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Role of Drought Early Warning and Social Planning in Industrial Growth

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Abstract

This paper presents challenges on industrial growth planning. A component of population change is dynamic in time and space, and has more dynamic components such as psychological, human preparedness, education level, and the most important one, which is the percentage of the population that is most vulnerable. Population change can influence growth due to the lack of trained and educated personnel, a rise of pressure on industrial sectors and variation in wages. The reason for this lies in the dependence relationship between the percentage of the working population and the other aspects of society such as the percentage of most vulnerable within the population and issues like population change. Industrial growth planning also depends on environmental issues and available resources. Climate change and climate extremes influence the availability of resources, especially water in case of drought. In all times the most important resource of all is water which has to be spread between different sectors and users wisely. Industrial development relies on good planning and proper management of all resources, natural and human.

Key words: *population change, industrial development, early warning, preparedness, natural resources, human resources*

1. INTRODUCTION

Global trends clearly show that flood and drought related disasters account more than 50% of the total economic losses due to natural hazards. Agriculture and the food industry are sectors hit hardest by disasters triggered by hydro-meteorological hazards. Disasters have a huge impact on the informal economy, especially in developing countries such as Serbia, where the organized sectors account for only a small fraction of the work force. Even though natural hazards can be life threatening, in this paper we more focus on the influence of the natural occurrence of hazards and the indicative population change on industrial development. The main assumption of planning in the prevention of, or reaction to, hazard situations is that we have static distribution of population, with a constant coefficient of vulnerability. This assumption only helps in identifying the most general needs, procedures and population categories under the risk. Financial, social and investment planning requires a much more accurate approach.

In order to gain an understanding of the interrelationship between the overall structure of a population and its various dependent components, vulnerability, financial planning and industrial development planning requires an interoperable logistic within and between factors such as hazard risk assessment, early warning, both macro and micro economic planners, investment trackers, financial institutions, various non-financial sectors, infrastructure planning authorities and government.

Drought historically has caused direct and indirect economic, social and environmental problems throughout the world. Some of these problems are difficult to avoid, even with early preparation. However, other ills are avoidable, especially those stemming from poor economic planning and delayed drought response [1]. Industries at risk from drought induced economic losses are the water supply and irrigation systems industry, food production and fisheries, agriculture-dependent industries, hydroelectric power, tourism, farming, construction industries etc. Increased unemployment within the agriculture sector, and losses among other drought-affected industries, are a strain on financial institutions (due to capital shortfalls, increased credit risk, etc.). There is a loss of revenue to both the

state and local governments (from a reduced tax base), there is reduced navigability of waterways, and there are increased transportation costs. These are just some of the effects of drought felt by municipalities, business and industry, agricultural enterprises, households, individuals and governments [2].

2. INFLUENCE OF DROUGHT ON INDUSTRI DEVELOPMENT

Mitigation of population migration and social planning do have an important role in ensuring that natural events are not converted into disasters. Human intervention can increase the frequency and severity of natural hazards. Hazard risks make economic growth projection targets vulnerable, and the occurrence of a disaster during a planning cycle can seriously retard development in general and negatively impact poverty outcomes in particular [3]. Due to the overlooked negative influence of disasters on the recovery of developing areas, the economic impact of disasters is usually underestimated. By incorporating valid hazard risk assessment within national macroeconomic projections, effective policy options at the national level can be explored and prudent preventive and mitigation measures can be implemented to make the economy more resilient.

