Proceedings of the 28th International Conference

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Conference Partners:
National Research Foundation of Korea (NRF)
National IT Industry Promotion Agency (NIPA)
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Edited by:
Tae-Hoon Moon
Production Team:
Robin S. Langer, LouAnne Lundgren,
Erin R. Sheehan and Joan M. Yanni

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28th International Conference
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Conference Venue Floor Plan ..... **Handout**

Welcome

Dear Colleagues,

Hwan-Yeong-Hab-Ni-Da! Welcome to the 28th International Conference of the System Dynamics Society. This year, the conference is being held in Seoul, Korea, located to the west of the central region of the Korean Peninsula. Seoul has been the capital city of the Republic of Korea for over 600 years. It is the heart of Korea's culture and education as well as politics and economics. Seoul is unique in that historical sites and modern cultural facilities coexist in harmony.

Again this year the program shows that the field of system dynamics is thriving. Conference participants come from more than 40 countries from all over the world. Including the PhD Colloquium and the Bonus Day, over the next six days you will have a chance to present, listen to, and discuss system dynamics work presented by leading academics and practitioners.

The main theme is *Beyond the Crisis: Greening Society, the Economy, and the Future*, reflecting global concerns about the environment and economic issues. The program will consist of invited and contributed sessions and workshops demonstrating the state of the art in the theory and application of system dynamics. The program schedule will also include exhibits, model assistance workshops, panel discussions, special sessions, a student colloquium, and Society business meetings.

To further increase your enjoyment of the conference, there will be time for social and professional interaction in a relaxed and fascinating setting, including an Informal Gathering on Sunday during and after registration, the Poster Symposium and Buffet on Monday, the Conference Banquet on Tuesday, and a traditional Korean performance. Local tours will also be offered including visits to the Korean Folk Village, Changdeokgung Palace, and Panmunjeom.

This year, 418 volunteer reviewers screened and commented on submissions. In addition, several dozen volunteers worked many hours to ensure a successful conference; without their commitment our conference would be impossible. A special thank you goes to all who helped.

In addition to all our other sponsors and our conference host, Korean System Dynamics Society, we are also very fortunate this year to have a series of conference supporters, National Research Foundation of Korea (NRF), National IT Industry Promotion Agency (NIPA), Korea Radio Promotion Agency (KORPA), Electronics and Telecommunications Research Institute (ETRI), Korea Research Institute for Human Settlements (KRIHS), Seoul Development Institute (SDI), Seoul Convention Bureau (SCB), and Korea Tourism Organization (KTO). We sincerely appreciate the enthusiasm and support of all our sponsors.

We hope that you find the conference stimulating and rewarding. We ask that you bring to our attention anything that may help us to ensure the success of the current conference, as well as future ones. Thank you for attending, and once more, Hwan-Yeong-Hab-Ni-Da!

On behalf of the hosts and conference committees, best wishes from,

Man-Hyung Lee, Tae-Hoon Moon, Khalid Saeed, Dong-Hwan Kim, Nam-Hee Choi, Sang-Hyun Park, and Roberta Spencer

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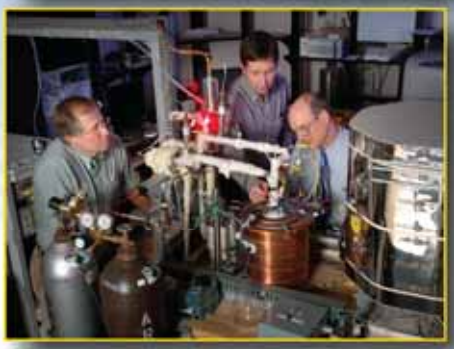

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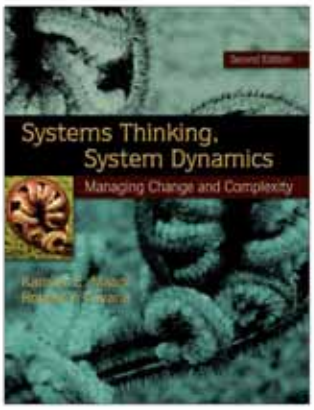

Systems Thinking, System Dynamics

Managing Change and Complexity

Kambiz E. Maani & Robert Y. Cavana

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This revised edition, re-titled **Systems Thinking, System Dynamics**, offers readers a comprehensive introduction to the growing field connecting systems thinking and system dynamics, and its applications. The book provides a self-contained and unique blend of qualitative and quantitative tools, step-by-step methodology, numerous examples and mini-cases, as well as extensive real-life case studies. The content mix and presentation style make the otherwise technical tools of systems thinking and system dynamics accessible to a wide range of people.

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What is it? The *SD Career Link*, started in 2000, is hosted by the System Dynamics Society. It provides a valuable forum for the exchange of information about organizations, positions and people in the field of system dynamics.

Career Link Allows Companies and Universities to Describe General Career Information as Well as Specific Job Opportunities. The *SD Career Link* web page of the Society web site has two subsections: (1) specific job listings, and (2) company/university profiles. In the job listings section, employers advertise their current openings. These are for any level of required expertise located in any geographical region. In the profiles section, company and university employers provide general yet descriptive information about how system dynamics fits into their organization, typical jobs, career paths, and other aspects of employment. This subsection allows employers to provide information about system dynamics opportunities within their organizations to supplement the more general information contained on their corporate or academic websites. Such career information is valuable to current as well as future system dynamics students, academics, and practitioners and we urge companies and universities to describe the use of system dynamics expertise in their organization even if they do not have job openings at the present time.

How to participate? Please refer to the *SD Career Link* page at the System Dynamics Society website at http://www.systemdynamics.org/sd_career_link.htm or send an email message to the Society office at <office@systemdynamics.org>. We look forward to your participation.

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- **Viewing/Opening/Reading the Supporting Material:**

Supporting materials will contain either a single file, or a PKZip format file which can be opened with a number of utilities or directly on some operating systems. File types that may be contained with supporting materials include plain text files or commonly used files types such as .doc, .ppt, .pdf, .htm, .html and .jpg. In addition, models may be included and these will have file extensions that depend on the software used to create them. Below, find information on how to access freeware/demo/trial versions for regularly used software from several system dynamics software publishers. Follow the links within the descriptions below to the software needed to view the files.

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Plenary Session Papers

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Improvised Facilitation: A Third Leg on the Group Model Building Stool

As practiced in our group at Albany, we envision Group Model Building as a stool supported by three complementary legs, Teamwork, Scripts, and Improvised Facilitation. The first two of these clusters of principles and skills have been previously described in the published literature. Our purpose with this paper is to describe how we use improvisational principles and techniques to guide our facilitated interactions with teams of managers engaged in Group Model Building.

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Greening the Economy with New Markets: Lessons from System Dynamics Simulation of Energy and Environmental Markets

This paper begins with background on government programs to spur economic growth through investment in green infrastructure and the creation of new markets. System dynamics has been put to good use in analyses of new and proposed markets dealing with energy and the environment. The paper describes simulation analysis of markets for renewable certificates, riparian shading offsets, wholesale electricity generation and carbon allowances. The paper summarizes the main policy conclusions from these studies, especially the conclusions that appear across markets and across countries. The paper concludes with a discussion of cap and dividend, a bold, new proposal for a carbon market in the USA.

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Eastern Thought and Systems Thinking

East Asians and Westerners have kept very different systems of thought for thousands of years. Generally speaking, in contrast to the mechanistic and analytic Western view, the Eastern view of the world is said to be organic. Various philosophies and religions have influenced formation of Eastern thought for thousands of years. Notably, this paper focuses on thoughts of Buddhism, Taoism, Confucianism, Yin-Yang theory and thought of Three Essences (time, space, ens). Eastern thought, in general, says that the world is, like a web, an interrelated complex system of the three essences. Therefore, according to Eastern thought, there is no space without time and ens, no time without space and ens, no ens without time and space. They are interpenetrating. The organic and ecological world view of the East Asians is very close to the systems thinking of the System Dynamics. Since, like this, systems thinking essentially has inhabited Eastern thought, Eastern Asians are relatively familiar with systems thinking in their daily life. Hence, this paper aims to seek the profound relation and harmony between ancient Eastern wisdom and modern systems thinking. Such a study could extend basis of System Dynamics across areas of Eastern philosophies.

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A Simulation System for HPAI Diseases Control

As Highly Pathogenic Avian Influenza (HPAI) had become an issue in Korea, Korean Government has decided to make a complete defense system of HPAI using system dynamics and agent based modeling techniques after a preliminary research. This paper summarizes the simulation part of the Korean Government efforts on HPAI. KAHIS (Korea Animal Health Integration System) is designed to help government agencies to perform their HPAI (and other animal diseases) related tasks on their computers. The simulation part of KAHIS(KAHIS-Sim in short) is designed to support tasks such as HPAI possibility evaluation, retrospective analysis, diffusion analysis, defense line analysis, and social cost evaluation. KAHIS-Sim consists of a user interface, and two models (AIR Model; and AID Model), which are programmed using Vensim DSS. AIR Model forecasts the possibility of HPAI occurrence for 4967 regions and more than 20,000 farms in Korea. AID Model simulates the diffusion processes of HPAI and estimates the economic impacts. The user interface summarizes and shows the simulation results using geometry information system. After test trials of the system, a few issues have been raised, including the simulation time, lacking data, and linkage with the weather forecast. Nevertheless, they have decided to use the system as references for their tasks. They have planned to upgrade the system for another 4 years.

