy means that desirable state of nations and governmental bodies is a society with minimum environmental impacts. Circular economy strives to reduce solid waste, landfill and emissions through activities such as reuse, remanufacturing and/or recycling.

The CE desirability is the reduction of the need for primary resources, freshwater demand and quality, and carbon emissions; the waste management could limit environmental pollution and adverse effects on human health. Waste management impacts directly on the rights to a safe environment, human health, clean water, healthy food, and safe shelter. The effects are global and evidently felt by both industrialized and developing countries (Velenturf & Purnell, 2015). Potentially significant net health benefits can be gained during and following the transition to a circular economy, which will contribute to achieving sustainable development. However, there is also the risk of adverse health effects if this transition does not adequately take into account health implications and health equity considerations. A review of potential health implications from transition to a circular economy highlighted many knowledge gaps, in particular in the nature of negative impacts, for example in the case of the possible diffusion of noxious chemicals, the severity and frequency of exposures and the extent of different health endpoints. It was also noted ("Circular economy meets environment and health", 2017) that such negative impacts often frequently fall disproportionately on vulnerable groups.

Braungart and McDonough (2008) propose using the CE structure to create eco-efficiency systems that support endless cycles of selected biological and technical materials. They adhere to this concept, claiming that they do not strive for sustainability, but go beyond and create industrial systems that not only minimize negative consequences, but also do not contain waste and, in fact, have a positive effect.

The CE aspires to shift society from its throwaway culture by the three R principles (Re-use, Recycle, Recovery) which itself is a very difficult social process. Assuming that CE model has the best of intentions and leads to the right direction, the missing link of social sustainability does not create the setting for a new arrangement of the society (Koumparou, 2017, December).

1.3 The need for a regional approach in contemporary conditions to address sustainable problems

In modern conditions, the need for regional orientation is dictated by at least four concepts in management of nature management (Mazur & Moldovanov, 2005):

1. Deep political reconstruction in Republic of Armenia (RA), conditioned by the collapse of the former USSR and its separation.

2. Increasing the importance of social approach in the field of economic development. Man is the main producer and he lives in a certain area. The whole region should be kept in mind for its high-quality satisfaction.

3. Increasing the importance of the development of the region, often instead of their unilateral specializations. Different regions are characterized by the diversity of the environment and population density. All this predetermines the necessity of harmonious complex development in the region.

4. Efficient solving of environmental problems only in case of regional approximation.

Regional approach is important because of at least two reasons. First of all, promoting sustainability at the regional level is desirable from both practical and normative points of view, because there are many issues that play significant role in normal functioning and well-being of people, and in the ecosystems in different regions. Those regions in order to develop and sustain need to address such issues. All mentioned above are important for policymakers, planners, developers to focus on the sustainability of city regions because the decisions and policies among the regions and peripheries has significant consequences for its citizens, in sense of well-being, as well as ecological consequences (Lennard, Crowhurst, & von Ungern-Sternberg, 1997). Besides that fact, by promoting sustainability, regions can play an important role on making and maintaining “conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations” (“National Environmental Policy Act,” 1969, p. 1-2).

The aggregate of these arguments supporting the view that regions are strategically convenient for promoting sustainability can be derived from the literature on regionalism. Regionalism focuses on interests of particular regions or larger administrative units such as states or countries. Regionalism offers arguments in favor of a regional approach to planning, land use, and economic growth (Dahl & Tufte, 1973).

A subset of regionalist arguments labeled as "new regionalism" view regions as a scale at which global competitiveness can be achieved. New regionalism emphasizes coordination and cooperation among localities for economic competitiveness (Wallis, 1994; Olberding, 2002; Frank & Marsden, 2016). While traditional regionalism argues that a regional approach is more efficient and has a competitive edge over locality based approaches (Wood, 1958; Ostrom, Tiebout, & Warren, 1961; Ziegler, 2009), “new regionalism" points out the benefits of coordination and cooperation from a regional approach in planning and implementation of economic development policies and programs (Olberding, 2002).

Below it is listed several arguments supporting regional approach to sustainability based on scale, efficiency, competitiveness and integration.

Scale: Regions can provide the most effective geographical scale to promote, analyze, and evaluate sustainability (Wheeler, 2000**;** Calthorpe & Fulton 2001**;** Banai, 2013). Regionalists argue, “The real city is the total

metropolitan area" (Briffault, 2000, p. 4). Banai (2013) discusses the advantages of metropolitan regions as units of analysis for sustainability policies and demonstrates that a regional approach to sustainability may be the most appropriate move for sustainable urban and regional development. Furthermore, Banai (2016) notes that regional cities or polycentric metropolitan regions with "linked mixed-use centers, multi-modal corridors, multi-functional districts, and natural preserves" are considered urban forms of the future (Banai, 2016, p. 1).

Efficiency: A regional approach to address issues that concern multiple localities can be more efficient than locality based approaches. Many urban and rural problems span the jurisdictional boundaries of localities. To address these issues, region-wide initiatives are required. If individual localities take initiatives to address such issues, they are likely to create duplicate policies and programs and generate externalities or spillovers (Ostrom, Tiebout, & Warren, 1961). Scholars argue that a regional approach to development can help overcome inefficiencies and policy fragmentation that arises from urban sprawl (Healey, 1997**;** Kübler & Schwab, 2007**;** Frank & Marsden, 2016).

Competitiveness: Supporters of regional competitiveness argue that the sector reduces productivity and the metropolitan areas, along with their surrounding areas, provide the spatial environment of economic competition. They claim that the suburban areas are economic competition units (Hershberg, 1996; Foster, 1997). Briffault (2000) notes that the provinces will be violated in the ability to engage in economic competition if they address their inner economic and social inequalities.

Integration: Another argument is that regional approaches to sustainable development can provide integrated territorial or institutional frameworks for sustainability (McEvoy & Ravetz, 2001). A number of scientists have shown how a regional approach to different areas of policy, such as urban expansion, environmental protection and poverty eradication and inequality, can contribute to sustainability. For example, urban areas can provide green space planning and climate change mitigation platforms (Frank & Morgan, 2012). Moreover, the regional approach in the field of environmental management can provide "a sustainable, adaptable and resilient regulatory system that effectively responds to a persistent and changing environmental problems" (Williams, 2013, p.1090).

1.4 Structure and problems of development of territorial solutions for environmental problems.

Since the UN Conference on Environment and Development is in Rio de Janeiro, in 1992, it became clear that economic, ecological and social development should be stable. At the Cardiff Summit in 1998, an initiative was started in the European Union to narrow the gap between European environmental aims and implementation. The concept, which has emerged as a rising place the international debate on this subject is "environmental policy integration" (Buck, Kraemer, & Wilkinson, 1999; Lenschow, 2002). Environmental policy integration means that everything that the regions

undertake in the various areas of action must take account of environmental goals at an early stage, with synergistic intention, and, where necessary, in priority. As far as content is concerned, the outcomes can include regional material cycling, regional ecological industrial estates, regional energy supply, improved regional public transport, or regional initiatives for ecological building and housing.

Because of its non-mandatory nature, inter-municipal and regional cooperation depends ultimately on whether the potential partners consider the utility of cooperation to be greater as a whole than the costs of cooperating (Fürst & Ritter, 1993). From an empirical point of view, this is by no means always the case. Since the 1990s, studies have shown that the incentives for regional cooperation tend to be weak. Diller (2002), for example, notes that such cooperation generally has to be initiated at a higher level or at least stimulated or supported from above.

Should be mentioned that regional cooperation projects promoting environmental interests are accordingly often to be found in connection with regional parks, national parks, or other areas where, for example, local recreation or tourism play a major role. With reference to the Regions of the Future competition, Dosch (2001) notes on the subject of sustainable land-use: “Strong and lasting engagement is to be found firstly in regions under ‘great strain,’ secondly in projects that contribute to the image of the region and thus to location marketing” (p. 11). Cooperative projects that integrate an ecological element into, for instance, regional business promotion or energy supply, are comparatively rare. An empirical study by Klemme (2002) confirms this with respect to the suitability of regional cooperation for sustainable development, which by definition adopts an appropriate environmental stance.