One way to measure impact of a drought is to look at changes in Gross National Product (GNP) or Gross Domestic Product (GDP). According to records of NBS (National Bank of Serbia) in 2009 and 2012 GDP recorded a fall of 3.5% and 1.5% respectively. In order to better understand the effects of drought in Serbia, it is necessary to identify the industrial sectors most dependent on weather and climate. These are the sectors whose activities are affected in major ways by adverse weather and climate, and at the same time have a large contribution to the GDP. The most important sector is agriculture, followed by the water supply and irrigation systems industry, food and fishery products and other agriculture-dependent industries, hydroelectric power, tourism, and the construction industries. The agriculture sector is one of the most important sectors in the Serbian economy. Primary production from agriculture accounted for approx. 12.7% of GDP in 2009. Over two thirds of the total land area of Serbia is agricultural land and two thirds of the population living in rural areas is involved in agriculture. In a country characterized by its rich land resources and a favourable climate, agriculture represents a vital sector of the Serbian economy. Drought is a real threat for Serbian agriculture. For example, according to the evaluation of drought impacts on the crop yield in east Serbia in the period between 1989 and 2000, the average drop in yield was 40.9% when compared to the average annual yield in the years without drought.

Bearing in mind the projected increase in air temperature and decrease in precipitation, agricultural production will be very vulnerable to climate change in the future as cited in the initiative on “Capacity Development to support National Drought Management Policy” (WMO, UNCCD, FAO and UNW-DPC), a national report about drought conditions and management strategies in Serbia).

In 2012 Serbia experienced its warmest summer since 1887, with air temperature passing 35 degrees Celsius for more than 50 days. Corn yields were half of the projected amount. More than one million hectares were hit, mostly sown with corn, maize and soya. Damage exceeded 130 million €. Palic Lake in the north of Serbia was artificially filled with many thousands of gallons of water from a river to save its fish and ecological system.

Drought impact on society in general expands due its influence on essential services like energy production. Drought started in 2009 and was in effect until 2013 which caused a serious hydrological situation which has had negative effect on many economic branches, especially the transportation traffic along the Danube and sowing works in agriculture. The regional power-supply industries have also suffered damage, as due to the low water level in the rivers and hydro-electric power plants worked at their minimum capacity.

On average the Serbian consumer spends over 40 percent of his/her monthly income on food. With current food price increases, the average consumer will spend over 50 percent. Serbian consumer spending is focused on basic food stuffs. The influence of drought on food prices is inevitable. Drought occurrence is widely predicted to become both more frequent and more severe. Thus early warning and planning is of critical importance.

3. OVERVIEW OF POPULATION CHANGE COMPONENTS THAT INFLUENCE INDUSTRIAL GROWTH

A population’s structure is of high importance for industrial development due to the intimate connection between manpower productivity and the rate of which production expands in a given area. A rise of output per man-year leads to improved productivity and even gradually to a reduction of end-product prices that can influence a rise in market share of a product without changing its quality. In contrast, the impact of higher wages and capital costs cannot be counterbalanced by increasing productivity due to productivity limitation in a human resource. The consequence of this is a persistent rise of prices and a loss of market share [4].

Industrial growth is not linearly connected with the growth of population involved in industrial production. Population demand on resources and market share excludes this direct connection. As an example, in IT industries the line of industrial growth will follow the line of involved individuals to the point where a continued rise in the number of involved individuals will lead to industrial decline. Any industry can only support a finite number of dependents; otherwise prices will start to fall rapidly, which leads to fall of wages and quality of products (basic supply and demand). Industrial growth has to take into account the limitations that demands make. Demand is made by the population that is using the end-product or services. Industrial growth can be sustained only if there is a parallel growing demand

capacity in non-industry population. For planning in any industrial sector there has to be an acknowledgement of their vulnerability to changes and negative factors on their specific industrial population and the relationship to factors within the greater general population. In the case of the IT industry, there is vulnerability due to the long-term brain drain and to infrastructural vulnerability resulting from natural hazards. These have to be taken into account. In the case of agricultural dependent industries, there needs to be a recognition of the frequency of potential natural hazards and they need to factor in the aging of the population engaged in agriculture and related industries.