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System Dynamics Problem Definition as an Evolutionary Process Using Ambiguity Concept

Problem definition, as system dynamicists believe, is the most important phase of the system dynamics modeling process. However, its literature is not rich enough so as to match its importance. In this paper, by reviewing the literature, we introduce the idea that the problem definition itself has an iterative and evolutionary nature. Here, we propose an approach to develop and enrich problem definition based on continuous and conscious effort to elicit the hidden ambiguities of the dynamic hypothesis and transform these ambiguities into questions whose answers would precise the definition of the problem and improve the dynamic hypothesis. We show how this approach on one hand can help us build models much more suited to dynamic real world problem and on the other hand help us much more effectively use models to understand and solve these problems. Finally, we propose some guidelines for revealing the ambiguities as basis to the problem definition and dynamic hypothesis in an iterative process.

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Limits to Growth and Industrialisation - Insights from small and metaphorical system dynamics models and simulators

In this presentation I develop a small system dynamics model of the fishing industry to explore sustainability and limits to growth. I then use the same model as a metaphor to think about limits to global growth and industrialisation and to appreciate the structure and dynamics of more complex models of industrial society. Since my aim is also to communicate about dynamic complexity, the paper and accompanying talk illustrate basic concepts of stock accumulation, feedback structure and dynamics.

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On the Foundations of System Dynamics and Systems Thinking

Reflections on the Foundations of System Dynamics and Systems Thinking. JW Forrester's original statement of the foundations of system dynamics emphasized four 'threads': computing technology, computer simulation, strategic decision making, and the role of feedback in complex systems. But the foundation of systems thinking and system dynamics lies deeper than these and is often implicit or even ignored: it is the "endogenous point of view." The paper will begin with historical background, clarify the endogenous point of view, illustrate with examples, and argue that the endogenous point of view is the sine qua non of systems approaches.

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Economic Development, Creative Destruction and Urban Dynamics: A Proposal for Rethinking Developmental Agendas

This paper revisits the problem of economic development questioning the implicit premise that developing economies are nascent systems on their way to maturity. It is proposed that the developing countries should instead be viewed as mature systems in a low-welfare homeostasis reached under resource constraints. When seen as mature systems, the transformation of the existing mix of economic activity into one that can yield better lives for people takes precedence over the widely advocated objectives of growth, productivity improvement, structural transformation, specialization for export, privatization and other such agendas that will not change the tendency towards the low- welfare homeostasis. Viewing developing countries as mature economies also calls for seeking as a part of the development strategy the accelerated decay of the obsolete and irrelevant baggage that might fill the landscape, so room is created for replacing it with more appropriate infrastructure. Schumpeters concept of creative destruction and Foresters Urban Dynamics model are explored as alternative frameworks for economic development. Key words: economic development, economic growth, creative destruction, urban dynamics, sustainability, development policy, system dynamics, urban renewal, economic stagnation, economic recession.

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The Road from Copenhagen: Supporting International Climate Negotiations with the C-ROADS Simulation

Misunderstandings about the global, long-term impact of proposals for greenhouse gas (GHG) emissions reductions and the lack of analytical capacity are impeding negotiations toward global agreements to mitigate GHG emissions under the UNFCCC. One contributor to the failure of the Copenhagen climate conference is the lack of transparent, documented, models policymakers can use in real time to design and test policy alternatives. The C-ROADS climate policy simulation has proved to be an effective tool to aid policymakers and build shared understanding of the response of the global climate to GHG emissions scenarios and proposals by individual nations and regions. C-ROADS is a scientifically-vetted model that allows users to examine the impact of proposed GHG emissions paths, specified at the level of individual nations or blocs (such as the European Union), on global GHG concentrations, mean global surface temperature, and sea

level. C-ROADS is currently being used by a number of key UNFCCC parties. Here we describe how the C-ROADS simulator was used to support the negotiations in Copenhagen and how the model is being enhanced and used to create a transparent, documented, scientifically sound platform for collaboration among multiple nations.

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On the Liquidation of Government Debt under A Debt-Free Money System – Modeling the American Monetary Act

Runaway accumulation of government debt in Japan under the recent financial crises seems to deprive the government of its effective policy discretion due to the burdens of debt repayment. This paper first examines that the government debt is structurally built in the current macroeconomic system of money as debt which is founded by the Keynesian macroeconomic framework, and it is very costly to reduce it. Then, it demonstrates how the government debt could be liquidated without cost under an alternative macroeconomic system of debt-free money that is proposed by the American Monetary Act. Finally, it is posed that debt-free macroeconomic system is far superior to the debt-burden current macroeconomic system in a sense that it can not only liquidate government debt but also attain higher economic growth.

Parallel and Poster Session Papers

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Accessibility of Norwegian Municipalities Websites: A Qualitative System Dynamics Approach

Access to all public websites is crucial to assuring equal opportunities for all citizens to participate in society. Several studies have been carried out to analyse the accessibility of websites. However, we have not been able to find studies on the factors (other than technical) affecting the accessibility of websites. The purpose of this paper is to explore different factors prior to the web page development that may have an influence on the accessibility of the municipal websites in Norway. This is achieved through reviewing relevant literature and performing a set of in-depth interviews with web-masters and web-editors from various Norwegian municipalities. The findings from these sources were compiled into a Causal Loop Diagram. Several leverage points to enhance public websites accessibility were discovered by exploring the Causal Loop Diagram: Increasing the budget devoted to the workforce, giving more attention to the workforce selection process while recruiting and retaining the experienced workforce members. Keeping the desired development rate at a level lower than the capacity of the available workforce. Training the workforce on the use of HTML and WCAG, in addition to technology updates, are possible long-term investments.

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Effects of Government Intervention in Interest Rates: Case of Iran

Government intervention in economy can be aimed at a variety of political or economic objectives, such as promoting economic growth, increasing employment, raising wages, raising or reducing prices, promoting equality, managing the money supply and interest rates, increasing profits, or addressing market failures. Advocates of free market or laissez-faire economics tend to see government intervention in the economy as harmful, due the fallacy of central planning, the law of unintended consequences, and other considerations. They believe government intervention for economy make things worse. In this paper we model the intervention of Iranian government in interest rates and consequences of this intervention which was increase of bank debts to Central Bank and also inflation. At the end, we offer two policies to solve high inflation and increasing bank debts.

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A System Dynamics Strategic Planning Model for a Municipal Water Supply Scheme

This paper reports the development of a System Dynamics model for the Strategic planning of a municipal water supply scheme. The model is capable of handling the critical variables that impact on the operations of a water supply scheme. The model was developed using the Dynamo programming software to handle the process dynamics. Other supporting software - Fortran, Clipper 5, and Epiglue are used to handle data input, analysis and presentation of results in a user-friendly environment. The model was validated by applying it to the simulation of the University of Ibadan Water Supply Scheme for which extensive data of operations were collected over a period of ten years. The results obtained were found to be realistic and useful for the planning of plant operations. It is concluded that the model developed is sensitive to variable changes and has the capability of answering various operational what-if questions. As a strategic planning tool, the present model generates, for different scenarios, important operational information for the management of the water supply scheme. It is concluded that SD model is a useful tool to assist water mangers and policy makers in making decisions and evolving strategic planning for water supply.

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Hegelian Philosophy and System Dynamics

There are some similarities between Hegelian philosophy and system dynamics theory. Hegel used a systematic view for his theory and generalized it to all categories. We try to express the similarity between the Hegels theory and system dynamics modes. In addition, a system dynamics tool as Causal loop diagram is employed to explain the dynamic trend of Hegels system. At last, we simulate an example of Hegels philosophy by system dynamics model.

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A Dynamic Simulation Model of Carbon Circulation and Methane Feedbacks in Anthropogenic Climate Change

The human induced climate change is one of the most serious and difficult environmental issue to manage that has emerged in the recent decades. Climate

change is a good example of a dynamic systems problem. It embodies several delays, feedbacks, nonlinearities and uncertainties in its dynamically complex structure. Therefore, the need for and the usefulness of descriptive and simple models explaining these dynamic complexities are undisputed. The aim of this study is to construct a dynamic simulation model for this end. The model integrates several components of the climate system. It includes the carbon cycle, radiative forcing of CO2, CH4, N2O and induced temperature change as well as the temperature feedback affecting carbon exchange between land and the atmosphere. It also proposes a representation of the permafrost melting and methane feedback processes.

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Commercial System Dynamics Modeling Software: Comparison and Evaluation

System Dynamics is a modeling method to understand the dynamics of systems that contain feedback. Thus, for the past few decades computer software engineers, mathematicians, and other scientists are pooling their talents together in order to build dynamic systems-based software that will be able to accomplish what is humanly impossible. This paper is aiming to provide overview of the systems dynamics software packages available on the market.

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Commercialization in Nonprofit Organizations, Modeling the Dynamic Revenue

Nonprofit organizations have grown dramatically in the last decades based on altruistic values. Nonetheless, philanthropic concepts are still among the least understood scholarly inquiry. In reality, charity organizations have to focus on the dual and often conflicting goals: fulfilling the charitable missions and generating enough revenue to maintain their operating structures. In other words; charity organizations want to generate more money but they dont want to commerce because they are not business sectors originally. We are confronting a fundamental question: Are we permitted to enter the commerce -by capital that earned from charitable donations- to increase the revenues? The serious threat is the possibility of losing donators in consequence of market orientation. Previous researches have shown that market orientation in charity organizations may consider as a source of revenue, on the other hand, persuade donators to less contribution. Anyway, at this dynamic situation, where is the equilibrium point for commercial incomes? In this paper, we attempt to propose a dynamic model to support managers decision in relation to commercial revenues.