Experience in solving regional use of natural resources enables to distinguish three main groups of development (Mazur & Moldovanov, 2005):

1. Specialized environmental action plans by regions,
2. Scheme of events, according to a particular natural resource or natural environmental protection component,
3. Regional environmental schemes.

As an example, for the first group of development, it is possible to bring the working program of introduction of environmental measures of metallurgical factories. The scheme includes hazardous waste disposal measures, through smokers, gas filters, special services, installation of gas cleaning operations, and so on. Obviously, such work schemes cannot determine environmental issues as a whole. For the second group of development, it is also characteristic to the lack of integrity, as measures are viewed as a separate environmental resource or a natural component of the environment.

Regional planning schemes and projects are essentially intended for regional industry organizations in line with their developmental targets set for the effective development and transfer of the general scheme. Thus, regional planning is a tool for decision-making on decisions that are taken principally in the interest of the development of individual fields. However, it is obvious that such

decisions are not generally agreed upon in the development of the projected region, especially in the area of environmental protection. Guided by efficiency only economic standards, industry ministries and departments (Burkov, Novikov, & Shepkin, 2008).

Finally, the third group of development predicts regional complex schemes for conservation of natural resources of regions (RCSCN), cities and major production facilities.

1.5 Problems and peculiarities of organization of production in the region

The interconnectivity of technical, economic and ecological-economic factors shows that at the expense of rational use of production waste it is possible to obtain additional profit in the national economy from 5 to 20% of the basic production (Baladsky, 1998). The main production waste that will be utilized in the national economy are as follows: mining and processing industries and other waste products for construction materials; industrial and mining rock waste for autoclaved silicates; industrial waste products for acoustic; thermal insulation; fireproof materials and construction ceramics; pigments for the production of elemental sulphur, sulphuric acid and agricultural fertilizers, cigarettes sulphur dioxide for storage of vegetables and fruits in warehouses; solid components of smog gases for using in chemical, metallurgical, pharmaceutical and other sectors of national economy (Kudinov, 1994). The list of products from production waste can still be continued in national economy.

In order to increase the efficiency of nature conservation and the full utilization of production waste in the national economy, the optimal operational and long-term integrated development and Regional Ecological of Economic Energy System (REEES) should now be reflected in the national program-oriented planning. However, the creation of an optimal plan for productive allocation, taking into account the environmental factors, as well as the allocation of consumers, meteorological, natural and other conditions of production from producers and producers of production, cause considerable difficulties and are gaining more attention.

Special attention to increase of efficiency of REEES is not accidental. This is due to the need for a optimization plan that should reflect regional aspects of resources reproduction at the national economy level. Among the problem of development optimization plan and REEES productive allocation issue, there is substantial identification and functional differentiation, depending on the set of factors, characterizing the peculiarities of the economic malfunction of the regional non-productive production complex and its separate sub-system (Baladsky, 1998):

1. Features of the forms of organization and processes in the regional system of environmental protection, including: the presence of a developed construction and its base; an increased level of specialization and cooperation; the intensity of the growth of the power of the waste-free territorial production complex of the main productions; the minimization of the volumes

of production wastes and the possibility of their cleaning systems from aggressive impurities; the possibility of various combinations of methods of cleaning production wastes, the implementation (or inconsistent utilization) of agreed and converted cleaning products; centralization of forms of control and the use of computer technology; organization of archives and information banks; creation of standards systems; other unspecified forms of organization of production and processes for the protection of the environment and the biosphere as a whole; accounting of meteorological and natural conditions.

2. Features of development of REEES:
   a) Factors of intensive development - the possibility of intensification of treatment plants and the introduction of REEES; improvement of the instrumentation control technology to increase the capacity and accuracy of information channels of communication between the functional components of the systems; improving the quality of the primary resources of social production; a significant decrease in occupational diseases of the population in the region; the creation of new high-performance treatment plants in the regional system of environmental protection and reducing the time of their implementation; increasing the level of profitability of REEES.
   b) Factors of extensive development - a significant expansion of existing purification plants and a decrease in the entropy of scientific forecasting of environmental economics; reduction of the cost price of the agreed products, further improvement of the quality of secondary products.

3. Location factors of REEES.
   Spatial factors - significant remoteness of the raw material being cleaned from specialized production of secondary products from waste; a significant number of system parameters and economic indicators characterizing the optimal functioning of a regional environmental protection system; substantial remoteness of production facilities producing reagents and cleaning equipment from polluting sources; transport and operational factors - multivariate transportation of reagents of captured products, cleaning equipment and materials; a significant degree of differentiation in the various options for transportation and operational traffic.

4. Scientific and technical progress.
   a) Improvement of gas cleaning processes - the growth of workers and the introduction of in-process technological automated installations; significant pace of implementation of computing and control equipment.

b) Improvement of the environmental protection system - conducting a system-static analysis of the range of captured and transformed products; a significant improvement in the quality of secondary (from industrial waste) products.
c) Increased requirements for waste stabilization, differentiation of raw materials to be cleaned; maximum coverage of all sources containing aggressive impurities; increased rates of introduction of more reagents in the process of sanitary cleaning of production wastes; improving the capacity of the transport and its lifting capacity.
d) Increase of special scientific and technical education and qualification of personnel.

5. Socio-economic factors.

   The need to create REEES to eliminate the effect of aggressive impurities on the health of living organisms; the use of captured products in the national economy and the creation of additional working capital; the impact of regional protection systems on the normal development of forest and agricultural plants; the influence of REEES on the general economic development of the area; improving living standards and improving the conditions of work and rest of the population.

6. Dynamic factors.

   Self-sufficiency and gradual transition of the environmental protection system from the state budget to the economic calculation; an increase in the degree of purification of industrial wastes from aggressive and sharply contaminating impurities; a significant increase in the needs of products of waste-free geographically - production complexes; Intensification of cleaning processes and reduction of time for transportation of the caught products and delivery of reagents; reduction of fluctuations in demand for the captured products by improving its quality; further growth of scientific and technological progress; increase the service life of buildings machinery and equipment; increasing the productivity of employees of the environmental protection system; increasing the efficiency of using equipment, reagents, energy, material, labour and other resources; reduction of reagent losses, energy, time spent on the transfer, processing and issuance of technical and economic information; reduction of occupational and other types of diseases of the population, animal and plant world of the region.

1.6 Peculiarities of distribution of productive forces in regional ecological and economic energy systems.

Many scientists from around the world made many studies around regional productive forces distribution. The classical theories include centre-periphery theory, growth pole theory and point axis theory (Liu, Fang, & Shi, 2009). These scientists seek to focus their research on macro-distribution issues, such as regional expertise and common development, regional division and cooperation, and the region's economic sector. They are interested in how the state can influence and control the distribution and coordination of the region's productive forces to ensure that the production systems in the region are able to work efficiently and that resources in the region are well allocated.

When designing the REEES optimal allocation plan, it is necessary to take into account the following features (Mkrtchyan, 1997):

i) Uncertainty of the REEES economic indicators and their relatively weak connection with the mainstream regional production cycle
ii) Lack of scheduling-targeted method in the economic area under consideration, in the regional unproductive production system.

The development of the economy must satisfy both the production and non-production needs of the national economy and the population of the economic region under consideration in the best possible way, and maintain optimal proportions between production and non-production areas in current and long-term consumption (capital investment). Therefore, the economic-mathematical model of inter-sectorial balance and economic laws in the system of environmental protection are the basis of program-targeted planning, balanced with each other economic indicators on the volumes of production of by-products, waste and commissioning of basic production assets for preparing raw materials and materials for use or sanitary cleaning of waste containing aggressive impurities, by year.

When solving economic problems of placing REEES in some of the most industrially developed area, a set of factors determining the operating conditions of a waste-free territorial production complex is considered. The successful operation of REEES is determined by the basic methods of purification, such as obtaining the elemental medium from tail gas, sulphuric acid, nitric acid, nitrogenous fertilizers and other products, rational use of raw materials, reagents, thermal and electrical energy, labour resources, building materials, finance, cleaning equipment and etc. For each waste-free territorial production complex, a list of possible locations for the installation of a nuclear power plant with environmental standards for aggressive impurities in the environment is indicated (Titengerg, 2001).

