ISPRS: Intelligent Services for Poverty Reduction Schemes

Petar Šolić
University of Split
Department of Communication
and Information Systems
Rudjera Boškovića b.b., 21 000 Split
Croatia
psolic@fesb.hr

Matko Šarić
University of Split
Department of Communication
and Information Systems
Rudjera Boškovića b.b., 21 000 Split
Croatia
msaric@fesb.hr

Darko Stipaničev
University of Split
Department for Modelling
and Intelligent Systems
Rudjera Boškovića b.b., 21 000 Split
Croatia
dstip@fesb.hr

Abstract: UN started with Millennium Development Goals (MDG) 10 years ago. Problems addressed in the goals achievements are meant to solve world's biggest problems. This paper proposes ICT solution which helps economists in decision making and to address problem no.1. "The end of world poverty". Proposed system has ability of self-learning in order to address a lot of exceptions and personalize economics of different countries. Modular expert system architecture system is proposed. It is compared to existing solutions and benefits over them are discussed.

Key–Words: Poverty Reduction, Economic growth, ICT modelling in economy, ICT solutions on poverty reduction

1 Introduction

"The World Bank's latest estimates show that 1.4 billion people in developing countries were living in extreme poverty in 2005. Recent increases in the price of food have had a direct and adverse effect on the poor and are expected to push many more people an estimated 100 million into absolute poverty. The proportion of children under five who are undernourished declined from 33 per cent in 1990 to 26 per cent in 2006. However, by 2006, the number of children in developing countries who were underweight still exceeded 140 million." [1]. Addressing such issues today is comprehensive and exhaustive task for all agencies and thousands of people working on them. Exaustive work today in poverty reduction brought to the following improves [3, 4] :

○ Microfinance has helped many of the world's poor to increase their incomes through self-employment and empowerment. With access to small loans and other financial services such as savings and micro-insurance, microfinance clients, mostly women, have formed micro-enterprises that generate income. Grameen Bank of Bangladesh is one of the worlds most successful microfinance institutions. From a starting base of 10 members in 1976, Grameen Bank today has over 7.5 million borrowers, 65 per cent of whom have managed to lift themselves out of extreme poverty [6].

○ For the past two years, Malawis voucher programme for fertilizers and seeds has helped double its agricultural productivity, turning the country into a net food exporter after decades of famine as a perennial food importer.

○ NERICA - or the New Rice for Africa, a crossbreed of Asian and African rice varieties - can produce up to 200 per cent more than traditional crops and is expected to generate savings of several million dollars per year in the cost of rice imports in several pilot countries.

○ Since 2002, the courier delivery company TNT and the World Food Programme (WFP) have developed a partnership called Moving the World to help fight global hunger. TNT has donated services totalling 38 million for activities including an emergency response system and a joint logistics supply chain.

Still, there is a lot of effort required to accomplish MDG tasks and to reduce poverty. Some of them are [2-4]: To Ensure that there are social safety nets to minimize the consequences on the poor of the global economic slowdown and higher food and energy prices. Urgently increase emergency food aid to enable WFP and other food-aid programmes to provide emergency food assistance. Promote school feeding programmes. Assist developing countries, especially in sub-Saharan Africa, to transform subsistence agriculture in order to ensure long-term, sustainable productivity increases and a more diversified economic base. Support research and development in yield-enhancing agricultural and climate change technologies. Promote equitable access to economic resources and decent work opportunities, especially for particularly disadvantaged groups such as women and
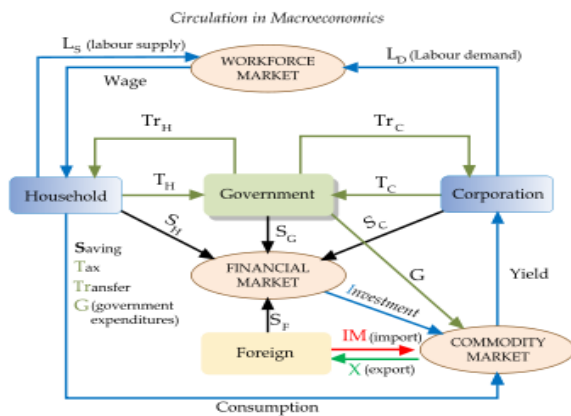
Figure 1: Macroeconomic key-components interconnectivity[23]

young people. Develop, for both urban and rural areas, the infrastructure and services that will enhance the productive capacity of enterprises and facilitate integration into the global economy. Adopt urban development policies that will upgrade slums and improve the availability of basic services. Facilitate the integration of the least developed countries into the multilateral trading system by increasing their access to funds under Aid for Trade.