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Use of Eigen value Analysis for Nonlinear Models by Taylor Series Expansion

Behavior of nonlinear dynamic systems is often too complex and awkward to analyze. Linearization of the differential equations defining such systems is the means often used to go around this problem. The common method for this purpose has been expansion of the set of nonlinear differential equations by Taylor Series up to the second term i.e. Jacobian matrix and leaving out the subsequent terms. This approach usually leads to a highly rough approximate of the system behavior under analysis. The reason is the said approach yields a first order approximation of the system Eigen Values which are the basic tools in qualitative analyses of the dynamic systems. In this paper by the aid of Kronecker

products, the nonlinear system of differential equations representing nonlinear dynamic system behavior under study are expanded around their equilibrium point by Taylor series to higher order terms and thereafter the effects of the post second order terms are captured and used to modify the Jacobian matrix. Doing so, a more accurate values of Eigen Values are arrived at, for the nonlinear dynamic systems. The use of the modified Jacobian matrix derived as above, results in a more precise qualitative analysis of the nonlinear dynamic systems and enables one to use Modal decomposition for such systems as well.

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Integrated Healthcare Delivery and Health Insurance Models for Studying Emergency Department Utilization

An important healthcare problem in the United States of America is that of emergency department overcrowding. A plausible explanation for such overcrowding is that the lack of access to primary care, which may be influenced by ones insurance status, leads to greater use of emergency departments. Additionally, it has been suggested that the inappropriate use of emergency departments, along with the phenomenon of cost-shifting, results in higher healthcare costs in the form of higher insurance premiums. Higher premiums may in turn influence ones insurance status. To study these relationships, we develop a system dynamics model that captures key interactions between population health state progression, healthcare economics, and population health insurance status. Two interventions are investigated: government subsidies to individuals for purchasing health insurance, and safety-net clinic capacity. We also explore the sensitivity of emergency department utilization to employment rate and population susceptibility to illness.

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Modeling Propagation of Infectious Disease as Connected Network

Pandemic is likely to occur in the near future, and it could cause significant disruptions in society. Avian influenza is such an example as it can potentially evolve to be transmitted from human to human, and spread world-wide in a short period of time. In order to prepare for such disaster and to develop global mitigation strategies for society, government as well as enterprises, need to understand how fast diseases would spread and also the magnitude of infection. As world has became more global than ever, population, social network and transportation would make it much easier for diseases to spread than before. In this paper, we describe a disease spread model that combines compartmental epidemiological model with connected network of geographical locations and airports using system dynamics method. We also model how various mitigation actions would affect the spread of disease. The model is intended to be used for firms in studying possible impact of pandemic disease on their business. Various scenarios of disease spreads are simulated and presented.

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Negotiating Fiscal Sustainability against Socio-Economic Development: A Model-Based Policy Analysis

Fiscal policy can be multidimensional in nature. On the one hand, it addresses socio-economic development, and on the other, it deals with ensuring fiscal sustainability. The ability of the government to design fiscal policies to achieve the twin goal of socio-economic development and fiscal sustainability requires

understanding the social, economic and public debt impact of the fiscal policy. This can only be achieved by contemplating on the complex relationships between the social sector, economic sector and public finance sector of the economy. Even though existing models and techniques offer insights about the impact of fiscal policy on socio-economic development and fiscal sustainability, they lack sufficient causal explanation of the dynamic impact of fiscal policy on socio-economic development and fiscal sustainability. This paper develops a causal socio-economic model to help analyze the impact of fiscal policy on socio-economic development and fiscal sustainability. We concluded that the balanced budget fiscal policy is the most workable fiscal policy for the government to achieve the twin goal of socio-economic development and fiscal sustainability.

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The Dynamics of Public Indebtedness in Ghana

Guided by economic models suggesting that growth can be stepped-up by increasing resources for investment, developing country governments have often resorted to borrowing to supplement revenue hence the accumulation of public debt. The purpose of this paper is twofold. First, it is to develop a dynamic model that identifies the fundamental structure of the public debt accumulation process. Second, it is to identify the mechanisms that generate public debt and their relative contribution to public debt accumulation.

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Modeling the Dynamics of Poverty Trap and Debt Accumulation

Absolute poverty is all pervasive in most developing countries and particularly in Africa (Gore 2002; Sachs, Mcarthur et al. 2004) and Ghana is no exception. For instance, the growth rate per capita for sub-Saharan Africa was negative in the 1980s, i.e. about -2% per annum and about -1% per annum during the 1990s (Birdsall, Claessens et al. 2002). Most common explanation for why countries fail to achieve economic growth focuses on corrupt leadership, inability to make productive use of loans and culture that impede modern development (Korner, Maass et al. 1987; Sachs 2005). However, in recent years, the idea that poverty itself causes economic stagnation has gain attraction and engages the attention of researchers. In this paper, we developed a system dynamics model based on the system dynamics adaptation of poverty traps and debt overhang theory to establish the causal structural mechanism that explains poverty traps and determine internal poverty trends and its link with public debt accumulation. We find out that the decline of per worker income in Ghana is attributed to significant reduction of investment coupled with high population growth. The policy analysis proposed increasing investment,(preferably FDI) as the best policy to reduce poverty and public debt accumulation.

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A System Dynamics Energy Model for a Sustainable Transportation System

The transportation sector is one of the most resilient to the shift away from oil. Policies have been put in place in different regions to introduce alternative fuels and reduce the road transportation heavy dependency on oil products and the related environmental impacts; results, however, are in most cases disappointing. The system is resilient and goes back to the historical dichotomy gasoline-diesel. If from a policy maker perspective, a system dynamics model of the automotive sector can lead to the development of effective policies to achieve sustainable

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mobility, from an energy company perspective, such a model could be used to analyze possible threats and design optimal adaptation strategies for a highly volatile and market that is always on the edge of starting a new major transition. The model here presented can serve both purposes, and the results obtained show how a similar instrument can really make the difference in highly dynamic sectors with ongoing major transitions.

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House Price Fluctuations in Tehran as a Case Study

House price fluctuations have been an especial interest of numerous researchers and many well-known scholars (Wheaton [1.2])have devoted a lot of effort to model house market and explain its oscillations. One can easily distinguish two distinct attitudes in researches accomplished so far. In the first one, house price oscillation is attributed to delay in supply and demand market, whereas in the latter one, the characteristics of house as a durable good are discussed to justify the price oscillation. In this paper, however, we are trying to introduce a new approach by portraying the effect of capital flow among three major markets (including House, Stock and Money) on house price. Concentrating on Tehran House Market as a case study, we have dynamically modeled the volatile capital portfolio among aforesaid markets to offer a better understanding of house market trends in Tehran. At the conclusion, some policies are suggested to put house price oscillations under control.

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Housing Affordability: A study of real estate market in Iran

In this paper by means of a simple system dynamics model, we analyze the dynamics of housing affordability in the context of real estate market of Iran. To do this we define an affordability index according to Iran's economic situation and show that in the absence of effective financial infrastructures, this index declines over time. To confront this problem, we analyze supply-side and demand-side housing policies. Moving into industrial methods of construction and increasing the volume of the construction loans are among supply-side housing policies. Also focusing on macroeconomic policies to reduce economic fluctuations and risk of investments in other markets is among demand-side housing policies.

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Systems Thinking, Dependent Co-Arising and Mental Model in Decision Making

This paper attempts to explore the relevance of the systems thinking approach with the doctrine of the dependent co-arising which is one of the central doctrines of the teaching of Buddha. The doctrine explains how one gets trapped into the vicious cycles of suffering and how one can come out of it. The main elements of the systems thinking such as complexity, cause and effect feedback loops, non-linearity, time-scale, endogenous perspective and experiential learning are inherent in the doctrine. One of the effective leverage points in the doctrine is the bodily sensation which can be used to transform the vicious cycles of suffering into the virtuous ones. The doctrine also gives clue how the mental model gets formed, and how it can be trained so that one can make spiritually informed and better decisions.

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Economic model with non-renewable resources and green energy

An example of mathematical modelling applied to identify the relationship between economy and the environment is discussed in the paper. Foremost, these associations concern global threats to the environment generated by its deterioration and the depletion of natural resources. In the model being analyzed, important and causal relations between its economic-environmental variables are presented. First of all, they concern the dependence between the size of production, environmental pollution and depletion of non-renewable resources. The possibility of replacing fossil fuel, which is a non-renewable resource, by such renewable resources as, for example, hydrogen fuel, is identified. Next, model simulations are presented by using the existing modelling tools in system dynamics. Results of the simulation confirm the possibility of depletion of natural resources as well as deterioration of the quality of the environment in consequence of realization of the economic growth strategy. The depletion of natural resources generates diminishment of the size of the global product in the economy as well as leads to a decrease in the size of the population.

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Reflections on the Validity of System Dynamics Integrated Simulation Models

The impossibility to identify and represent events and emergent characteristics of the system analyzed with computer simulation models aimed at projecting future events has posed serious questions about their validity in the field of social science. While methodological issues, both concerning the foundations of the methodology and the formulation of models, are identified, the System Dynamics methodology seems to allow modelers to gain a deep understanding of the systems studied while answering the four dilemmas identified in this study. These models allow for the structural representation of the system through the identification of causal relations underlying its main functioning mechanisms, represent both dynamic and detailed complexity using wide social, economic and environmental boundaries. Dynamic simulation models are by no means perfect and will never be; nevertheless, modelers have the responsibility to use our best scientific understanding to develop reasonable and sustainable policies. Integrated models allow us to do so by enhancing the understanding of systems.