The level of profitability showing the optimized value of REEES is giving by equation (1):

$$y_7 = \sum_{j=1}^{m} \Pi_j \pm \theta_j \,/\, \sum_{j=1}^{m} \phi_j \qquad (1)$$

Where ϕj - funds; Πj - profit; θj - prevented or inflicted damage, or Yj - minimum total costs. The level of profitability of REES functioning is determined with restrictions on maximum permissible concentrations and maximum permissible emissions of aggressive impurities.

The structural set of economic and mathematical models of optimal environmental management planning was first published in a textbook on environmental economics. The economic and mathematical model of REEES includes the main optimization model of planning and improving the profitability of environmental measures by indicators (Nesterov, 1984):

$H_{ij}^{t} = \frac{Q_{RRN}^{t}+Q_{RRP}^{t}+Q_{ART}^{t}}{Q_{PC}^{tt}+Q_{NC}^{t}+Q_{EB}^{t}}$ - *environmental health indicator in the region under consideration* (2)

Where:

Q_{PC}^{t} , Q_{NC}^{t}- respectively, production and non-production consumption of natural resources

Q_{EB}^{t} - the volume of the infected element of the biosphere,

Q_{RRN}^{t} , Q_{RRP}^{t} , Q_{ART}^{t} - volume of the restored resource by nature, production and artificial restoration in a certain period of time

The economic-mathematical model of REEES forms interconnections of economic indicators of the total costs of delivering raw materials, reagents and materials for the functioning of regional purification systems in order to clean production wastes from toxic substances and to obtain by-products. The minimization of the total cost of providing the links of the economic and ecological system with the rhythmic operation of transport in the conditions of a developed system of cooperation is simulated by mathematical models according to the normative method.

In this context huge role should play distinguish some characteristic features of transportation to meet the needs of different REEES, doing preparations such as classification and categorization (“Transport of Biological Materials”, 2018).

• Transportation costs do not have a significant impact on the development of specialization and placement of the main production and cleaning system of its waste. The mentioned applies to the northern areas of our country, where the issues of inconsistent recycling of production waste do not encounter significant difficulties.

• Transportation costs may have a significant impact on the formation of an optimal plan for the main production and production of a by-product derived from waste, but do not affect the development of specialization in the processing of semi-finished products obtained in the process of cleaning production waste. This corresponds to the case when waste treatment products are used as raw materials that can be recycled at the main production facilities of the region in question or as a final product that is in demand in the region in question.

• Transportation costs for the transportation of semi-finished products, reagents or inconsistent waste disposal make up a significant proportion of all transportation costs in the region in question, with minor transportation costs for the transportation of the final product of waste treatment.

• Transportation costs cause a significant impact on the formation of a development plan and the placement of local treatment plants and REEES, which leads to the need to solve a multi-stage production and transport problem.

Part 2. Empirical research

2.1 Methodology

Providing the reader with the opportunity to evaluate the reliability reasonability of this study, this part will explain the steps taken to conduct the research and usage of methodological tools.

The emphasis will be on circular economy as a main core of solution of regional problems, and to reach sustainable development. To try give a definition of it as a concept, and define good or bad influences as a concept for environment, for a region. Answer the question such as how can circular economy contribute to sustainable development. And try to go deeper in solving practical problems of transportation waste and secondary products, try to minimize the costs.

The aim of the research is to propose the implementation of measures to increase the environmental protection efficiency in the Republic of Armenia and, as a goal, measure the economic benefit of these solutions. The framework to achieve these goals is to use the sustainable development theories and circular economy solutions.

When a problem or question is complex and important insights or theories of the problem are offered by two or more disciplines it is justified to use an interdisciplinary approach (Repko, 2011, p 84). The report aims to be as interdisciplinary as possible, including a several scientific discourses to answer the research goals.

To broaden the interdisciplinary approach, literature, theories and methods were found in various fields and combinations from the very beginning in defining the problem and formulating research questions. This research process began with the original literature and research equipment in the relevant areas. In parallel, unstructured interviews were conducted with professionals who have connections with CE, as well as participation in networking events and lectures on the topic of CE. During this process, it turned out that the CE concept is based on several different, well-studied concepts and that it is a mixture of old and new theories transformed into a more attractive whole. The concept of CE, however, is relatively poorly covered in research. It seemed that the concept of CE today is mainly developed by enterprises and consulting firms.

In this research were made as literature review and interviews in order to get primary data. Literature review part was mainly done in order to provide background context about research. As a primary data have been done some interviews with professionals in connected spheres. This method is considered as a qualitative. Important to know that interviews have taken place with Armenian language and translation was done with trying to maintain the same meaning for efficiency and effectiveness. The interviews with members were held by phone interactions.

The interviewed persons are:

- David Adunc, academic education: Industrial economy with an emphasis on sustainability.
- Larisa Charkhifalakyan, academic education: Ecological economist.
- Rudolph Hovsephyan, academic education: Environmental economist.
- Marina Aghayan, academic education: Industrial economy. Interdisciplinary and system thinking
- Hakob Sargsyan, academic education: Agricultural scientist.
- Samvel Paranyan, academic education: Economy in power engineering field

In qualitative interviews, representative choices and similarities are not the main goal (Holme & Solvang 1991). Here were used sampling were interviewers are not statistically representing. Were used Purposive Sampling method (Hair 2007), when we choose respondents according some specific objective. So, in this case they are associated with people who have made a significant contribution to the field of sustainability science. Some of which were identified by the supervisor and appraiser.

A disciplinary triangulation was conducted to select the appropriate theories to understand a particular problem. Before the semi-structured interviews, a theoretical coordinate system was drawn up. After the interviews, the first rapid analysis of the information collected was conducted to find out in which areas additional theoretical tools are needed to help understand, explain, and interpret the information collected in the answers to the research questions. Beside of speaking around the concept of circular economy it was remarkable to find links to address with some regional issues, such as supplying reagents and semi-finished products for cleaning systems in the region. In regards of this was implemented the transportation problem in the region connected with the supplying of waste to the waste-processing plants. The data for that was taken from National Statistic center of Republic of Armenia.

The experimental assessment methodology is the most commonly used in scientific research and planning tasks that allow for the optimal development of the object being explored and the initial classification of determinable indicators in the problem solving (Mkrtchyan, 1997). We will use this method in solving transportation problems, regardless of territorial circumstances.

2.2 Data analysis and discussions of results

The next two subtitles will talk about the regional economy. First of all, it will give a definition of what the regional economy is. Where will be presented in the comparative formats with the literature review and interviewers answers. The second sub-topic will include a practical regional environmental problem and will show its optimal solution for it. So, as an option for a particular solution, the problem of a living in a particular area.

2.2.1 Description and analysis of the interviews

In this section, research questions will be analyzed with the concept of regional economy, how can a CE contribute and be a foundation for sustainable development. Why do we need a regional economy now and how do specialists find solutions to today's problems. Answers to these questions will only be available after analyzing the results of the report and comparing the answers. The outcome for the regional economy has created an interesting attitude to stability. As a result, we have theoretical assumptions and opinions about the CE, and there are still many questions that need to be further studied. The other part will be discussed in terms of experts in the field.

Discussions will include a number of topics. These topics should represent the logical sequence, which will inspire the interviewer. These topics are:

- Pattern transformation (behavior change and norms)
- Sustainable economic growth
- Business impact
- Globalization
- Course dependencies
- CE and Sustainability

Pattern transformation

We cannot solve our problems with the same level of thinking that created them. That means we have to review the entire system that has created an unstable system that we have today. Some authors believe that CE is kind of pattern transformation, which is completely new way of thinking. Which can be a remedy to solve many problems which humanity faces. It was interesting to know opinions of researchers about this. Is CE a new system or it is reversed representation of current system and in the core part there is no differences.