Many solutions are developed in assistance of developing MDGs, such as MDG Monitor [5], SEDAC [7], or the other within [8]. They are used for poverty mapping, and its applications allow users to get right information about real statistics in each area of poverty. Other solutions like MBWin [9], Abacus [10], Topaz [11] are providing solutions on microfinance levels. Sangam Krishi Sangam (SKS) is a micro credit project in one of the poorest parts of India-the drought-prone Medak District. SKS has developed a robust backend management information system through the use of a smart card to record details of savings and loans [12]. "E-choupal" [13] is a web portal which allows the farmers in India to check both futures prices around the world and local prices before going to market. Access to the Internet via satellite and solar panels provides information about local weather conditions, soil-testing techniques and other expert knowledge that will increase their productivity.

However, none of the existing solutions provide full services for poverty reduction monitoring. Complete solution requires expert system in economics, with implementation of both micro and macro factors because of their interconnection depicted in figure 1. To differentiate between the two, the analogy of the forest and the individual trees can be helpful. Macroeconomics is the study of the behaviours and activities of the economy as a whole; hence, the forest. Mi-

croeconomics looks at the behaviours and activities of individual households and firms, the individual components that make up the whole economy; hence, the individual trees [14]. In accordance with the lack of the information systems developed in this area, the system proposal provides assistance in accomplishing United Nation MDGs and its first problem of reducing poverty and ending hunger. The proposed system can handle all requests and necessities on reducing world poverty and produce righteous capital inflow distribution. Proposed solution provides expert system on economics as the solution fully modular with learning ability. Intelligent system uses it own senses such as number indicator of money inflow from World Bank, IMF, donator countries or individuals. Sensed information will be macro and micro indicators in each area of poverty. That information can be only updated from high rated people in the system. Personal rate should be deserved from the previous work as a professional or volunteer. The same or another people assigned by them, make requests on system with needs in impoverished area. Provided inputs are used from central Knowledge Based System (KBS) to process information in order to provide accurate answer on investments proposal. As a feedback, resulting proposal would provide information about predicted economic growth.

Article is structured as follows: section 2 gives problem description with detailed system proposal, as well as its implementation proposal. Section 4 gives some conclude remarks.

2 Poverty Diagnosis, Reduction Schemes and ISPRS

Inspired by the lack of information exchange proposals and economics expert systems, article proposes solution which addresses problems both in economics and poverty reduction schemes. To address such problems it is important to make accurate poverty diagnosis in order to know how to fight upcoming issues on poverty reduction. According to [14], there is checklist for making poverty diagnosis, such as: poverty mapping, economic policy framework, fiscal framework and fiscal trap, physical geography, transport conditions, agronomic conditions, disease ecology, governance patterns and failures, cultural barriers, geopolitics, cross-border security threats, international sanctions, etc.

One of the main conditions of economic progress is developing healthy environment for information interchange. Already investigated problems [15] consider ICT as a sector to achieve economic growth and as a enabler for achievement of the other goals like
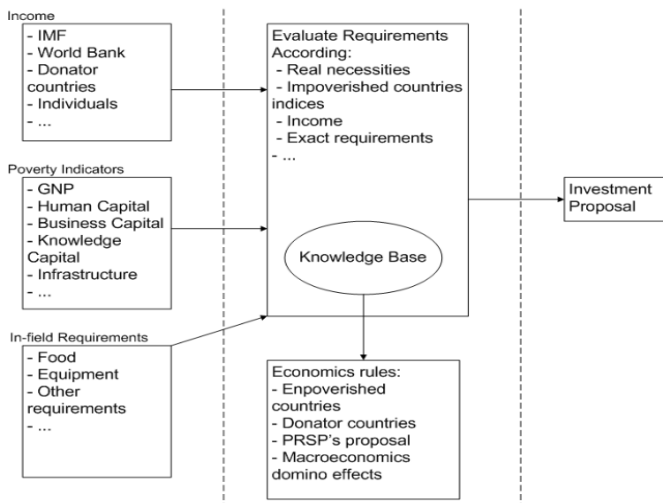
Figure 2: ISPRS: Intelligent Services for Poverty Reduction Schemes