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A Context-Inclusive Approach to Support Energy Policy Formulation and Evaluation

Observing the many and varied reactions to the Kyoto Protocol, it becomes clear that different governments find themselves in different contexts that eventually direct them towards taking dissimilar positions on energy issues. This paper, through five integrated studies, investigates whether contextualizing energy issues is relevant to support energy policy formulation and evaluation, and provides insights on how to operationalize the contextualization. Instead of considering the most widely accepted tools currently used to assess and evaluate energy policy, this research proposes the utilization of a holistic framework that incorporates social, economic and environmental factors as well as their relations to the energy sector, to better contextualize global, regional and national energy issues. This framework, which accounts for feedback loops, delays and non-linearity, is

applied to case studies to investigate the longer-term performance of selected energy policies. Results of the study indicate the likely emergence of various unexpected side effects and elements of policy resistance over the medium and longer term due to the interrelations existing between energy and society, economy and environment. Furthermore, while side effects and unintended consequences may arise both within the energy sector and in the other sectors, they simultaneously influence society, economy and environment.

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The social role of simulation models

This paper suggests a classification of the social roles simulation models can play. Two dimensions are distinguished according to the context and use of models: models can be boundary objects or representative objects and they can be epistemic or technical objects. These two dimensions allow a classification of four types of model roles. Models can be ascribed different roles over time and different roles by different stakeholders involved in their development and use potentially leading to misunderstanding and conflicts. The suggested classification framework can be applied to a variety of problems around the use models including the discussion of the differences between System Dynamics models and Discrete Event Simulation models and the comparative analysis of model use.

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A qualitative Analysis of Institutional, Social, Eco., Env. and Hydrological Interactions of Water Management System in the WMA

The water management system for the Washington Metropolitan Area (WMA), like many other public utilities, is reaching its maximum service potential in the face of this rapid growth and climate change. Frequent droughts have prompted pricy withdrawals from reserve water supplies and have generated varied responses from different local governments that make up the WMA, reflecting lack of cooperation. The objective of this ongoing research is to capture and assess interactions between social, economic, political, institutional, and hydrological sub-systems of the water management system for the WMA. This study will help WMAs policy makers understand the linkages between the various subsystems so that they can understand how their decision will impact the whole system. This study not only analyzes various demand and supply management strategies but also tries to investigate the motivation and pressures leading to the adoption of these strategies and tries to uncover policy repercussions and resistance.

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Improving Performance Through a Dynamic Balanced Scorecard for Opera Houses: An application to the 'Massimo' Theatre

To support planning and performance improvement at the Massimo Theatre, a dynamic Balanced Scorecard (DBSC) has been developed. The analysis has been conducted with the primary purpose to: 1.define performance indicators associated to end-results, with regard to the four BSC dimensions, i.e.: customer, internal processes, learning & growth, and financial; 2.understand the key linkages between such indicators and related performance drivers; 3.identify the strategic resources affecting performance drivers; 4.analyzing the factors

impacting on the accumulation and depletion flows affecting strategic resource dynamics, and particularly: policy levers on which managers can operate, external constraints, and decision makers involved, in-and-outside the firm. Main feedback loops have been identified, to depict the processes affecting the theatres performance. Qualitative modeling has been also supported by the gradual design of the DBSC structure, and therefore by the SD simulation model portraying the BSC. In particular, the following issues have been focused (1) decision levers, that have been included in the DBSC control panel; (2) performance indicators (i.e. objectives, measures, and targets) related to the above four dimensions, which have been included in the scorecard window of the SD model; (3) reference behavior modes for key variables.

Political Dynamics Determined by Interactions Between Political Leaders and Voters

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The political dynamics associated with an election are typically a function of the interplay between political leaders and voters, as well as endogenous and exogenous factors that impact the perceptions and goals of the electorate. This paper describes an effort by Sandia National Laboratories to model the attitudes and behaviors of various political groups along with that populations primary influencers, such as government leaders. To accomplish this, Sandia National Laboratories is creating a hybrid system dynamics-cognitive model to simulate systems- and individual-level political dynamics in a hypothetical society. The model is based on well-established psychological theory, applied to both individuals and groups within the modeled society. Confidence management processes are being incorporated into the model design process to increase the utility of the tool and assess its performance. This project will enhance understanding of how political dynamics are determined in democratic society.

Influence Diagram Supporting the Implementation of Adaptive Campaigning

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Adaptive Campaigning describes the Australian Land Force response to the challenges of future warfare. It discusses the need for Army to perform successfully over various lines of operation and to maintain an adaptive approach in order to achieve its objectives in an ever changing complex environment. However, the novel nature of this approach poses some conceptual and practical implementation difficulties. A visualisation technique known as Influence Diagrams is employed to develop an Adaptive Campaigning Influence Diagram to abate some of these difficulties. The benefits of employing the diagram are illustrated by recent real world experiences of US Forces in Baghdad.

Adaptation on Rugged Landscapes: Competitive Strategies in the Presence of a Common Objective

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This paper examines the ability of companies to change their organizational forms in an effort to obtain higher performance. We use the concept of fitness landscapes and we expand the notion of attributes to include not only the capabilities, but also the purpose organizations attempt to serve usually the market. We decouple the fitness a form represents from the actual fitness an organization that incorporates it will experience due to the effect of competition for a common objective, creating a dynamic landscape. The extended model

incorporates the notion of feedback from the environment in a twofold manner: the structure of the underlying landscape and the interaction among rival organizations. On one hand, the feedback helps organizations into making decisions based on increased information and on the other hand, the outcome of those decisions is no longer entirely predictable. We examine two different rules of transformation, namely the local adaptation, and the distant adaptation. The results indicate that the proposed scheme can more accurately explain the variation observed in real environments than previous models. In addition, it can serve as a means of predicting the possible reforms of rival organizations on a common landscape.

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The Player Number Growth in Online Social Games

The steeply growing numbers of players of social games on Facebook motivate to analyze the influencing factor, which lead to these successes. For this purpose the most played browser games are tested for their similarities in a qualitative survey based on the VICTORY model. Namely the games are FarmVille, Caf World, Fishville, Mafia Wars, Zynga Poker, PetVille and YoVille by Zynga as well as Happy Aquarium by CrowdStar, Pet Society by Playfish and Farm Town by Slashkey. The resulting findings from the survey deliver the basis for the model of a notional ideal-game integrated into social networks. The model uses the methods of System Dynamics and simulates the spreading features, the game design, advertising and supporting processes. The spreading features of popular browser games focus on viral marketing within Facebook. Players for example report their successes via pin board entry to their friends. Likewise especially rare items are distributed, if players react to pin board entries of their friends. Lastly the donation of in-game items helps the players to motivate their friends to take part in the game. With the potentially high number of players social networks are perfect for the verification respectively falsification of complex dynamic models. Therefore a prototype of an ideal game is in development to be integrated into Facebook and to deliver further knowledge.

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Self-Organizing Market Structures, System Dynamics, and Urn Theory

This article argues that the tools of system dynamics and urn theory can be used to model self-organizing markets. A fundamental characteristic of self-organizing markets is that size of firms by rank order follows the Zipf distributions. While complex industrial structures of this kind are hard to describe with conventional theories, system dynamics and urn theory are equipped with adequate tools to deal with this kind of evolutionary phenomena.

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System Dynamics Applied to Combat Models (Military and Naval)

Different mathematical models explain the main features of combats, such as models concerning the attrition of the forces involved; numerous battles employing these models have been recreated. Unfortunately most of this work remains in classified records. In this study basic models of Lanchesters Laws are reviewed and Salvo Equations are introduced both employing system dynamics concepts and tools. System Dynamics is a relatively new tool in military analysis that provides an understandable and intuitive way to deal with the subject, including soft variables normally present in real combat situations. To apply those

models a fictitious land combat case between two forces is presented, improving the basic model by adding some parameters to test commander decisions. In the naval combat scenario, the Salvo model introduced is applied to the First Battle of Latakia, held in 1973 between Israeli missile boats and Syrian missile boats, indicating some future studies that may be done. Finally, stochastic approaches are presented.

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Scriptapedia: A Digital Commons for Documenting and Sharing Group Model Building Scripts

Modelers facilitating group model building (GMB) sessions often draw on a set of sophisticated pieces of small group processes called scripts (Andersen & Richardson, 1997; Vennix, 1996). Andersen and Richardson (1997) have proposed that documenting the scripts that modelers use will help advance the field and practice of GMB by making the process more transparent and replicable. However, no common format or central library yet exists whereby scripts can be shared. This project responds to this need by proposing Scriptapedia, an open source Joomla based digital commons for documenting and sharing GMB scripts. Key features of Scriptapedia will include the ability to search for scripts, revise or develop new scripts, track the history and authorship of how scripts change, and review samples of a GMB agenda of scripts. This poster presents a prototype of Scriptapedia including examples of scripts, agendas, and draft policies for encouraging the documentation and sharing of scripts.

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The Use of Group Model Building for Analysing Event Causality within the Nuclear Industry

Currently the most frequently used tools for investigating and learning from industrial accidents are based on linear, reductionist models of event causality. It has been suggested that complex socio-technical systems exhibit non-linear behaviour, incompatible with these approaches. An alternative approach based on system dynamics group model building is proposed and investigated within the context of the civil nuclear industry. The success and feasibility of the approach is assessed though the analysis of a case study event by a group of industrial experts previously unfamiliar with system dynamics. A selection of the models produced is discussed. The investigation demonstrates the feasibility of the approach and its potential to provide additional insights and learning. A possible archetypal structure is also identified and described indicating the possibility of the discovery of further archetypes through this approach which could then be shared for contextual learning between organizations and industries.