Vulnerability is a factor of how small or great the consequence will be, should a hazard or change manifest. There are generally four types of vulnerability: physical, social, economic and environmental [5]. The social vulnerability measures the individual, societal, political and cultural factors that increase or decrease a population's propensity to incur harm or damage as result of a specific hazard or change [5]. Certain behaviours can contribute to or reduce that population's ability to protect itself from harm.

Factors that influence the level of social vulnerability are: religion, age, gender, health, literacy, health, politic, security, human rights, government and governance (including social security), social equality and equity, traditional values, customs, culture, and population change (migration). Some components of factors related to people, we can assume stay more or less constant over time (such as religion, gender, traditional values, customs, culture), plus time variables such as age, health and literacy. Components that are generic are political, security, human rights, government and governance, social equality and equity. The most complex factor is population change, as it is a time and space variable that includes all factors, both personal and generic ones.

Population change has three components: births, deaths and migration. All population change components are influenced by the relationship between all personal or generic social vulnerability factors. The most basic method of calculating numerical population change over time is the "balance equation", shown (1.1)

$$P_1 + (B - D) + (I - E) = P \qquad (1)$$

Where P2 is the population at a later date, P1 is the population at the earlier date, B is births and D is deaths between the two dates, and I is immigration (or in-migration) and E is emigration (or out-migration) between the two dates. To estimate the influence of population change on vulnerability two steps are to be done:

1. Defining categories of vulnerable population - vulnerable and most-at-risk populations are key populations where vulnerability and high risk converge. In every society, there are individuals and population groups who are more vulnerable than others to come to harm. For instance, to become sick or to experience poverty and social rejection. Generally, the very young, the elderly and people who are sick or live with a disability are especially vulnerable in every society. In some societies, women, ethnic or religious minorities, migrants or other groups can also be especially vulnerable to abuse, discrimination and even hatred which in the event of a hazard, or through sudden change, an induced situation can be magnified. Often, it is not so much the actual composition of a particular population that makes it more vulnerable, but rather how that population is regarded by others, for example by their local community, society, at the political level or by the business sector. For that reason a population who is vulnerable in one country, could be well protected in another (Canada vs. Serbia).
2. Estimating dynamic of population change - population dynamics includes birth and death rates and factors that influence demographic change

Population change in an area can be triggered by political changes, environmental changes or most commonly by a change in the availability of resources, or through a hazard occurrence

4. CASE STUDIES

With the aim of showing the influence of population change on the vulnerability within society two case studies were done. Observations were taken in two countries and their population change: Serbia and Canada.

The first reason to compare these two countries was the fact that there is high level of migration between them. As well, a government's and a population's financial status influence the population structure itself and affects its ability to protect itself from the consequences of a disaster or to adapt an industry to change. Taking into account their differences in economic and social security matters as factors of influence on generic components of social vulnerability, we were able to focus just on population change as main factor to define population vulnerability fluctuations.

Within the migration literature vulnerability and risk are key concepts in explaining migration from the point of view of the 'migrant at origin', 'migrant in transit', the 'migrant at destination' and the 'migrant's family at source' location. Migration is an issue of primary importance in Serbia. Migratory movements of the Serbian population have been caused by various historical, social, political, economic, and demographic factors.

Serbia has been and continues to be a country of emigration. Inflows are moderately increasing in recent years, mainly due to immigration from other countries in the region and also from further East (e.g., China). The main status of immigrants are refugees 97,417 (excluding Kosovo/UNSC 1244, 2007), asylum seekers 64, and labour immigrants. (gender ratio 29.5% female, top five countries of origin: China (2,918), Romania (513), the former Yugoslav Republic of Macedonia

(286), Bulgaria (177), and Slovakia (174)), 6,324, students, 2,369, transit migrants 39,364, irregular immigrants 773, approximately 512,336 people, while somewhere around 2,298,352 emigrated [6]. Considering the number of people that emigrate from Serbia, we can conclude that population within Serbia has become more vulnerable to hazard situations. Emigration statistics show that people who are leaving Serbia are mostly educated, workers, professionals and younger people, those who are staying are unwilling to go or their expertise is inadequate for emigration.