Sargsyan says that he worked as a livestock consultant over the first four years since 1984. He says that many of the knowledge needed for sustainability is the old knowledge of agriculture and forestry that we could not accomplish in our modern societies. The concept of circulation in agricultural science has been a long time ago. What happened when the sustainable development was introduced at the end of the 1980s (connected with the collapse of USSR), the land as a production factor was eliminated but

it was an important part of the economic theory of the eighteenth and nineteenth centuries. Agricultural and forestry science has been instrumental in generating wealth through country and forest resources. This perspective has been shifted to the focus in the 20th century when not expensive troglodyte energy was less dependent on the production factor and emissions were at the local level and still did not affect our well-being on. What happened was instead of current photosynthesis replaced by historical photosynthesis in the troglodyte record. Instead of transforming the regional economy as a pattern transformation, Sargsyan sees how the economy worked in the eighteenth and nineteenth centuries.

Charkhifalakyan says it cannot be a patter transformation at all. She does not sees something new ideas, however it is able to lead to new things if it is a way of bringing people together. In the green economy, however, having CE, as part of it, coupled with green tax shifts and so on, it should be part of the solution. She makes an impression that change of a more stable position and norms is not in the focus of the CE, but it can have a positive side effect.

Hovsepyan says that saying CE sounds something familiar, something that we knew long time ago. He mentioned the Earth theory by Kenneth Boulding (1966), saying that it is something close to the concept of CE. When CE nowadays begin appearing at is saying that some different groups of people has come to the same concepts and conclusions and realized the problem with new business opportunities. He compared it with the clothes of queen in nowadays.

When it is from the side of the exchange of economic business models as part of a CE, Hovsepyan has noticed the same example as a revolutionary 20 years ago on the natural stroll. For instance, Xerox copiers, car sharing and interface floors. Leasing was used as a solution then, which, as it turned out, was not kind of solution. Hovsepyan referenced that perhaps the market was not ready for it, and maybe we are ready now whether it is deeply rooted in property rights. Or was it not because it was a more complicated department of administration, which has now said that it supports intelligent technology. It's just a part of the solution, and it's been a long time, but it's slow and meets opposition and contrast. Hovsepyan, perhaps positively wander to know what the CE can do, and if he does, he saw such initiatives before that has died out. It is a step, he says, but not the decision that changes the current paradigm. However, Hovsepyan wants to support and consider himself as a person who is in favor of that people who consider it a solution.

Aghayan also sees CE some key in order to change in a system. She noticed that here are always new ideas that are created as a major change, for example, ecosystem services started as a kind of patter transformation and it seemed that everything was understandable. She thinks that CE is not much new and not a full representation of the experience, and even it is constructed on the idea of cyclical processes. She brings some examples saying that there are not new and we still can see that things worldwide, such as using woods shaves. She mentioned that these things can be done better with the quality and emphasizes that they are not new with CE. Aghayan does not think that the CE is new and large enough to have an impact on the fundamental driving forces that have created today's unstable experience. In some aspects, consumers are concerned at this point, but believes that the norms come and go quite fast and are part of the trends. The trend of turnover economy is not felt reliably, such as

the impact of more expensive raw materials. It is difficult to rely on behavioral change, but require political tools to change the rule of the game, interference and taxation, so new norms become secondary and more forced to save the natural resources. Constraints will affect the mechanism of price determination, which will have the same effect over time. It would be good if the policy could speed up the change. Without such a policy, price adjustments will be too late.

Paranyan expresses doubtful sight of the CE as a pattern transformation. He thinks it will not be comprehended as a revolution or drastic change. Though it can rebuild the system so that the final result becomes the maximum shift, in this perspective can be kind of transformation. Consequently, hope that will be a rapid, gradual pattern transformation, rather than a system change from roots. Anyway, if it succeed, it will be look like flashback in accordance to that system shifted. He is frustrating, but says that probably will not be the case. He explains that switching to the CE will be easier, if people can see how to reproduce parts and products, and not always completely new, we should re-lean. He says that he can see that things slowly changing in new generations. When attitudes begin to change, it is good if there is a strong business in circulation, since marketing will help to change the norms and the norms will change the business, thereby promoting a positive response to positive circles.

Adunc contrariwise thinks that indeed CE is pattern transformation. He describes his point of view leaning on what means pattern transformation. He mainly spoke about the potential of the sun energy that we can use. Hoping that we can derive the economy in sustainable wheels. With this also a big transition in thinking takes place.

Sustainable economic growth

The question of economic growth should be of great importance when it comes to the stability of the economic system. The dominant position among society, politicians and businessmen is that economic stability is needed for environmental sustainability. Only in case of economic growth it will be possible to have sufficient financial resources in the form of investments in the form of environmental solutions and overcome social stability in unemployment. Environmentalists, on the other hand, often criticize the desire for economic growth. The question here is whether the CE has the least potential to address the above-mentioned problems and at the same time not to damage or destroy the planet.

Hovsepyan thinks the growth has not been substantiated by proponents of the CE. Aghayan and Hovsepyan point out that the ongoing economic growth is impossible because of natural laws that it is physically impossible. As a consequence of what Aghayan says about proponents of CE, through closed cycles we will not go beyond the boundaries of the planet. Aghayan and Hovsepyan do not agree and are inclined that the entire closed loops are impossible. For example, the shirt from recycled plastic bottles will still contain plastic particles that will expose water ecosystems and accumulate there when it is washed. However, it is better to circulate plastics in this way than to use virgin materials, as they will eventually pass through a multilayer, reach the nature already modified and have a new negative impact on nature. Moreover, in any case, when the product is intended for recycling, reuse and co-ordinates in the system, even in the case of thermodynamics laws, it will inevitably be the loss of energy, in this case

it will be necessary to increase the amount of energy (Aghayan, Hovsepyan) and as a result of the primary impact the quality of the raw material will be reduced (Hovsepyan). Sargsyan also claims that energy-related circuit cycles are unrealistic, as a result of which he sees the energy quality declines. Of course, 100% recycling of materials, as a matter of course, requires tremendous resources, and at a certain point in time, at a certain level of processing, the resulting amount of energy will grow, progressive work will be introduced, and it will be impossible to deliver it to an absolute closed cycle and close it. Aghayan says humanity can register growth without breaking a certain border. Aghayan sees the regional economy as acting on that border, which in its turn will enable us to continue our work, which cannot go too far. If we can produce 100% sustainable energy and 100% recycling it will be possible with continuous economic growth, but it does not correspond to the reality. According to Aghayan, the ideological basis of growth is that we are never satisfied, and he answers why the total amount will continue to grow.

Adunc quoted the author as describing the activities of the economist as a sort of green, colored and black (Laestadius, 2013). Green as an ecologically clean, black as a fossil and volatile, blue-capable, considering black as an opportunity for greenery, such as railway construction or metal mining. He says that with no growth or even an increase in the economy, it should not mean that it is ecologically stable as it can still be a black economy. Thus, Adunc avoids discussing the possibility of continuous growth, not emphasizing whether we can have a stable growth, whether it is unnecessary as long as the overall economic activity is unstable. Adunc claims macroeconomic overview and transition to macroeconomic conditions. All of this is a combination of total consumption and investment, and the whole economy should be CO_2 neutral. As long as it sees only green economic activity, and what it is about to produce, it needs a change of black to grease, thus blurting black and adding green, allowing the blue events on their way. This does not depend on growth, the overall activity of waste should be neutral and if the main production volume is occupied by black, then the green growth does not benefit from this. In his opinion, the CE with only business profit perspective centered on increase of the profits in business, it's not bad to focus on the image. According to him, the activity of the CE may lead to the growth of GDP, but this should not be considered as a bonus. Thus, the growth of the CE is not positive and not negative, as long as it is green, but we should not assume that growth is necessary. Thus, we have to conclude that growth is not a necessity for sustainability, but there are certain political motives and limitations for zero growth. And the GDP growth partially solves these separation conflicts, where other methods should be applied in case of their solving.