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A Qualitative System Dynamics Analysis of the Effects of an Emissions Trading Scheme on the New Zealand Forestry Value Chain

As part of New Zealands obligations to the Kyoto Protocol, New Zealand has developed an Emissions Trading Scheme (ETS) as a mechanism to reduce its

national greenhouse gas footprint, and to encourage and support global action on climate change. The forestry sector in New Zealand was the first sector to enter the ETS, effective from 1 January 2008. So far many forest owners in New Zealand have been slow to join the scheme. To investigate this situation further, a systems thinking group model building workshop was held to discuss the effects of the ETS on the New Zealand forestry value chain. A qualitative system dynamics analysis was undertaken, whereby a range of relevant issues was generated by a group of stakeholders, and based on these a set of causal variables was identified. These showed a strong bias towards an economic viewpoint of the basic issue being examined. Causal loop diagrams were made from these variables, and the dominant loops were briefly analysed. This paper will discuss some of the insights gained from this project to date.

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Applying the Goal Setting Practice in the Dynamic Balance Scorecard Learning and Growth Perspective

The purpose of the present paper is to build a system dynamics model for goal dynamics in organizations within a Dynamics Balanced Scorecard framework. In this paper it is proposed a model of goal dynamics in which Goal Setting and two other related Human Resources practices (Management by Objectives and Training) is viewed as a managerial tool able to enhance workers goal commitment, and therefore, improve organizational performance. In the first part of this paper, an analysis of Dynamic Balanced Scorecard - to measure performance in dynamically complex systems - and Goal Setting Theory - in bettering workers performance - are stressed. In the second part, a case-study, the causal loop and a quantitative model of goal dynamics in organizations are described. In the third part, the stock and flow model is depicted. Finally, scenario analysis is presented.

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A generic framework for hybrid simulation in healthcare

Healthcare problems are complex; they exhibit both detail and dynamic complexity. It has been argued that discrete event simulation (DES), with its ability to capture detail is ideal for problems exhibiting detail complexity. However from the strategic perspective, System Dynamics (SD) with its focus on a holistic perspective and its ability to comprehend dynamic complexity has advantages over DES. Both paradigms provide valuable insights but none of them is capable to capture both detail and dynamic complexity to the same extent. It has been argued in literature that an integrated hybrid approach will provide more realistic picture of complex system with fewer assumptions and less complexity. Hybrid simulation is a form of mixing methodologies and due to fundamental differences, mixing methodologies is quite challenging. In order to overcome these challenges this paper has attempted to provide a conceptual framework for hybrid simulation. On the basis of knowledge induced from literature, three requirements for framework have been established. In order to address these requirements, a three phase conceptual framework for hybrid simulation has been proposed. In future work the proposed framework will be evaluated with examples from healthcare.

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A platform to produce hybrid models in order to manage risks and uncertainties on financial and actuarial organizations

Planning under uncertainty requires reliable tools and methods for dynamic financial analysis. A financial and actuarial problem is how to consider returns of investment forecasts and foresees based on uncertain incomes and liabilities. To adress asset and liability management (ALM) problem one must model stochastic liabilities based on stochastic assets to set more reliability to investment policies simulators. This articles analyses a combination of methods and techniques to better model uncertainty to give to financial and actuarial analysts and actuaries a way to perform more realistic analysis of the solvency and liquidity, fuzzy logic and agent based modeling. The conclusion propose a framework where a combination of many methods and techniques are possible and useful to integrate all these approaches and, on an open system perspective as a way to manage long term investment policy based on current liabilities, both stochastic in nature.

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Modeling Transportation Public-Private Partnerships

The present paper discuss and demonstrate arguments in the use of the System Dynamics as a main approach to a new research area here named of Territorial Engineering. More specifically the aims are help the main stakeholders involved in the process to decide about the bankability of infrastructure projects. It is also considered the possibility of using agent-based modeling in the form of a hybrid model. This new research area wish establishing a new focus on infrastructure funding, whereby it is argued that the investment decisions should not be taken based solely on the gains obtained by users and indirect beneficiaries, but should also consider the infrastructures ability to accomplish an economic growth that may be captured fiscally. This proposition emerges from the limitations of the current funding approaches, both public (fiscal investment) and private (PFI and PPP), to cover the increasing construction and maintenance costs of infrastructure.

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Ambidextrous Effects of Relational-specific Investments in the OEM Transactions

This study interprets why does Original Equipment Manufacture (OEM) suppliers choose to invest in relational-specific assets dedicated for foreign brand buyers without economic safeguards. By combining the case study method and inductive causal-loop modeling approach, this study model the ambidextrous strategies adopted by interviewing five Taiwanese OEM suppliers to initiate simultaneous both exploration and exploitation effects on their capability and transaction value in vertical transaction structure by exerting relation-specific investments in dependency-asymmetric OEM-supplier transactions. The study results theorize that the relation-specific investments made by weak contractual party can exert the ambidextrous effect on those specific assets with the dominant exchange partners for changing its bargaining position. The causal-loop diagrams highlight the managerial implications and strategic logics behind the unilateral asset-specific investments along the transaction dynamics.

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A system dynamics model for marine cage aquaculture

A system dynamics model is built in order to study the sustainability of marine cage aquaculture. Profitability is assumed to be influenced by the availability of dissolved oxygen in the water, which is itself influenced by the farms effluents. The base run suggests that as long as the farm releases organic matter in the water, the level of dissolved oxygen will tend to decrease thus increasing the fish death rate and therefore jeopardizing the aquaculture venture. Three policy options are tested and their effects on the company sustainability are discussed: - Any improvement in feed floatability is not likely to lead to any major change in the farm sustainability; - The introduction of a delay between two production seasons leads to a modification in the pattern of the total profits of the company which tends to take a more linear shape; - The cancellation of one whole season if the amount of dissolved oxygen appears to be under the threshold level of 5 mg/l leads to cancel one season every two seasons and however gives the best results concerning the long term sustainability of the company.

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Modeling the Evolution of Public Industry R&D Institute-the Case of ITRI

The Industrial Technology Research Institute (ITRI) has been recognized as a successful example of nurturing the industry development through public industry R&D institutes. During its development process, ITRI has experienced several stages of strategy and organizational reforms. The evolution of the organiztional structure and the interactions of ITRI with its social-technological environment are complex and dynamic, and all together being important for ITRI to generate impacts to the industries. This study analyzed the development process of ITRI, and derived a system dynamics model to examine the structure behind the success experience. The results of the model are discussed.

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Introduction of Renewable Energy Sources in Brazil: An agent-based specification based on causal loop analysis

The depletion of oil sources and the phenomenon of climate change have converged for questioning the sustainability of the current industrialised society. The severe repercussions of both may invoke for a transition of the existing energy infrastructure to adapt our current society to alternative energy sources. The management of any transition process is limited due to the complexity of energy infrastructures, which are complex, large socio-technical systems intertwining actors decision-making and technical regimes, and the insufficient understanding of the phenomenon of transitions. To unravel the phenomenon of transitions, a multi-disciplinary theoretical framework for transition decomposition has been developed. Here, actors in the energy infrastructure system are put at the core of this framework as the motor of transitions. This transition framework is applied to the historical case of Brazil and the sugarcane ethanol as fuel for light vehicles. Causal loop diagrams are then applied to trace the dynamics between actors and are used as a stepping stone for the specification of actors, making them suitable for agent-based modelling.

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Roles Differentiation in Family Firms Succession: The Impact of Private banking and Private Equity

Family Firms are organisational forms where the continuity of the relationships between the owning family (families) and the firm is mutually beneficial to both the family and the firm. Succession is one of the key processes of continuity dynamics. Successions are often considered turning points, which may have profound consequences for continuity itself as well as for the family and firms destiny. From the firms point of view, successions can result in a fragmentation of ownership and in a differentiation of roles among family members. A well-managed succession process can contribute both to the continuity of the family-firm relationship and to the firms performance. We propose a model, based on a resource-based view (RBV) of family firms and on dynamic capabilities (DC). We simulate the effects of the succession on the firms entrepreneurial performance. Our simulations help to understand the contribution that banking services, particularly private banking and private equity, can provide to the management of succession. Key words: Succession, resource based view, dynamic capabilities, entrepreneurial performance, private banking and private equity.

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The Livelihood-Energy-Conservation Nexus: Intervention strategies to promote conservation in forest villages

In this paper, we present results from a modeling excercise to understand human pressures on a forest sanctuary in Rajasthan, India. For the very poor energy insecure households and communities located inside and in proximity to the Kumbhalgarh Wildlife Sanctuary, harvesting forest resources from the government sanctuary constitutes a critical source of livelihood. The sanctuary, supports in varying degrees the need for fuelwood, timber, grassy fodder, and other non-timber forest products in 160 villages in the area. At this rate, the pressures on resource extraction from the sanctuary are alarmingly high and it is being denuded rapidly. This study utilizes participatory appraisal techniques and community-based participatory model building, combined with expert testament to trace and examine local behavior patterns to identify routes of intervention to stem resource extraction from the sanctuary. The resulting System Dynamics Model highlights employment, buffer zone management, and household energy efficiency as three possible routes that could directly reinforce conservation efforts and reduce sanctuary degradation without disrupting the livelihoods of the implicated communities. Strategies of intervention are discussed therein. The goal is to use this excercise to assist Foundation for Ecological Security in designing effective interventions to protect forests and ensure human security.