education, healthcare, etc. The overall goal is to build the national capacity to design and implement effective poverty reduction strategies. The Poverty Reduction Strategy Paper (PRSP) preparations have led to increased demand for capacity building in poverty measurement and diagnostics, poverty monitoring and poverty impact evaluation.

Putting it all together results in an intelligent system architecture which is consisted of 3 main parts. First part contains its senses as an information input for further processing. Second part of the proposed architecture is central part, consisted of Knowledge-Base, which elements are based on micro and macro economics principles and PRSP's. Knowledge Based System (KBS) knows how to handle income data and in accordance with key formula provide information to the third part of system: "System Actuators", which composes Investment Plans used by the System Users or Administrators. System proposal is depicted on figure 2.

2.1 The Senses

Information that is sensed play crucial role in system development. It is important for them to be exact and full. Sensed information for the system input should be numbers that describe:

○ Human capital: health, nutrition, and skills needed for each person to be economically productive.

○ Business capital: the machinery, facilities, motorized transport used in agriculture, industry, and services.

○ Infrastructure: roads, power, water and sanitation, airports and seaports, and telecommunications sys-

tems that are critical inputs into business productivity.

○ Natural capital: arable land, healthy soils, biodiversity, and well functioning ecosystems that provide the environmental services needed by human society.

○ Public institutional capital: the commercial law, judicial systems, government services and policing that underpin the peaceful and prosperous division of labour.

○ Knowledge capital: the scientific and technological know-how that raises productivity in business output and the promotion of physical and natural capital.

○ Money inflow to the system, whether IMF, World Bank or individual donors.

2.2 Knowledge Based System Proposal

Proposed KBS needs to be able to handle all kind of requests and choose correct reduction strategy in accordance to MDG-based poverty reduction strategy. It has five parts:

○ A Differential Diagnosis, which identifies the policies and investments that the country needs to achieve the Millennium Development Goals.

○ An Investment Plan, which shows the size, timing, and costs of the required investments

○ A Financial Plan to fund the Investment Plan, including the calculation of the Millennium Development Goals Financing Gap, the portion of financial needs that the donors will have to fill

○ A Donor Plan, which gives the multiyear donor commitments for filling the Millennium Development Goals Financing Gap

○ A Public Management Plan that outlines the mechanisms of governance and public administration that will help implement the expanded public investment strategy

To reduce problems the system must include main reasons of poverty spreading, in order to make decision making system more accurate, and not to repeat main faults like in the past. Reasons which brought to the extreme poverty: Poverty trap itself - the poor do not have ability to run out of mess by themselves. Low BGP means there is no money for all kinds of progress aspects. People are not able to save money, because their income is not even enough to survive. Physical geography - transport costs sometimes play crucial role. It was very important in the period of world rapid economic growth. Fiscal trap - impoverished countries governments cannot pay for all their debts,
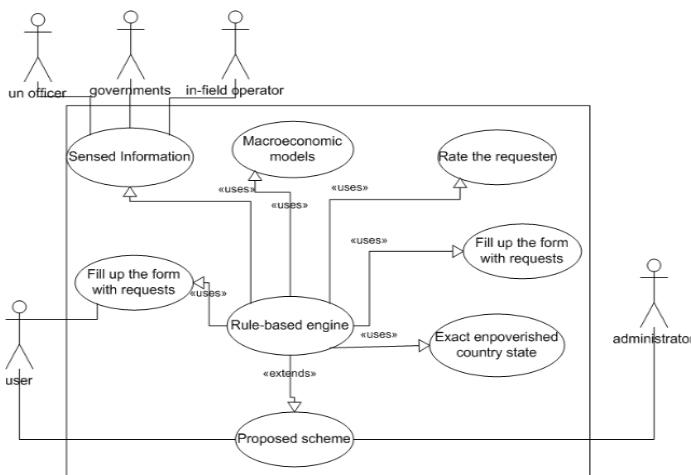
Figure 3: Use case model of ISPRS