In period, between 2002 and 2011, the negative rate of population change in Serbia was -5%, or around 377,335 persons less. Just in period 2010/2011 Serbia recorded a negative population growth of 72,244 people, while Canada recorded in the same period, a population growth of 270,153. Serbia as well recorded a higher average age of population over time. The data from 2012 shows that average age of population is up to 41.3. As well Serbia has had an increase in the unemployment rate which is up to 26% while Canada only has 7.4% unemployed. AS a result more and more people (minors and adults) are becoming beneficiaries of welfare in Serbia.

Considering the number we can safely assume that the population in Serbia is becoming more and more vulnerable, due to population change (births-deaths, emigration and immigration).

While Canada has potential to raise its ability to be more resilient to hazard situations due to the positive population change rate and the high rate of immigration especially among skilled workers and young people. If, as in Serbia, the population is overall getting older, and a large component of the active and skilled adults are leaving country, industrial development depends on those who stay or will be born in the future.

Another major problem that arises in Serbia due to the aforementioned negative population growth - the lack of experts and skilled and trained personnel of the type needed to conduct changes and implement new tools for improvement of industry. On the other side Canada is not facing with this situation, as most of the immigrants are healthy, educated, skilled younger people. The positive change to the population also contributes to a higher percentage of the population that makes society more skilled and productive.

Vulnerability also depends much on the distribution of population between rural and urban areas. In Canada the long term trend towards greater urbanization shows that 80% of the population is now living in an urban area, thus the risks faced are often risks of technological hazards. The problem in Serbia is of a different category, as most of rural population are elderly people, and the trend is leading towards their dependency.

Cities are more centres of younger population, what can indicate more problems with regulation of social safety during hazard events. The high rate of unemployment makes the urban population more vulnerable. The purpose of an evaluation of the demographic distribution includes an assessment of their daily migrations from urban to rural areas and the need for appropriate planning and management of emergency response.

	Укупно пописана лица *Total enumerated persons*	Укупан број становника *Total number of population*		Апсолутни порast-пад 2011–2002 *Absolute increase-decrease 2011-2002*	Индекс 2002 = 100 *Index 2002=100*	Укупан број домаћинстава *Total number of households*	Укупан број станова *Total number of dwellings*	
		2011	2002					
РЕПУБЛИКА СРБИЈА	7 565 761	7 120 666	7 498 001	-377 335	95,0	2 497 187	3 243 587	REPUBLIC OF SERBIA

Figure 1. Total enumerated persons, total number of population according to the Censuses 2011 and 2002 and total number of households and dwellings (source: Dissemination database of Statistical Office of the Republic of Serbia, http://webrzs.stat.gov.rs/WebSite/public/ReportView.aspx)

In many cases emergency response costs much more than prevention, (like the cost of establishing local emergency centres). As well people who during hazard situations need to go on rescue missions are at a higher risk in this environment when they need to deal with more people having special needs and care.

People with disabilities and impairments, and without special training, are not capable of giving adequate response to rescue mission. Thus more should have to be invested in prevention and early warning and timely evacuation in such areas. Rural areas are, due to the lack of adequate infrastructure, more vulnerable, even though urban areas have more risks.

A change of population influences all planning policies and as a result it requires more regular adaptation of prevention measures and response plans (yearly is ideal). Investments need to be planned not just in accordance of regulations that are made 10 or 15 years ago, but in accordance to dynamical changes within the population distribution, composition, and an assessment of its vulnerability factors.