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How the concept of organisational value highlights corporate performance drivers

Numerous studies and publications focus on the concept of information system value analysis in industry. The purpose of this paper is twofold: 1) We have endeavoured to describe the as yet still rather unconventional concept of organisational value, demonstrating that both technical and cognitive aspects play a part in its construction. Not only are the components of this organisational value linear and static; they interact with each other over time. Our wish, in fact, was to

study the evolutionary dynamics of this organisational value generating a greater or lesser impact on corporate performance; 2) We have built a teaching simulator (a "serious game") to illustrate how this systems dynamic works and to show students how the usually-concealed drivers of change generate this organisational value. The teaching value of the tool is to provide two modes of operation: the automatic mode, where the computer decides, and the manual mode, where the student decides alone or as part of a group.

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The system dynamic study of regional development of Manas Basin under the constraints of water resources

The arid Manas River Basin, Xinjiang, China, similar to the other arid regions is facing the problem of water constraints. Within the social economic and political systems, growth and expansion has always been the key driving force while it occasionally is forced to slow down or even decline due to the water constraints. To date, the growing populations, industry and agriculture water demand has largely been met by improving and expanding reservoir capacity, by mining fossil groundwater resources, and by improving the water use efficiency. However, bringing future demand in line with available supplies will require increasingly efficient water management practices and greater conservation of water resources. A system dynamics approach has been used to develop a model to evaluate the sustainability of the water resource system in the Manas River basin. The study shows that the technical solutions on the improvement of water supply and the improvement of water use efficiency are not the fundamental solutions. Acknowledging the water capacity and changing a growth orientated value system is crucial in the sustainability of Manas River Basin.

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Towards a model-based Tool for Evaluating Population-level Interventions against Childhood Obesity

The prevalence of obesity in the UK is mirroring trends in the USA. There is a need for research to provide public health agencies with advice as to the most effective means of securing behavioural change. The work reported here is in its very early stages. The history of obesity modelling using system dynamics is charted. A model of the energy intake and expenditure by a population of children aged 2-15 years is then described. Both of these two influencing factors on the caloric balance are modelled in some detail. A specimen output graph is included before an exposition of the intended use of the model. Mention is made of soft variables and the role of social marketing in effecting behavioural change.

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Lake to Puddle: A System Dynamics Approach to Social, Economic, and Environmental Consequences of Water Use in Udaipur, India

Water scarcity could define the modern era, as 67% of the world will experience water shortages by 2025. In Udaipur, India, shortages are already evident as lakes in the city dry to mere puddles every summer. The shortage in Udaipur results from the convergence of social, economic, and environmental factors and is especially detrimental due to the economic importance of lake tourism for city residents. Students from Washington University in St. Louis, in collaboration with the India Institute of Technology, Tata Institute of Social Sciences, and the Foundation for Ecological Security conducted a field study to investigate these

shortages in greater depth. A system dynamics model was constructed in order to best examine: (1) interdependency of domestic, industrial, and tourist water use on the supply of Udaipurs water sources (2) areas for policy and conservation interventions to alleviate water shortages, and (3) areas of future research. While the availability of data limited the model that could be constructed, it allowed the authors to capture the interrelated factors influencing Udaipurs water supply. The collection of additional data will help test suggested interventions, which include reducing distribution losses, reducing water demand, and treating polluted water sources.

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Dynamics of Enforcement and Infringement of Intellectual Property Rights and Implications for the Incentive Function

The literature recognizes the dynamics of Intellectual Property Rights implementation. However, a framework that examines these dynamics and analyses the interactions is missing. We use established theory to build a system dynamics model that explores the feedback effects of Intellectual Property Rights use, infringement and enforcement to explain how the strength of Intellectual Property Rights arises endogenously. The model looks at a scenario in which Intellectual Property Rights have been implemented recently. We show that the strength of Intellectual Property Rights arises endogenously without being tied to the formulation of the law.

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Bottom-up and top-down approaches in energy efficiency estimation.

This paper studies the role that energy efficiency improvements can have in Italy. After a wide discussion of the situation of the European Union and Italy in the context of the climate change issue, it proposes two kinds of simulations which aim to measure possible energy efficiency improvements: bottom-up and top-down simulations. They can be seen as complementary methods for studying the savings that can be obtained through energy efficiency. The estimations show that the possible gains are huge, both in energy and monetary terms. Thus, their exploitation should be considered as a fundamental step of the Italian climate change policy.

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Humanitarian Crisis: when Supply Chain really matters

The supply chain of humanitarian aid is a complex and interlinked network in which different actors, processes, decisions and information are mixed to serve the needs of the victims in a catastrophe. As aid can be vital, also the correct management of the supply chain and the efficiency in each one of its stages is important not only to support the reconstruction efforts, but to allow a correct and pertinent assistance of the needy population. In an incidence as a disaster, arrivals, transportation, storage and delivery of necessary goods becomes a difficult task that requires the mobilization of a great amount of resources. The supply chain is therefore stretched to their limits; that is why it is so important to understand its behavior and capacity, regarding the handling of shelter, food, water, and health care (among other necessities). The main objective of this paper is to model and describe the different phases comprising the supply chain of a humanitarian crisis

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using the system dynamics methodology, understand how those variables affect its operation and identify critical break points and inefficiencies that arise in each of the stages.

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A System Dynamics Sustainable Business Model: Case Based on the Global Reporting Initiative

We present a System Dynamics (SD) model to explain the implementation and development of business sustainable policies in a Mexican oil company. The model was built using information reported by this company in the Global Reporting Initiative (GRI) website. The paper begins by reviewing the theoretical basis of the business sustainability concept and describes the stakeholder model. Then, the evolution of firms towards implementing sustainability and how this relates to innovation and business competitive advantage are examined. We provide an overview of the content of sustainable reports, and particularly the dimensions considered by the GRI. The study is in a developmental stage, we expect to implement the model when data is fully fed. In this paper, we report on the literature reviewed; and we only sketched the SD sustainable Business model. This investigation, when completed, will highlight the complexities that companies face when deciding to implement sustainability.

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Decisions from Experience reduce the "Wait-and-See" behavior in Climate Change

In past research, the wait-and-see behavior for climate has been exhibited in people's use of the correlation heuristic (CH, e.g., thinking that stabilizing carbon-dioxide (CO2) emissions will stabilize CO2 concentration) and violation of mass balance (VOMB, e.g., thinking that the CO2 concentration will stabilize when CO2 emissions exceed absorptions). This paper provides evidence for reduction in peoples wait-and-see behavior in climate change using an intervention that depends upon peoples experiential knowledge. In a laboratory experiment, participants were randomly assigned to one of two conditions: description, where participants performed a climate stabilization (CS) task as a written description on paper; and experience, where participants performed the same task in a dynamic climate change simulator (DCCS). The CS task was given to participants after they finished playing the DCCS in the experience condition. Results revealed a significant reduction in the wait-and-see behavior in the experience condition compared to the description condition, demonstrated by a significant reduction of the use of CH and VOMB. Policy implications of the findings are discussed.

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Boom and Bust Cycles in Wind Energy Diffusion Due to Inconsistency and Short-term Bias in National Energy Policies

Common knowledge in the wind industry pinpoints inconsistent policy, such as the production-tax credit scheme in the US, as a key source for boom and bust cycles in the wind energy industry. This paper looks at the sources of the industry boom and bust via a system dynamics model for diffusion of wind energy technology. A model is developed through the combined use of theory and calibration to a set of comparative national and state-level cases. The formulated model captures the effects of inconsistent policy for different national scenarios.

The paper demonstrates through the system dynamics model how short-term bias can harm the long term development of the industry by perpetuating these boom and bust cycles. Finally, various policy scenarios that will encourage more sustainable industrial growth are suggested and simulated within the model.

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A System Dynamics Model of Information Systems Program with Learning Outcomes Assessment feedback

The aim of this study is to develop a theoretical dynamic model of an Information Systems Academic Program with Outcomes Assessment Feedback. This model can help academic administrators view the future consequences of their decisions in a dynamic frame rather than the usual static frame. The study uses the methodology of system dynamics approach which can model complex and dynamic social situations. The developed model architecture, functions and variables are determined based on existing research and experience in assessment of information systems programs. The model is implemented and tested in system dynamics simulation environment. The simulation examines the dynamic behavior and can investigate the variables that are crucial for the success of assessment policies in academic environments. However, the model is yet to be tested with real academic situation data.

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The Study of inflation effects on Iran Large Industrial Workshops profit: combination of system dynamics and econometrics

In the most of the done studies, such as Anindya Banerjee & Brill Russell (2005) and Anindya Banerjee & at el. (2001), inflation has a negative effect on markup. In this paper, the effects of inflation on profit of big industrial companies have been inspected. The variables such as inflation, international CPI levels, profits of agencies, sale (income), total costs, cost of R&D, total factor of product (TFP) and quality of products are being inspected. In this study, first the relation between the variables have been estimated by using panel data during 2000-200, then the accuired results were simulated by system dynamics method, we used from Vensim PLE,. The results show that the inflation causes more increase in incomes than expenses of agencies and finally the profit increase. The reason is that because the agencies dont respect the standards of the products in inflation conditions-, they generally can decrease the quality of the products and as a result increases the prices of their product.

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Systemic strategy development and implementation using the example of a lead brokerage financial service provider

This paper examines systemic strategy development using the example of a lead brokerage financial service provider. To do so, different elements of several systemic and cybernetic induced theories are combined to a three step approach: 1) system diagnosis to derive redesign actions, 2) identification of critical system variables, 3) creation of a modular software prototype with the help of a control loop model. This approach is induced by action research building on an interactive inquiry process that balances problem solving and actions implemented in a collaborative context. Data-driven collaborative analysis is implemented to better understand underlying causes and to enable future predictions about organisations and processes. The results of the approach

application seem promising in two ways: 1) a real benefit for the lead brokerage financial service provider was generated by the operationalisation of its strategies, 2) the approach itself shows potential to be of general applicability to successfully support business processes with IT.