Paranyan was the only one among the respondents who seems to be distinguished by the possibility of continuous economic growth and absolute decoupling. It depends on how economic growth is defined and believes that it should be measured in other ways than today's GDP. Consequently, Paranyan says, before we focus on growth, we must first penetrate to make sure that planetary limits are not exceeded, and meet the social minimum. Paranyan also mentioned that during the transition to the green economy, the unstable growth will be inevitable, which, according to him can have good sides.

When we have a divided economy, which is in line with planetary boundaries, then vitality may again increase. Then we can boost the planetary boundaries and make the product more productive with clever innovations. The next step will be step up to the Maslow pyramid, which, according to Paranyan, will be considered as a real development. If it is seen as a growth in the future, and not as an increase in GDP, it should still be decided. If everything is done in a precise sequence and invested in natural capital, then what will happen in terms of growth is difficult to answer, but supposedly, it is possible that a situation where people will continue to chew more quality products, of course, taking into account the environmental limitations. And as a consequence it will boost economic growth. Paranyan underlines that even if the growth continues to be measured in GDP, it is still possible that the CE is a more stable economic system than the current economy which is centered on resource using, and hence result in higher GDP, if it continues "traditions". It is not necessarily higher GDP than today's level, but it may be higher GDP than today's system can create in the future with current capabilityes, so we have to compare different future scenarios with each other and not just in the present time to discuss growth.

Sargsyan also says deficiencies connecting with GDP as a measure and says, like Paranyan, that the goal should be to satisfy people's needs and desires. Thus, maximizing GDP is not an adequate goal, the goal is to meet people's needs and desires, and therefore satisfaction is something that should be measured instead. Sargsyan considers the possibility of sustainable growth as a higher degree of satisfaction of our welfare in the field of natural resource extraction and environmentally sustainable emissions - while defining economic growth is an opportunity and something worth striving for. Thus, GDP is an interesting measure, but only a partial measure that needs to be complemented by measures for CO_2 efficiency, natural resource use, energy content and other environmental impacts.

Hovsepyan says the economy cannot be separated up to 100%, however he believes that we can do more in this regard than today. He says that a decoupled economy is a welcome idea, but based on pleasure calculations, since absolute decoupling is thermodynamically impossible. Sargsyan also believes that absolute separation is impossible. Separation for Sargsyan means we are going to separate the energy base with everything that happens in the economy and in the lives of people. Which he considers impossible, in his opinion we can significantly increase the efficiency of energy use, but not separate it. He says that most people in post-industrial society seem to believe that we are more energy efficient than in the past. However, the relationship between GDP and energy is very strong - equally now as with the rural society. Paranyan says that we must believe in the possibility of absolute separation from the Council of Europe and work to achieve this goal. He believes that a large economy, measured in GDP, will produce large net emissions, so we need a stronger policy to push the rebound effect. Paranyan proposes a political regulation that forces profits to return to green investments, sectors use the money saved by the process, which makes energy and resource savings possible. Thus, proposing policy rules to avoid the rebound effect. He thinks that total emissions will be lower if the economy is more circular and more divided due to more non-renewable circulating more effectively, all primary resources used must be renewable and used for a longer service life, and environmentally friendly products to last longer within ecosystem source limits.

Business impact

It seems that the concept of regional economy and practice are closely related to business, do researchers agree with this viewpoint and take into account the viewpoint and how they treat it both positive and negative. What can this be done for the possibility of the CE to be a positive force for stability.

Hovsepyan and Charkhifalakyan see CE mostly business-oriented and business-centered. They think about some possible person or group of persons with high enthusiasm who will construct questions among business people. They believe that this group should target new businessmen who have not been interested in environmental issues in the past.

CE is a good concept for business that we should be grateful, says Charkhifalakyan. It's not unheard of, that it's made by business, but that's right, because then they do something that makes sense. Then she adds that the changes in sustainable development, and it also means the change in the lifestyle and values, to a more non materialistic culture is large concept for business understanding. She advises that consulting firms and businesses should have a destination as we aim to have less linear flows and more natural adaptation; stability should remain a goal. That is good, she says, that business primarily focuses on effective resource flows because business is hard to negotiate on culture and values. To have a positive impact, however, one must pay attention and not only through the CE's greater profit, but also approaching stability and accountability. Unless sustained by sustainability, the CE practice will only continue to work effectively and gradually improve.

Paranyan believes that the CE is developing cooperation among researchers, business networks and consulting firms. Like a reason for expressing the CE in financial interests, employment, and growth is to get politicians as politics can greatly help the CE further steps.

Aghayan expresses such thoughts as Paranyan that researchers are mostly using the CE to do more work in the court of the business, which is a good breakthrough. Nevertheless, it emphasizes that it is best to remove the prospect and see that in the big picture is much more than the CE is needed. Business lease or service business sales model says to give incentives for the busineses prespectives to keep products longer. This is fine, says Aghayan, but at the same time, it is a risk in businesses they will own more and more and have more and more people depend on businesses we have. This allows a higher complexity system and a higher risk of exclusion, who cannot afford to lease.

Sargsyan sees the CE as a quite good way of discussing about sustainable development in the context of current business comprehension. Today, he believes that business stability will be more interconnected in the recent series of stability than actually working sustainably by means of business. In general, we are punishing business, and not encouraging those who have a solid foundation. However, the industry should not be perceived as a bad guy, it is a policy that should set boundaries, Sargsyan says. Thus, in order for a circular business to be sustainable, it must look at the entire company, and not at individual processes or products.

Globalization

Today's economy is heavily globalized for all types of goods. This section tries to answer the question if the global economy can be organized on a global level for CE to achieve stability.

Aghayan and Charkhifalakyan note that the CE should be of all sizes and that the geographical scale can have circular processes. Circular processes should try to connect different types of businesses and urban environment can create portable processes by working infrastructure to create a functioning metabolism.

Charkhifalakyan and Aghayan both discuss the current environmental problem of transportation. IN this perspective, Aghayan notices that CE should be more local, in order to get raw materials from nearby rather get them from far away. Aghayan explains that infrastructure such as like underestimated transport and subsidized energy should be changed so that the global system can be ecologically clean and environmentally friendly. If the transportation system is properly evaluated and real costs are taken into account at market prices, we will have a larger number of local markets. Then we will have another model of globalization and, in turn, a shorter flow of resources that will be considered regional and local. With the regional economy, the food industry will move closer to local and more commercial models. Something is wrong in the world market model today and it is the wrong ideology in reliving that the decisions on the world market is efficiently decided and priced. How can market prices change if we keep on protecting human rights and internalizing environmental costs, Charkhifalakyan asks rhetorically. A dilemma, however, is that even though developing countries would have the largest social and environmental gains their production would be hard-hit economically with a real green economy that is as circular as possible. The reason for this is that both social and environmental disruption is the largest, and therefore will require more significant changes and investment. These are questions that are not yet answered in CE theories.

Paranjan thinks that a stable global system can be obtained through right investment and policy. However, it will not be as it is now. It should be double-globally, double-localized and double-localized. In general, we need to have more local flows, but there may be some resources that are imported from outside. More biologically viable materials should be circulated with local scrubbing, or at least with regional pumps.

Course dependencies

The linear economy today is largely dependent on fossil fuels and other environmental adverse effects. In CE, one could ask whether there are other risks or even signs of a new exchange rate dependence in an unsustainable way.

Charkhifalakyan believes that the regional economy is capable of creating new negative course dependencies. She believes that the emphasis on reprocessing and secondary use can help keep it in the system which is should not desirable to use at all, it means the materials that are subject to substitution. There is thus a risk that businesses working circular might settle for unsustainable material in the resource flows just doing the flows more efficient but not thinking of that the basics is unsustainable

no matter what. CE can also create blockages in technical solutions that are circular in themselves, but are in themselves a business idea that is unsustainable and needs an alternative.