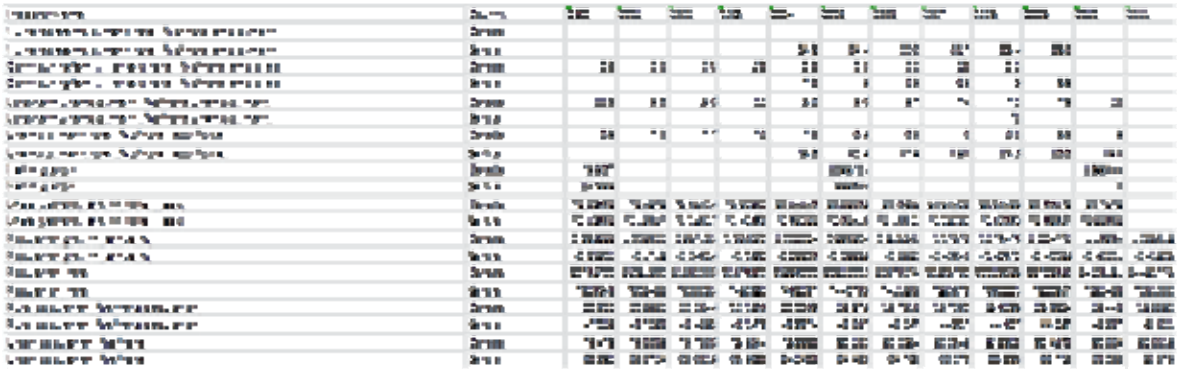

Figure 2. World development indicators (source: World Bank data base, http://data.worldbank.org/country/canada)

5. INSURANCE: PRECONDITION FOR SAFE INDUSTRY GROWTH IN DROUGHT SITUATION

Depending on the type of risk components (hazard, vulnerability, exposure, and resilience), climate related disaster risk can be allocated to:

- Individuals and businesses;
- Local, regional or/and national governments, international organizations and UN;
- Insurance and reinsurance market.

Risk allocation depends on the selection of disaster risk management techniques that are the most appropriate for certain climate related risk. It could be managed through:

- Risk retention;
- Risk reduction;
- Risk prevention;
- Risk transfer, before disaster occurs;
- Risk transfer, after a disaster occurs.

Proper choice of management techniques for climate related risk depends on the intensity of the consequences of risk realization. Also, they differ on timescale. Pre-event disaster risk reduction measures are adequate for low and middle layer risk. For high level risk, risk transfer is required.

Risk transfer before disaster occurs refers to risk management through insurance and it is both preventive and corrective measure. By issuance of an insurance policy between the insurer and the insured, known as the policyholder, the insurer undertakes that he will compensate losses that may or may not occur. The policyholder preventively buys insurance, but if an insured event occurs, insurance indemnity will cover the loss, acting as a corrective instrument for facilitating recovery process.

In mature insurance markets, insurance has a substantial role in mitigating climate change consequences. Insurance reduces the effects of weather variability and extremes on national economies and provides security against poverty that strikes regions affected by climate change.

Smartly designed insurance instruments can provide powerful incentives for reducing risks.

Insurance in agriculture is a special type of property insurance that applies to agricultural producers in order to prevent the loss of income from agricultural activities. Insurance in agriculture is not limited only to the crop and also applies to livestock, bloodstock, and may apply to greenhouses, forestry and aquaculture.

The consequences of a growing imbalance trend between supply and demand for agricultural products have resulted in increased food prices. Since 2000, global prices for food have doubled [7].

The agriculture sector in many emerging markets represents a large portion of the economy. [8] Surprisingly, emerging markets have a large world market share with regard to major agriculture products.

Growing global population and increasing fuel demands mark the agriculture sector as a growth area. As a valuable global interest it has to be well secured and insured.

Agricultural insurance (and reinsurance) have seen fast growth in the last decade. (Figure 3.).

Regarding to the geographic dispersion of the global premium 2012e (Figure 4), the main share is in the US and Canada, while Europe, with about 14% of the overall premium is in third place, behind Asia, which has about 25% share [8].