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System Dynamics Approach For Assessing Parking Demand For Multistoreyed Commercial Shopping Complexes

Parking is a big issue as traffic, since the vehicular population is increasing at an alarming rate and the demand for parking spaces in major activity centres of metropolitan cities like Chennai has been increasing proportionally. The parking standard for Indian conditions was formulated by IRC- SP-12 of 1972. For Chennai, the parking standard is proposed by Chennai Metropolitan Development Authority (CMDA) in Development Control Rules (DCR). The parking standard for multistoreyed shopping centers is based on the parking demand obtained from mere patrol survey. It has been observed that the parking standard is not the same for all multistoreyed shopping centres as prescribed in the DCR norms and it depends on various parameters that attract a trip to these centres. It is for this reason that there arises a deficiency in the parking standards in some areas like in the city whereas in other areas like the CBD and CMA, the parking standards provided is in excess. Hence a study is conducted to assess the parking demand based on various influencing parameters for shopping complexes located in CBD, City and CMA using a regression analysis. The equation obtained is input in the System dynamics model to obtain the parking requirements and frame the standards for multistoreyed commercial shopping complexes.

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The Process of Strategic Innovation. A System Dynamics Approach

The paper presents a System Dynamics model that explores process of strategic innovation. Strategic innovation is the result of a dynamic process that enables companies to redefine the way to do business delivering more non-monetary value to customers with a high level of operational effectiveness. The firms ability to generate and implement strategic innovation is determined by the diffusion on a certain degree of entrepreneurial orientation among front-line managers. Entrepreneurial orientation is determined by the introduction of organisational innovations that allow the release and the control of the entrepreneurial energy embedded in the organisational structure. Front-line managers contribute to the renewal of the firms strategy developing strategic initiatives supported with resource allocated by top managers. The effectiveness of the process of strategic innovation is influenced by top managers ability to recognise main feedback structure and to control two critical trade-offs. First they have to balance the entrepreneurial orientation of middle-level managers with a certain degree of strategic discipline to govern the selection and integration process of new strategic initiatives, secondly they have to balance resource allocation to support exploration activities finalized to generate new strategic initiatives and exploitation activities that allow strategic initiative development and integration in the strategy of the firm.

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Modeling Dynamics of gaining expertise in a call center

Knowledge and expertise are the most precious assets of a call canter, which enables the staff to serve the customers on high quality. As call centers have a tense working condition, staff are likely to leave this job to a better position in the company or outside, so a real challenge for the managers of these centers is first to moderate the working condition , and then to cope with the high rate of turnovers. This article aims to the last, by modeling the cycle of training a new staff and building experiences, which helps him to serve the customers. By entering the risk of leaving job, this model is objected to find scenarios to reduce the costs of turnover.

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System Dynamics Analysis of Organizational Accidents: A Review of Current Approaches

Organizational accidents are increasingly being studied using system dynamics (SD) tools. However, as compared to qualitative research of organizational accidents, most of the SD studies conducted so far lack grounding in actual data. Ironically, organizational accidents usually have available data in the form of inquiry reports and other public reports. This study reviews SD studies of organizational accidents and proposes ways to improve the rigor of SD analysis of organizational accidents. Eight relevant papers were identified and classified into two broad types: (1) practice-to-theorizing and (2) theorizing-to-practice. Practice-to-theorizing refers to deriving theories from analysis of actual organizational accidents, while theorizing-to-practice refers to use of pre-conceived theoretical model for research. The study found that both approaches can be improved through textual analysis techniques. The paper proposed data analysis procedures to improve robustness of SD analysis of organizational accidents.

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Systematic Approaches to Cyber Insecurity

Recent developments have demonstrated that as the diffusion of cyber enabled technologies increases, so too does dependency on a cyber infrastructure susceptible to failure, outages, and attacks. While current efforts are underway to introduce new methodologies and techniques to manage risks, particularly localized risks (such as those at a particular firm), developing resiliency at the system level requires transformative thinking to increase collaborative situational awareness, improve our understanding of risk, foster strategic coordination, and define actionable plans at the sector level to address pervasive sector-wide risk. The overall goal of this research is to develop innovative management and operational approaches using experts, emerging data sets, policy analysis, and relevant theory, along with simulation-modeling, to enable real-world implementation of high-leverage opportunities to promote corporate resiliency to cyber threats.

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Integrating System Dynamics and Enterprise Modeling to Address Dynamic and Structural Complexities of Choice Situations

The ability enterprise managers to come up with the decisions leading to the best outcome for the enterprise is hampered by their cognitive limits in understanding and addressing the dynamic and structural complexities residing in choice situations. Dynamic complexities deal with the behavior of the enterprise and its environment over time. Structural complexities, on the other hand, arise from the number of the departments within the enterprise, their interactions and the interactions between the enterprise and the entities across its boundary. The policy aiding methods developed to assist managers in the analysis of choice scenarios address these two types of complexities in separation. In this paper adopting a holistic approach, we integrate System Dynamics (SD), a method for understanding the behavior of systems over time and Systemic Enterprise Architecture Method (SEAM) a modeling method that provides insights into how an enterprise and its interactions with other entities are structured. Integrating SD and SEAM we present an approach to modeling, analysis and simulation of choice scenarios aiming at reducing the dynamic and structural complexities involved in the decision making process. We illustrate the applicability of our approach by applying it to an example of a choice situation in a manufacturing company.

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Supplier Capacity Decisions Under Retailer Competition and Delays: Theoretical and Experimental Results

Inflated orders by retailers competing for scarce supplies are a common cause of the bullwhip effect, a frequent and costly problem in supply chains. This paper presents a formal model describing the impact to suppliers of retailer order inflation and describes an experiment to explore a suppliers reaction. We provide experimental evidence that shows that a reinforcing loop created by retailers inflated orders leads to excessive capacity, backlog and costs for the supplier. Subjects making capacity investment decisions for a supplier perform poorly compared to an optimal benchmark. In particular, long times to build capacity and aggressive retailer competition for scarce resources lead to poor subject performance. Furthermore, when subjects face retailers that moderately inflate orders (10% order inflation), the majority of the supplier costs are due to changes in capacity (investment/divestment). The costs associated with frequent changes in capacity capture the inherent complexity of setting the proper capacity level. In contrast, when subjects face retailers that aggressively inflate orders (50% order inflation), the majority of the supplier costs are due to supplier backlog. Costs associated with inadequate backlog management capture the inherent complexity of managing the positive feedback loop of retailers order inflation.

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Stock and Flow Failure: Initial Stock and Priming

The Stock and Flows (SF) failure is a robust difficulty in people's understanding of accumulation. Although it has been suggested that people use the wrong cognitive representation in solving SF problems (e.g. the classical People in the Store problem, PinS), we know little of what that mental representation people use. It has been suggested through verbal protocols that the initial stock value

plays an important role in the way people answer stock questions in the PinS problem. In this research we investigate the value of knowing the initial stock and the value of introducing the concept of accumulation (priming) with a simple and familiar problem (The party-in-the-house, PinH problem). We found that providing the initial stock value is important to increase the accuracy in the traditional PinS task, particularly by reducing the number of "cannot be determined" answers in these problems. The value of a simple and familiar induction graph is less clear.

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Mental Models of Dynamical Systems: Taking Stock and Looking Ahead

This paper deals with the representation of the structure of mental models of dynamical systems (MMDS). Systems are dynamical if its present output depends on past input. Available research about mental models has most often accounted only for aspects which have the capability to form a static mental modeli.e., simple variables, common links, and their polarity. The properties which translate such models into dynamical mental model are feedback loops and delays. Not many mental model studies have accounted for them up to now. The contribution of this paper is twofold: First, we elaborate the structural content of a MMDSthe conceptual structure. And second, we use this conceptual structure to enrich the seminal definition of a MMDS. Based on a current overview of research about MMDS, we lay out paths for further research.

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An Object-oriented System Dynamics Programming Model

This paper presents an Object-oriented (OO) programming model and a framework for building and executing differential equations within the context of the System Dynamics (SD) modeling paradigm. The inherent core structures and mechanisms of SD tools and languages are identified along with proposals of OO designs of these structures and mechanisms. This is the foundation for the design and implementation of a programming model and a runtime environment for SD models within an OO framework. The framework consist of a time event based programming model, also called an instruction type hierarchy, a parser, a semantic analyzer, a runtime library and a simulator integrated in an Interactive Development Environment (IDE) for Java. A recurring pattern in SD is used as an example and implemented as a reusable component to illustrate the potential for handling complexity and contribute to reuse of common patterns for building scalable SD models within the OO paradigm.

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Rats, Black Swans, and Personal Careers - an Investigation of “Go with the flow” and “Deviate from common behaviour” Strategies

The purpose of the paper is to provide a formal representation of the so-called rat race, in which the major question is whether rats should go with the flow or deviate from common behaviour. With the help of a didactic system dynamics model, various concepts from business, investment, and personal career strategies can be explained and their quantitative requirements can be determined. In an eclectic fashion, the paper draws on many scientific concepts, of which some have become widely known lately because of popular books in their fields. One

finding of the simulation analyses is thatwhile behaviour following rational choice theory might be useful if decisions can be made without dependencies on other agents, leading to a norm-behaviour for an agentdeviating from the norm is beneficial when many agents in a system are coupled by a common resource. Furthermore, with many coupled agents, total system resources are more fully exploited when not all agents are rational. The value of the paper lies in its attempt to link different content areas with the help of a dynamic model.