For reasons of road dependence, Parianyan mentions that the metals and all the resources that have been removed from the Earth all this things its better circulat rather then not circulate them. It is however essential to think of the ecological effects and keep that i n mind within CE, thus not only have the loops as a single goal and being satisfied there. The new CE business models that are popping up could create lock-in effects if clients are signing long contract of leasing instead of buying new products. Also continue to use old techniques even if new better energy generation is available for instance. Being dependent on rare earth elements and how to deal with imports is rather a political question than a question for CE he says. We will be dependent on both these metals and imports, the question is how to grasp what we need in a sustainable way, in regards to all three sustainability dimensions.

All other respondents agreed that there is always a risk of course ependencies, but does not have much sense about questions those go depper in case oc CE.

CE and Sustainability

All of the abovementioned topics are part of the investigation connected with CE sustainability study. This part is devoted to investigation of possibility of CE to succeed in promoting to a sustainable development. Humanity need to find way and distribute resources in a smart way giving to more people a higher welfare. There should be a form of economy that will be based on a rehabilitation, regeneration inventory. The regional economy should represent a replacement model that does not replace the entire economy. This starts with efficiency measures and continues with new business models. In this case climate changes is not a bid deal and does not require huge focus on it. Create a regenerating economy that returns all material flows and for instance phosphorus and nitrogen and the rare earth elements is the biggest challenge (Wijkman & Rockström, 2012).

Aghayan thinks that the CE is trying to find answers to many questions and tries to incorporate the notion that is incompatible with itself, and she prefers to divide the ideas. For example, can we solve energy problems with renewable energy sources and solar sources. She thinks it is a matter of separate research. At the same time fossil energy has to be liquidated – CE is not solving this she says. His fears about the CE include that it looks like the CE is trying to include everything and that's why it's becoming more and more risky in a realisation. Paranyan on the other hand thinks that focusing on “The Maslow-needs-provisioning” effects are more important than defining if something is actually part of CE or not.

Adunts and Paranne note that the CE can be non-favorable in terms of environmental or sustainability, depending on where the focus is on. Paranyan stresses that circulation can be either productive or ineffective, one could put everything in cycles but that do not mean it is good to keep it in use. The most important thing is bio-effectiveness. Hovsepyan says those businesses that have a new business model with CE should not have to have an environmental profile- it could be done in order to give people breath free and some sense of convenience before they will do their businesses environmentally good. This can be a step on the road, but not solved because the exchange of the

economy may still require resources, if we then see the possibility to have access to more new things rather than just sharing what we already have today.

Paranyan explains that if you look at the outside, you realize that the extreme balance is currently moving in the wrong direction, that is, we contribute to the heating of the surrounding area. In our economy, real income can be expressed as the amount of solar energy that we successfully save in creating a positive potential in our work, so we continue to grow to preserve what we have already invested in energy, and not to destroy life-sustaining systems and useful resources to people's trust, as we do today. The CE can help in this regard, which enables us to keep what we have already invested in energy. Obstacles to the economy and society should be based on natural sciences and based on biophysical properties and properties, there are no relative restrictions with which you can trade, for example, prices. At the same time, he must meet the social needs at maximum, said Paranyan.

Aghayan says it is remarkable to have production system which has circular posibilityes, but it should not be thought that this is a change in the economic system. To achieve stability, we must think deeper and continue work , and not only transmiting in cyclical processes. This should be done, but that's not a solution, for the bigger perspectiuve we need something more as a cange in whole system. Aghayan emphasizes that it is good to lift the gaze and see that in the big picture a lot more than CE is needed. CE is good and is part of a sustainable development solution, but we need to rethink economic growth. It is important to distinguish and understand what may be hidden under the CE, so one should not hide the fact that the idea of the CE conceals only ecosystem changes. And instead of ignoring the idea of making more significant changes. Aghayan says that this framework should be set beyond what we need to regulate the flow of resources in the economy, not just setting rules in the economy, thereby regulating the borders of the system and shrink the economy, at least with material flows.

Hovsepyan expresses similar thoughts on the risks associated with the CE. To say that he thinks that if the processing industry can win the market share at the expense of other enterprises, it is a risk if it is considered a long-term solution. The CE's sustainability depends on where it goes and we have to be careful and at the same time oversee the overall energy consumption and transportation. If circulating materials is taken as a reason for not forbidding certain substances – for instance heavy metals – then it has to be reevaluated after a while – how much is recycled and how much is leaking into the ecosystems. It is important to watch out so that it does not just become rhetoric’s but an actual systems shift. Sometimes it seems like business is calling things circular production even though there is not a big difference in action – again a fleece sweeter from plastic bottles is not a circular product but just stretching the linear process. Hovsepyan sees the greatest potential for closed loops in food supplies.

Charkhifalakyan points out that the CE is more than reprocessing and reuse. This is indeed the reproduction of the natural economy and the reduction of linear resource flows. For the potential to be solved, the CE should concentrate on new business models rather than the ultimate solution. She believes that CE can delve into lifestyle issues and deals not only with the flow of resources and their processing - but this is the basis of this. CE is an old concept that is now popularized to show how to make money out of it and make great profits through efficiency. She says that in order to achieve stability,

we need to deepen what we need to do, taking into account the sustainable development principles. Sustainable development is a more significant transformation of values than consumption and production systems, and we need radical changes that at the same time reduce our consumption and our needs. She sees the CE and the green economy as a means of creating an effective industrial structure in the economy. However, green taxation, which is additional, similar to marginal changes, can lead to greater transformations. CE can also lead to transformation, but by itself is not a radical concept. She notes that CE is part of the decision of stable systems. However, she also notes that circular businesses often have no vision. Instead of efficient use of resources to save money that will be used in other business areas, this amount should be directed towards sustainable development.

Adunc notes that social and economic stability does not work or does not provide any benefit if there is no ecological part, which is more important for the ecological part of the sustainable development. If we have less than 20 years to reduce CO_2 emissions before losing control on it so that we do not reach more than two degrees and thereby find a possible point of departure, Adunc emphasizes that we cannot start social or economic transition. Instead, the ecological transition should be put in front. However, social factors should be taken into consideration so that they can make the passages required for ecological stability.

The CE can play an important role in a stable planetary boundaries system, says Hovsepyan. At the same time it should be problematized. It is better that businesses embrace and grow with circular business models than with the old linear model, but it is not the solution just an amelioration. Industry and politicians will not hear the person who comes and says that we have to break and slow down, so it's a good approach, though a little dishonest. In a long-term perspective, we both have to close the loops and draw down on the scale of the economy. Then, get the wheels turning more slowly and slow growth. The latter is difficult to get people to listen to. Hovsepyan explains that the transitional movement says that we have to solve the big problem right away so that we do not lose CE or other "small" solutions. He believes, however, that in the short term, the CE will continue further development, and long-term outcomes are difficult to anticipate. It is possible that people do not want to hear the message of stability.

Paranyan believes that the CE is the way we should take. The discussion is in the right direction, but true policy is, however, wrong or inadequate as it thinks. However, Paranyan says that due to political, social and economic weakness the system will hardly be able to achieve stability.

The idea of Aghayan sustainability is to think fully and systematically, not parts and focus on increasing or decreasing consumption.

In conclusion, we can say that CE seems to be a new composition of old concepts that can influence the transformation of patterns. To realize his potential, he must maintain stability as a goal and help in the form of a new policy. Then the CE is likely to become part of the sustainable development solution. Below two tables (Table 1 and Table 2) summarize the ideas given above by the interviewers.