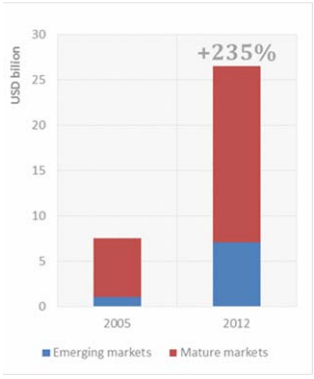

Figure 3. Estimated agricultural insurance premiums worldwide, 2005 and 2012 [8]

In total agricultural premium structure dominates crop insurance with around 90% share. Insurance products

in agriculture that exist in the world market can be classified into two main groups depending on the method by which the sum insured * is paid out

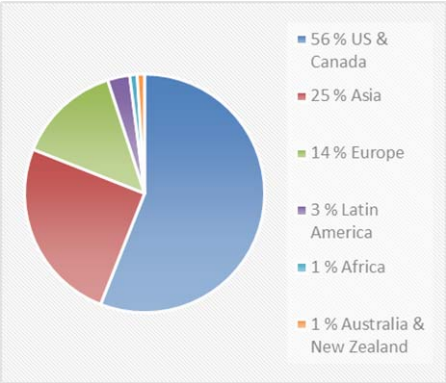

Figure 4. Share of global agricultural insurance premium 2012e (Source: [8])

1. Indemnity based crop insurance products - Insurance pay-out is based on the actual loss at the insured unit level (Named-peril crop insurance, Multi-peril crop insurance and Revenue crop covers)

2. Index based crop insurance products - Insurance pay-out is based on an index measurement (Area-yield insurance, Weather insurance products and Remote sensing products)

The most commonly used product in agricultural insurance of climatic risks is Multi-Peril Crop Insurance (MPCI insurance policies include wide range of perils like drought, flood, frost, excessive moisture and sometimes diseases). If there is a drop in yields below a historical average, farmers receive compensation by a pre-agreed price per tonnage. Named Peril Crop Insurance covers only losses from specific perils like hail, fire, windstorm, or a combination of these.

MPCI initiative is frequent in Canada, USA, and India and gains increasing popularity in Brazil, parts of Europe and most recently in China.

6. PRIVATE-PUBLIC COOPERATION IN AGRICULTURE INSURANCE

Although insurance in agriculture is essentially a commercial business, it is quite common that governments around the world take an active role in this sector. The state has a clear interest in maintaining the overall productivity of the economy of the country and to work for the benefit of the development of rural communities as well.

Governments after weather-related events and realization of climate risks that lower agriculture production levels, often have to intervene and to help in the form of emergency funding or tax relief. In developing countries and countries in transition are often struggling with finances, as such hazards are an unexpected burden and adds additional volatility to production.

Pre-event risk management and funding has attractive advantages compared to unplanned payments after the disaster for governments. Agriculture insurance is in that sense one way to support the producing sector. To secure stable industrial and economic growth public and private collaboration is essential. Worldwide governments provide agriculture insurance subsidies. In some countries up to 70% of the premiums are used to stabilize agriculture production (such as in Italy and Portugal). Some governments limit their participation on subsidizing, and others take an active role in designing crop insurance policies, terms and conditions, and have an important role in creating forecast models. The next table shows the participation of some states in agricultural insurance systems for European countries that implemented MPCI.

The role of government is to set up legislation and to select private insurance companies that will create insurance policies using their expertise in quantifying risk and transfer excess of risk to the global insurance market (to reinsure risk).

Table 1. Agricultural insurance systems in Europe (Source: European Commission, 2008)

Country	*MPCI*
Austria	Partially subsidized
Bulgaria	Non subsidized
Cyprus	Compulsory, Partially subsidized
Czech Rep.	Partially subsidized
Finland	Non subsidized
France	Non subsidized
Greece	Compulsory, Partially subsidized
Hungary	Non subsidized
Italy	Partially subsidized
Luxemburg	Partially subsidized
Poland	Non subsidized
Portugal	Partially subsidized
Romania	Partially subsidized
Slovakia	Partially subsidized
Slovenia	Non subsidized
Spain	Partially subsidized
Sweden	Non subsidized

In emerging markets like Serbia, the practice of buying insurance is very low and insurance distribution channels are undeveloped. But with state support and a shift from pre-event to post-event financing, the necessary changes are possible.