2.3 Rule-based engine of KBS

In accordance with the macroeconomics policies we define set of basics rules and their ponder values. Basic rules are semantically organized in the tree. General macroeconomic apparatus has its main tools. Reducing or raising each of them in different scenarios will have different effects [18]. In accordance to PRPS, we generate initial state. After initializing the system, some actions in poverty reducing can be done. Action options are provided by rules well known in macroeconomics, and its domino effects. Modelling of economics is hard task for everyone. It can be simplified by implementation of the rules, but it is not only factor, because of specifics of the each economy observed. Examples of rules based on Mundell-Fleming, Keyns or IS/LM are [19]:

Money supply changes cause:

○ Reduction of the local interest rate (forces the local interest rate lower than the global interest rate).

○ Depreciation of the exchange rate of local currency through capital outflow.

○ Depreciation makes local goods cheaper compared to foreign goods and increases export and decreases import.

Increase in government spending will cause the local interest rate to go above the global rate. The increase in local interest will cause capital inflow and the inflow will make the local currency stronger compared to foreign currencies.

Application of the rules may not have same effects in different environments, i.e. economies, so it is necessary for someone to monitor and correct outcome results. There must be a reason why it is corrected, and the person who corrected it, must explain why. Explanation must be written correctly so the system can update corrected information. This is the way the system learns. According rules, subjects in the sentence is derived and pondered in accordance with PRPS for particular country. System users, such as economy specialists can add additional subjects and their ponder values. It is the way the system is learning. After re-calculation system will provide new results, with new data added to system decision. Decision about investments is hierarchical, which will make decision making easier for the person with authority to decide what investments will be made. Through described system, new subjects will be added, evaluated and the system will learn additional information about specific case in poverty area. This will create global system, with actual information about progress of empowerment. According to the feedback information, necessary actions should be executed in order to improve empowerment progress.
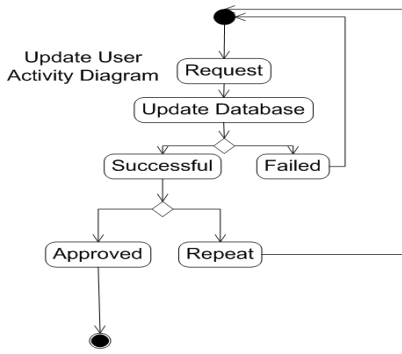
because of corrupcy or earlier debts. Governance failures - crucial is government policy. If it lacks in right decision making it is the biggest problem in all areas of the micro and macro economy. Cultural barriers - cultural and religic norms in some countries are slowing down economic development. Geopolitics - making progress in trading, means that trading barriers with impoverished countries should be declined and trade sanctions regime cancelled. Lack of innovations - even if the impoverished scientist have new ideas they do not have a chance to transform it to the reality, because of badly organization in law matter. The demographic trap - the large number of the children resides in catastrophic results of impoverished countries. Already impoverished, cannot carry out new children, i.e. to invest in their healthcare and education.

Using information from the senses, KBS which has macroeconomic domino effects implemented, assign funds to the each poverty affected area using the key formula, derived from macroeconomic principles [17], MDG proposal [4] and Stern proposal [16]. World experts will react on the Expert System Decision and define another rules with the exact description of reason, why is the Expert System Decision correct or not. Factors in decision making system are pondered, in collision with well known PRSP's implemented in the KBS, as an initial condition. As the time passes, PRSP's will change in accordance with real scenario. According to macroeconomics, real situations in poverty affected areas, and the other poverty reduction ideas, system will scale the best and optimal support to the poverty affected areas. According to the strategy, progress must be visible from the senses, and the key formula calculates new values for the new investments. Use-case diagram of the ISPRS is depicted on figure 3.