Table 1. Summary of the main ideas expressed by the interviewers on topics such as pattern transformation, sustainable economic growth and business impact

Interviewer	***Pattern transformation***	***Sustainable economic growth***	***Business impact***
D. Adunc	Sees the transformation within using potential energy from the sun and foregoing the fossil dependencies.	Question of growth should be subordinate. Focus should be on the whole economy. Activities have to be "green".	Strong opinion about CE to be business oriented.
H. Sargsyan	Does not think that idea are new. Formulated is as a rediscovering of the wheel.	Do not inclined that absolute result is possible. Loops cannot be closed. Materials will deteriorate with time.	Strong opinion about CE to be business oriented.
S. Paranyan	CE could lead to a pattern transformation due to a transformation in mindset.	Decoupling is possible, if economy is regulated with taxes and policies, avoid rebound effect, instead sustainable direction.	Strong opinion about CE to be business oriented.
L. Charkhifalakyan	Idea is not new. It can lead to something new with gaining ground and bringing people business along to each other.		Thinks normal to focus on business on effective recourse flows. Stability should be the main goal and not high profits.
R. Hovsepyan	Does not think that idea are new. Compared with the new stile clothes of queen.	Thinks that the supporters of the CE do not doubt the growth issue	Express connection strong as long as it gives business tools to work more stable.
M. Aghayan	Sees CE as a change within the current system. This may affect the main driving forces and norms.	Such as Sargsyan. Can exist always that closed loops, there will be needed additional energy to transform things.	Sees risk in producing more services and increasing leasing instead of production products and goods.

Table 2. Summary of the main ideas expressed by the interviewers on topics such as globalization, course dependencies and CE and sustainability

Interviewer	***Globalization***	***Course dependencies***	***CE and sustainability***
D. Adunc	Importance the role of transportation problems	Agreed about the existence of course dependencies but don't have dipper comprehension	Sees potential of renewable energy as a one of the most promising parts. CE does not have to be clean
H. Sargsyan	Importance the role of transportation problems	Agreed about the existence of course dependencies but don't have dipper comprehension	
S. Paranyan	Sees costs of production and transportation remarkable in terms of trade patterns.	Stressing that environmental impacts should be taken into account and not concentrated on circulation only	Depending on business CE does not have to be clean. Thinks CE should go public and next to political initiatives.
L. Charkhifalakyan	CE should be on all scales. Huge importance giving of transportation problems.	Sees also negative course dependencies, like in recycling process there are materials which instead of substituted are capped in loop.	CE should be implemented about new business models to achieve full potential Belief that CE can deepen the way of life.
R. Hovsepyan	Importance to transportation problems	Agreed about the existence of course dependencies but don't have dipper comprehension	CE models should not obligatory be environmentally friendly. Sharing economy is recourse demanding.
M. Aghayan	CE should be on all scales. Regards to transportation problem, CE should be more local.	Agreed about the existence of course dependencies but don't have dipper comprehension	Concepts that are not feted into the idea of CE should be separated. For example renewable energy issues should be represented as a separate research.

2.2.2 Formalization, identification and aggregation of functional links in the region ecological-economy energy systems

The Republic of Armenia is divided into 10 regions. Large industrial centers are located in Syunik and Gegharkunik regions. Large quantities of waste emissions are also dispatched to those regions mainly. Recent surveys done by National Statistic center of RA show the number of wastes generated by the regions throughout the year, as shown in Table 3.

Table 3. Quantity of waste generated on organizations during the year by RA regions, for the period 2013 to 2017 (values in Tons)

Regions	***2013***	***2014***	***2015***	***2016***	***2017***
Aragatsotn	1 850.0	1 276.0	1 159.0	1 171.2	769.9
Ararat	545.7	757.4	900.3	693.9	2 005.2
Armavir	9 891.3	8 167.2	5 233.6	13 486.7	6 978.6
Gegharkunik	27 687 552.5	24 315 026.0	25 663 129.5	29 291 917.1	32 253 862.6
Lori	41 549.0	36 123.7	35 487.7	94 981.6	2 648.5
Kotayk	3 180.7	1 616.3	6 013.9	4 111.8	1 652.9
Shirak	2 261.9	2 934.0	2 035.0	51 890.4	16 983.0
Syunik	21 561 901.3	22 124 313.4	21 604 078.9	25 686 423.3	27 250 668.1
Vayoc Dzor	85.9	146.3	2 378.6	602.6	231.0
Tavush	1 412.1	1 348.1	129.0	353.0	1 780.6
Total RA	**49 332 122.5**	**46 511 925.7**	**47 338 512.1**	**55 161 397.7**	**59 622 444.3**

From Table 3 we see that around 45% of the country's waste is consumed in the Syunik region. It is noteworthy that the choice of that region is that Syunik is a very important and strategic region for Armenia. And today the state is exerting efforts to increase the population and tries to attract investors' attention and financial flows there. This, in its turn, gives an additional importance to the region. Currently, the waste is discharged in tailing dumps, which is only a temporary solution. In Syunik, there are natural reserves that are endangered in the presence of current environmental waste.

The following table (Table 4) shows the transport of waste trucks by means of organizations waste according to regions.

Table 4. Quantity of waste transported to landfills by means of organizations by RA regions, for the period 2013 to 2017 (values in Tons)

Regions	***2013***	***2014***	***2015***	***2016***	***2017***
Aragatsotn	1 721.6	1 242.8	904.9	862.5	519.5
Ararat	2 772.5	2 980.4	3 346.5	248.5	32.4
Armavir	5 387.1	1 502.2	743.8	13 275.6	85.0
Gegharkunik	27 688 759.7	24 312 736.4	25 643 687.8	28 650 673.0	31 973 248.0
Lori	8 084.0	4 540.9	7 344.3	1 334.2	2 199.4
Kotayk	5 156.8	6 507.7	7 338.2	10 045.3	787.1
Shirak	1 970.0	2 733.8	2 203.8	1 759.9	16 773.2
Syunik	18 149 304.6	18 570 288.6	18 068 054.4	19 660 649.1	24 571 786.9
Vayoc Dzor	362.0	431.5	603.3	590.6	213.0
Tavush	1 376.3	1 299.2	1 241.2	299.1	0.6
Total RA	**45 880 273.0**	**42 920 849.2**	**43 747 501.8**	**48 350 702.8**	**56 616 312,9**

Judging by the data that we have been given, the Statistical Bureau is becoming increasingly apparent that annual growth in Syunik region is driven by a considerable pace of waste. Taking this into consideration, and taking into account the quality of the waste, government of RA already deals with the need of construction of recycling plants. Taking into account this and the great importance given by the respondents to the transportation problem, we will sole the transportation problem in Syunik region. Which will aim to minimize the total volume of transported raw materials, from factories to recycling centers.

Syunik region is situated in the South of Armenia and occupies 15% of the territory of the Republic. It is rich in flora and fauna, forested and water resources. It is also rich in certain mineral resources and is considered to be the richest mining district with 9 metallic and 38 non-metallic deposits. It is natural, where there is mining industry there is pollution. Unfortunately by pollution Syunik region is also at the first place in Armenia. The region's water, forests, land resources are bearing negative effects of enterprises tailing dumps, industrial wastewaters and sewage disposals ("Armenia - Disastrous ecological situation in Syunik", 2016).

The region plans to build three waste-processing plants, which will be supplied with raw materials from five industrial communities and cities. Table 5 represents the matrix representation of the dependencies. Consumers are mentioned in first column, in which case they are factories. Raw materials suppliers are listed on the left from left to right. The last column representws the maximum capacity of each plant in accordance per year. The table outlines the distances between consumers and suppliers.

They are represented in matrix (3). On average, suppliers of raw materials deliver to cotton, nutrient, polyethylene waste, glassware and sewage sludge, respectively, 2, 4, 8, 10 and 6 million tons.

Table 5. Matrix representation of source data

Plants	***Industrial communities***						***Waste requirements***
	A1	***A2***	***A3***	***A4***	***A5***	***A6***	
P1	30	60	100	50	70	0	20
	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	
P2	110	50	40	50	70	0	20
	X_{21}	X_{22}	X_{23}	X_{24}	X_{25}	X_{26}	
P3	60	70	40	40	100	0	20
	X_{31}	X_{32}	X_{33}	X_{34}	X_{35}	X_{36}	
Waste inventory	2	4	8	10	6	30	60

Matrix representation of the distances (km) between plants (consumers) and industrial agglomerations (suppliers)

$$C = C_{ij} = \begin{pmatrix} 30 & 60 & 100 & 50 & 70 \\ 110 & 50 & 40 & 50 & 70 \\ 60 & 70 & 40 & 40 & 100 \end{pmatrix} \quad (3)$$

Where C_{ij} (j = 1, 2, 3; i = 1, 2, 3, 4, 5) is the distance in kilometers from the j-th supplier to the i-th consumer.