There are two basic forms of agriculture insurance that currently exist in the Serbian insurance market: Crop insurance and Livestock insurance. Crop insurance covers the yield loss as a result of realization of some of the insured risk. The standard and most present insured risk are hail, fire and windstorm, but the most common is only hail insurance.

* Sum insured - a maximum amount that an insurance company will pay to policy owner or person who makes a claim

Drought is still not possible to insure in the Serbian insurance market, but there is a positive attempt from some insurance companies (like Delta Generali) to find solutions to cover this risk with the support of the state.

7. CONCLUSION

Due to the different time scales of processes that are needed to bring safe, sustainable prevention, reaction planning and hazard risk management, it is almost impossible to take into consideration all of the dynamical components of social vulnerability and financial capacities to cope with hazards. That means that any moment of hazard event there is a strong possibility to make a wrong decision. And using five or ten year old (or more) plans of reaction, or prevention strategies developed 10-20 years ago can, if implemented now, have a high possibility of error.

Financial capacities are vary over time and there is a responsibility to ensure that timely reviews are done. Due to the interrelationship between the dynamic structure of any given population, and its components and an assessment of the vulnerability, financial planning and social-constructive methodologies in the occurrence of a hazard event requires an integrated and resilient whole-of-government and society approach to emergency management planning. This includes better prevention/mitigation of, preparedness for, response to, and recovery from drought hazard. Comprehensive and integrated emergency management is a shared responsibility between all levels of governments, the private sector, non-governmental organizations and individual citizens.

The pilot project initiated by the World Bank with the Malawi Department of Climate Change and Meteorological Services as a participating partner was testing a new way of dealing with drought risk by the provision of index-based weather insurance directly to smallholder farmers. The project, was primarily driven by the private sector and goes to the heart of food insecurity in Malawi by tackling the major cause of low levels of farmer investment in new technology [9].

There are many instruments for cooping drought, but there has to be will for practical application. In changing environment and faced with fast population changes economy has to be proactive. Industry growth depends and relies on good practice and adaptive economic instruments and programs that take in account hazard occurrence and population change.

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Uloga rane najave suše i socijalnog planiranja u industrijskom razvoju

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Rezime

Ovaj rad razmatra izazove planiranja industrijskog rasta. Komponenta promene stanovništva je promenljiva u vremenu i prostoru, i sastoji se od više dinamičnih komponenti kao što su: psihologija, ljudska pripremljenost, nivo obrazovanja i najvažnija procenat najugroženijeg stanovništva. Promena sastava stanovništva može da utiče na rast i razvoj zbog nedostatka obučenih i školovanih kadrova, porasta pritiska na pojedine sektore i varijacije u zaradama. Sprega leži u zavisnosti između procenta radon sposobnog (zaposlenog) stanovništva i drugih aspekta društva kao što su procenat najugroženijih i promena structure stanovništva. Planiranje rasta i razvoja industrije zavisi takođe i od ekoloških i pitanja životne sredine kao i od dostupnih prirodnih resursa. Klimatske promene i klimatski ekstremi utiču na dostupnost resursa, naročito vode u slučaju suše. U svim prilikama, kao najvažniji resurs od svih voda mora da se rasporedi mudro između različitih sektora i korisnika. Industriski razvoj zavisi od dobrogplaniranja i upravljanja svim resursima, prirodnim i ljudskim.

Ključne reči: *promena structure stanovništva, industrijski razvoj, rana najava, pripremljenost, prirodni resursi, ljudski resursi*