Figure 4: Update user activity diagram

Figure 5: User activity diagram

Figure 6: Administrator Activity Diagram
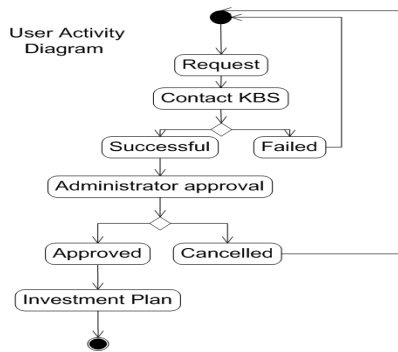
According to the poverty reduction schemes, it is important to build up model with keywords explaining state of the art. Keywords with their objects and describers are built in order to maintain stability and make improvements in impoverished countries. Sentences explaining adjustments must be concise and accurate, explaining action need to be done. Using data described in the model sentence example on the highest level of abstraction would be: "(1) Investments (2) 5 million USD - (3) education (4) Rwanda". The sentences must be more accurate, developing tree which explains it more accurate. For example, investments:

○ How to invest i.e., which investment plan to follow, and determine plan of progress

○ Which money to use

Moreover, what investments in education should be done, with explanation on it. First level should have main purpose of describing action over impoverished country. Down layered parts should explain it more accurate. Scheme of first level is: "(1) What to do?" - "(2) Describe (1), i.e. provide values" - "(3) What to do with (1)" - "(4) Where to make action". There are 3 types of application users:

○ User provides information about impoverished area he/she is operating. Request user makes requests on all-kind needs in that area. Request user activity diagram is depicted on Figure 4. Every user sub-
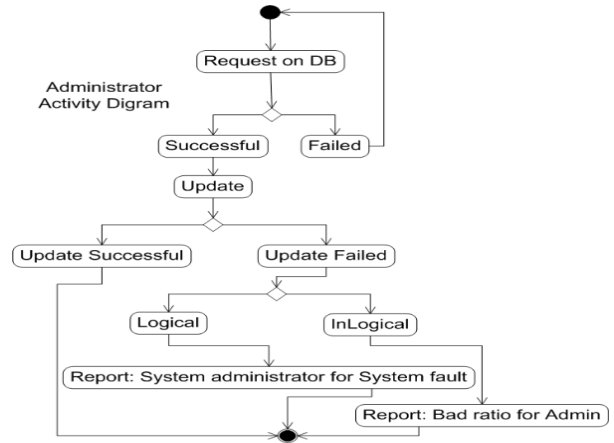
scribed on ISPRS is rated properly, by the administrator, through rate system describing their previous actions. Requirements are assigned by the volunteers and economic specialists from World Bank and IMF.

○ Administrator - uses information provided by KBS and allows/declines requests. Administrator must give a reason why to decline requests. Described reason Administrator provides is used in further KBS decisions. They have ability to monitor all-kind of income information from senses and make decisions accordingly. Full activity diagram for administrators is provided on figure 5.

○ Update User - provide update information to KBS, with recent information about impoverished countries. Activity diagram for Update Users is described on figure 6.

2.4   Realization Proposal

System realization and implementation of the proposed model can be developed on various platforms and devices. But, it is very important for the people using these services to make easier access on them wherever they are. To provide device and platform independence, SIP (Session Initiation Protocol) [21] communication protocol is proposed. Benefits include live communication between all kinds of users, as live status of user requests [20] through services of the IMS (IP Multimedia Subsystem) and presence server. Besides SIP, usage of SIMPLE [22] is proposed to access additional features on their communication properties. Architecture proposal is depicted on figure 7. Proposed architecture allows interoperability between different platforms and services, which feature is important for in-field operators, so they can use any technology they have.
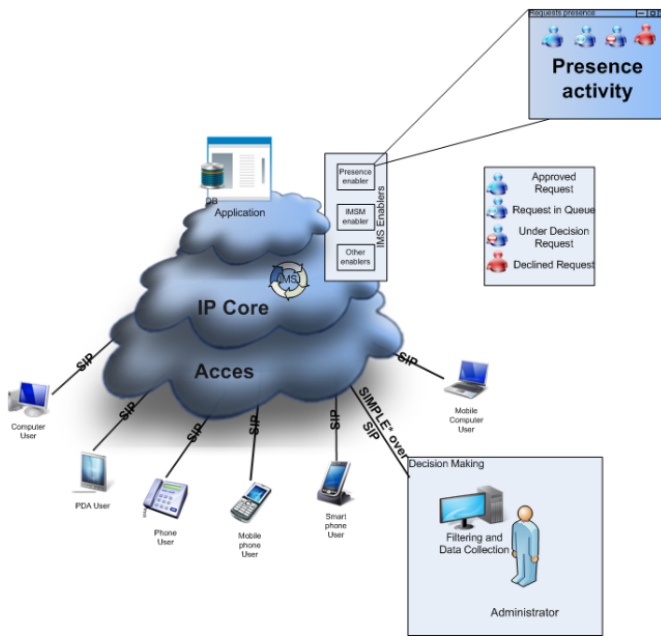
Figure 7: Use case model of ISPRS