The objective of this transport problem is to determine the minimum capacity of the plants in millions of tons of processed raw materials per year in such a way that all waste of industrial agglomerations is processed and the total traffic volume (in ton-kilometers) is minimal. The capacity of each plant should not exceed 20 million tons of recycled waste per year.

Initially, for the convenience of solving the problem, we will assume that the incoming raw materials from each industrial agglomeration to each plant were processed and the total traffic volume (ton-kilometers) was minimal. The capacity of each plant is 20 million tons of recycled waste per year; and the total supply of five suppliers of raw materials is 2 + 4 + 8 + 10 + 6 = 30 million tons, thus demand for 30 million tons will exceed supply. Therefore, the mathematical model of this task will be open, and in order to obtain a closed model, we will introduce into consideration a fictitious supplier to each of the

plants and we will consider the delivery rates equal to zero, so the traffic volumes from the fictitious supplier to the plants will be zero. In matrix C, a 6th column of zeros will be added. Having completed the solution of the modified task and then excluding from consideration the volumes of deliveries performed by the fictitious supplier, it is easy to find a solution to the original problem. After will make a mathematical model in which the required volume of raw materials is taken as Xij. In this case, the matrix of planning the structure of consumption of raw materials (4) is as follows:

$$X = X_{ij} = \begin{pmatrix} X_{11}X_{12}X_{13}X_{14}X_{15}X_{16} \\ X_{21}X_{22}X_{23}X_{24}X_{25}X_{26} \\ X_{31}X_{32}X_{33}X_{34}X_{35}X_{36} \end{pmatrix} \quad (4)$$

Where X_{ij} is required volume of raw materials.

Below matrix is used to plan the volume of waste transported for processing at the plants. The total volume of waste transportation is (million ton-km):

$$Z = 30X_{11} + 60X_{12} + 100X_{13} + 50X_{14} + 70X_{15} + 0X_{16} + 110X_{21} + 50X_{22} + 40X_{23} + 50X_{24} + 70X_{25} + 0X_{26} + 60X_{31} + 70X_{32} + 40X_{33} + 40X_{34} + 100X_{35} + 0X_{36}. \quad (5)$$

Following system of equations (6 and 7) are taken form the objectives of the problem.

1. All waste intended for recycling from cities and industrial areas should be taken to the plants:

$$\begin{cases} X_{11} + X_{21} + X_{31} = 2 \\ X_{12} + X_{22} + X_{32} = 4 \\ X_{13} + X_{23} + X_{33} = 8 \\ X_{14} + X_{24} + X_{34} = 10 \\ X_{15} + X_{25} + X_{35} = 6 \\ X_{16} + X_{26} + X_{36} = 30 \end{cases} \quad (6)$$

2. The needs of all plants must be fully satisfied:

$$\begin{cases} X_{11} + X_{12} + X_{13} + X_{14} + X_{15} + X_{16} = 20 \\ X_{21} + X_{22} + X_{23} + X_{24} + X_{25} + X_{26} = 20 \\ X_{31} + X_{32} + X_{33} + X_{34} + X_{35} + X_{36} = 20 \end{cases} \quad (7)$$

Further, the matrix model has the form to find the smallest value (min) of the objective function Z, which is determined by equality and subject to constraints, assuming that all unknowns are non-negative. Table 6 represents the optimal distribution of raw materials between plants.

Table 6. Representation of results of distribution of raw materials

Plants	***Optimum delivery***					***Total in each plant***
P1	2	0	0	0	6	8
P2	0	4	8	0	0	12
P3	0	0	0	10	0	10

From Table 6 it is observed that the minimum capacities of the plants (P1, P2, P3,) are equal respectively to 8, 12 and 10 million tons of waste per year. At the same time P1 takes 2 million tons of waste from the first supplier (A1) and 6 million tons from the fifth (A5). P2 takes 4 million tons from the second (A2) and 8 million tons from the third (A3). P3 gets 10 million tons from the fourth (A4). These are the optimal distributions to each plant, taking into account the objectives of the minimization transport problem. Also the minimum total volume of traffic will be 1 400 million ton-km.

Conclusions, limitations and suggestions for further analysis.

The aim of the research was to propose the implementation of measures to increase the environmental protection efficiency in the Republic of Armenia. The framework to achieve these goals was to use the sustainable development theories and circular economy solutions. Although many ideas of the CE are not new and return more and more to the original meaning of the economy - save at the expense of resources - This can be a new way to combine knowledge from different areas and its influence on the economy and politics. Thus, if a business is chosen widely enough, this may lead to a paradigm shift in practice.

There is no need to accept that economic growth is or is not an opportunity for the CE in the context of sustainability. As for the conclusions in this thesis, then, apparently, you can continue to hold different views on this issue and find out it during the trip. However, it is important not to set any expectations about GDP as a goal in the CE system, but to use measurement as a tool on the way as long as necessary. Thus, having welfare and sustainability as a comprehensive goal, but at the same time, enterprises have the opportunity to strive for growth. Paranyan tend to belive in separation, but, as other researchers say, there seems to be no evidence of absolute separation. Growth should be viewed as positive and take nature as an example. Natural cycles not only grow and grow, but also sometimes die to give nutrients for new things.

Today, CE is mainly business oriented. As can be seen from the analysis, this is one of its strengths, since it can attract more companies that have not previously addressed sustainability issues. From business administration we know that what you measure is what you get (Merchant & Van der Stede, 2007) and thus, a problem may arise when companies operating with CE do not do this in order to ensure sustainability, but continue to measure profitability as their main goal. As mentioned in the interviews, the objective should be laid on sustainability, making CE to develop in this way. The time to move to CE ideas may be right now due to lack of resources, advanced information technologies and consumer attitude and comprehension, which makes people more ready to access through possession. This may be so, and it seems that the CE attracts attention and engages. Information technology can help support solutions that allow for more environmentally friendly and, for example, exchange products. However, focusing on technological solutions, there is a risk of higher complexity in society. The technology also increases energy demand and makes us dependent on rare earths and other natural resources. As stated in the interviews, savings and sharing in productivity can also be very resource intensive and do not provide overall lower resource consumption, since we, for example, may see an opportunity to have access to more products and constantly want to continue upgrading. Thus, a lower overall consumption lever is still needed. In addition, there is a risk that enterprises will get more power,

and people will become more dependent from the moment of renting or buying services, and with this - a higher risk of social complexity and exceptions for those who do not have financial resources.

As some of the surveyed researchers pointed out that thinking in loops is not a guarantee of environmental friendliness. Thus, it is important to not forget the principle of non-toxicity and find out what Braungart and McDonough (2008) call unmarketable materials, which should not contain a biological or tutrient node. Creating a regenerating economy can expand the outer boundaries in a way that Paranyan talks about. Thus, remembering what noted Rockstrom about CE that it is a transformative process and not a ready package, even if today in the practice of the CE there are gaps between theory and practice, this should be viewed as a process.

As shown in this work, the importance of the transport problem for the purpose of reagent distribution. As a result, his positive financial impact is a useful way to reduce costs. Thus, the total volume of waste transportation has been minimized.

As shown by this work, the CE has the potential to take part in changing the system of stability. However, the development of the regional economy can not be leave alone by the enterprises but should be followed by political tools, that at the systemic level should reduce the impact of the economy on the planet and begin to seriously respect planet before reach the points after which there is no way back. As shown in this paper, the importance of the transport problem for the purpose of reagent distribution. As a result, his positive financial impact is a useful way to reduce costs.

We can say that very few researches have been made in the sphere of regional economy and food supply. Interviews gave importance to food supply issues, and more local and closed loops. Consequently, there is a need for further research in this area. There is some in the planning and production cycle of the regional economy associated with the use and recycling of materials. Materials that remain within the cycle, instead of being substituted for the cycle, should therefore be considered in all production planning cycles. More deep research is required in this area to understand whether all these materials are safe in production. The regional economy has not yet responded to such questions.

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