3   Conclusions

This paper provides information system solution which helps in poverty reduction. Additional feature on self-learning system in economics is proposed, in order to address individuality of each economy specifics. System is consisted of 2 main parts. Administrator part corrects system proposals and monitors the progress. User part is dedicated to in-field operators which can log on the system and make requests for the needs in the area they work, as the update users which task is to update information senses. Users can progress through the hierarchy by getting better results. This will make connection between macroeconomics and micro location needs for development.

References:

[1] United Nations Headquarters, High-level Event on the Millennium Development Goals, New York, 25. September 2008

[2] United Nations, *Committing to action: Achieving the MDGs*, Background note by the Secretary-General for the High-level Event on the Millennium Development Goals, New York, 25. September 2008

[3] United Nations, *The Millennium Development Goals Report 2008*, New York, 2008

[4] United Nations, *United Nations MDG Database*, available at: http://mdgs.un.org

[5] United Nations UNDP, *MDG Monitor Website*, available at: http://www.mdgmonitor.org/,

[6] Gramee Bank, *Grameen Bank website*, available at: http://www.grameenfoundation.org

[7] Center for International Earth Science Information Network (CIESIN), *The Poverty Mapping Project at CIESIN*, project information available at: http://sedac.ciesin.columbia.edu/povmap/

[8] Rep. of Korea e-Asia and Knowledge Partnership Fund, *Project: ICT-based Inclusive Growth and Poverty Reduction in the Pacific*

[9] MBWin, *MBWin project*, available at: http://www.mbwin.net/

[10] Fern Software, *Abacus*, Information available at: http://collab2.cgap.org/gm/folder-1.11.15128

[11] Top Systems, *Topaz Microfinance*, information available at: http://collab2.cgap.org/gm/folder-1.11.12760

[12] SKS Microfinance, *SKS India*, information available at: http://www.sksindia.com/

[13] ITC limited, *E-Choupal project*, information available at http://www.echoupal.com/

[14] Jeffrey D. Sachs, The End of Poverty, The Penguin Press, New York, 2005

[15] Asia-Pacific Development Information Programme, *A Perspective from Poverty Reduction Strategy Papers (PRSPs)*, APDIP e-note, 2005

[16] Mark J. Stern, Poverty and the Life-cycle, 1940-1960, *Journal of Social History*, Volume 24, Issue 3, Spring 1991, pp. 521-.540.

[17] Carlin Wendy, Soskice W. David, Macroeconomics and the Wage Bargain, New York, Oxford University Press, 1990

[18] International Monetary Fond, *IMF PRSP database*, information available at: http://www.imf.org/external/np/prsp/prsp.asp

[19] Blanchard Olivier , Macroeconomics, 2nd ed., Prentice Hall, 2000

[20] P. Solic, N. Rozic, N.Ukic, ROADS: RFID Office Application for Document tracking over SIP, Proceedings of the SoftCOM 2009, 24-26 Sept. 2009, pp. 95–100

[21] J. Rosenberg, H. Schulzrinne, G. Camarillo, A. Johnston, R. Sparks, M.Handley and E. Schooler, SIP: Session initiation protocol, RFC 3261,Internet Engineering Task Force, June 2002.

[22] SIMPLE protocol working group, SIP for Instant Messaging and Presence Leveraging Extensions (simple), available at: http://www.ietf.org/dyn/wg/charter/simple-charter.html

[23] Gacslyi-Meyer-Misz-Simonits, Economics II. Macroeconomics, National Textbook Publisher 2005., Hungary