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Speculative Bubble in Tehran Stock Exchange: a dynamic description

While the majority of literature on speculative bubbles has focused on bubbles in large stock markets, this paper will focus on the formation of bubble in the smaller Tehran Stock Exchange. We have used a system dynamic approach to build a model describing what happened to Tehran stock market during 2002 till 2005 years. To gain a better model we have amalgamated some behavioral finance issues with price behavior dynamics. We believe that short-term investors had a major role in the great growth of Tehrans bubble. With such a model developed we finally propose some policies which could be applied in Iran in order to prevent bubbles formation. These policies include reducing attractiveness for short-term investors and preventing the sudden capital entrance.

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Systems Dynamics Study of Integration in Information Technology

Information Technology offers a continuous choice of options to be harnessed and used to support business. IT applications have specific domain focus to solve business problems. Since business is always dynamic the technologies offered to support business are always being improved to promote flexibility agility and user friendliness. Integration domain helps in streamlined integration of various enterprise applications, data, business process etc. Applications, technology and software belonging to this domain are perhaps the most dynamic of all other IT domains. The paper gives a high level view of technology lifecycle of various integration lifestyles. Understanding the various forces acting when a technology is being offered will help an IT worker, whether he is an architect (for choice of integration style) or a project manager (for investment decisions in specific technology) or an IT consultant (for decisions on learning specific technology).

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Church Growth via Enthusiasts and Renewal

A word-of-mouth model is constructed for the growth of a church through enthusiasts, a subset of the church members who are active in recruitment. Two mechanisms for the source of new enthusiasts are proposed: new converts, and existing church members through a process called renewal. The conversion and renewal processes are compared and policies that could enhance the growth of a church are analysed. It was found that renewal is able to lower the epidemiological threshold present in the conversion process making rapid revival growth easier to achieve, even when that conversion process is inadequate. This is in part due to the expanding network of contacts a growing church produces that can enhance the renewal process. Policies to foster church growth centre on encouraging renewal, even at the expense of traditional evangelism. Some re-grouping of churches is suggested in order to attain critical masses of enthusiasts and church members that could tip a church into growth.

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Sensitivity Analysis of Oscillatory System Dynamics Models

Oscillatory system dynamics models are usually difficult to analyze with statistical sensitivity analysis because of nonlinear and cyclic behavior patterns. Therefore, behavior pattern sensitivity analysis, which focuses on the sensitivity of pattern characteristics such as equilibrium points and periods, is appropriate for this type of simulation models. In this article an analysis procedure is suggested for pattern sensitivity of oscillatory models and this procedure is applied to the inventory workforce model described by Sterman(2000), using regression method.

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Sensitivity Analysis of System Dynamics Models by Behavior Pattern Measures

Parameters of system dynamics models are subject to uncertainty, so sensitivity analysis of simulation results is important for the reliability of such models. Since system dynamics is a behavior-oriented simulation discipline, sensitivity of behavior pattern measures -such as equilibrium level or oscillation amplitude- to the model parameters should be evaluated in order to explore the effect of parameter uncertainty on the behavior pattern of the simulation. In this study, a procedure for pattern sensitivity analysis of system dynamics models is suggested. Then this procedure is applied to a project management model (Taylor and Ford, 2006) and two oscillatory system dynamics models using regression method. Our results indicate that pattern measures of output behavior are appropriate in analyzing the parameter sensitivity of system dynamics models.

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Modeling passenger flow at hub airports: Implications for security, infrastructure investment, and stress levels at airports

Passenger related security measures at hub airports have continuously increased in number and complexity due to terrorist threats and attacks over the last years. Airport operators have been forced by legislation and different stakeholders to adjust passenger-related security processes making their operations suffer and their overall passenger flow change. In this context, understanding the inherent dynamics of the airport systems is crucial to making correct decisions leading to increased security, adequate infrastructure investments, adequate passenger stress levels at airports, increased attractiveness of airports, better operations, and increased overall performance.

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Dynamics of Glucose-Insulin Regulation: Insulin Injection Regime for Patients with Diabetes Type I

Diabetes Mellitus is a disease associated with body insulin deficiency or inefficient use of it. A patient with diabetes either cannot produce insulin to absorb glucose and turn it into energy or cannot properly respond to insulin. Treatment approaches for the disease are associated with managing the illness. Insulin injection is the main treatment for patients to maintain proper circulation of glucose in the body. However, managing the glucose level in the body is a

complicated process. The main complexity comes from the changing levels of glucose in the blood several times in a day and the delays between any action to alter the glucose level and its effect. Changing levels of glucose in the blood leads to hyperglycemia or hypoglycemia which can be dangerous for patients life in some cases. The purpose of this study is to create a model based on a recent study that reflects the self-managing nature of blood glucose level by a diabetic patient and make it more realistic in order to give true dynamics. The study showed that with a combined treatment of insulin injection and food intake regime gives the best results to keep the patients glucose values within the desired limits.

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Dynamics Model of Housing Market Surveillance System for Taichung City

In August 2007, the US subprime mortgage crisis led to a crippling global financial crisis, creating immense monetary and asset losses for the worlds economy and financial organizations. Forming a financial crunch and bank credit shrinkage. It halted all economic developments in the world, so how did Taiwan prevent its housing bubble from bursting? The purpose of this study was using the techniques of system engineering, fuzzy delphi, system dynamics to formulate the dynamics model of housing market surveillance system for Taichung City. The model was simulated with different scenario of sensitive variables to understand the prospective development of housing market in Taichung. The research findings showed that a joined strategy of gradual price index movements, high interest rates for loans and lower unemployment rate can effectively strengthen urban housing market risk control, reinforce effective resource utilization and ultimately stimulate overall urban housing market development.

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Exploring Sustainable Policies for Xidi, the World Heritage Village

The preservation of the historical town xidi is under debates. There are many different perspectives on how to conserve the historical towns by using tourism as a policy tool, from strict conservation policy to remain authenticity, to tourism growth development policy and the community development orientated policy. This study attempts to develop a holistic a system dynamics model to analyze the interaction of the social economic heritage sectors to examine policies to achieve the goal of development and conservation. The study shows that conservation alone cannot lead to its own goal. Economic development strategies could be a better choice if the development is careful planned and effectively controlled to avoid over consuming resources.

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Better Healthcare through Better Design of Healthcare Research and Development

One of the major benefits of a government funded research center or lab is the infrastructure it can provide investigators to enable them to stimulate research and training in high priority areas. Most research centers and labs represent complex organizations that must juggle a variety of different funding streams, projects, physical infrastructure, and human resources. Managed well, such organizations can find themselves in a virtuous cycle that leads to an increasing trend of cutting edge research, innovation, and funding that could ultimately have a large impact on society. Poorly managed, research and development organizations can find

themselves in a vicious cycle of decreasing funding and quality of research that may ultimately threaten the safety of research. Improving the design, planning, and management of research centers and labs could have significant benefits on making the research and development process more efficient. This paper describes the development and application of system dynamics model to support the design of research center and accompanying management plan. The research and development (R&D) model represents both the current and projected projects that would be needed given a growth scenario, and includes a number of sectors including staff, funding, space, and human resources.

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Combining Group Model Building and Participatory Rural Appraisal in Southeast Rural India

Interest in group model building has increased as a means to increase stakeholder involvement in the modeling process. However, most reported efforts have focused on involving policy makers and managers in the modeling process. Extending group model building to include marginalized communities such as people living in poverty and forest dependent communities raises a number of methodological issues about the nature of participation and modeling. Addressing these issues is critical to advancing the practice of participatory group model building techniques, and more generally, the application of system dynamics to addressing problems such as energy, environment, and health across diverse communities. This paper takes up the challenge by drawing on field experiences in rural India to develop a methodological approach that combines participatory rural appraisal development methods with group model building to better understand problems such as declining soil fertility and availability of fuelwood.

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What Can Formal Modeling Add to Qualitative Systems Thinking? A Simulation Model of the Shift the Burden System Archetype

While qualitative-based system archetypes have helped popularize the application of systems thinking since the publication of "The Fifth Discipline", some argue using the archetype alone, without the knowledge derived from working directly with formal models, can be dangerous. This paper presents a formal simulation model of Shift the Burden, one of the most popular system archetypes. I seek to create a model as parsimonious and generic as possible while grounding the formulations based on behavioral decision processes. A set of leverage points are identified that prevents the system from tipping into a vicious circle where more symptomatic solution leads to erosion of fundamental solution that augments problem symptom. Counter to the common advice of eliminating symptomatic solution whenever possible, I demonstrate when and why symptomatic solution could be useful or even necessary under certain conditions. The appropriate use of symptomatic solution along with fundamental solution can help dampen oscillation in fundamental solution, prevent vicious tipping dynamics and sustain high fundamental solution in face of volatile exogenous shocks. I hope to contribute to the systems thinking literature by demonstrating how formal modeling can deepen the insights of qualitative system archetypes and call for similar efforts towards other archetypes.

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Under What Conditions Does Employee Ownership Work? A Model of Ownership Structure and High Performance Work System

Under what conditions does employee ownership improve firm performance? Employee ownership structure is part of a larger corporate system. To answer this question, one needs to unpack the underlying causal mechanism of how ownership structure affects the corporate system and how the corporate system and market conditions in turn influence the design of ownership structure. We developed a model of a startup company with various compensation and ownership structures, how they influence employee behaviors that drive business processes, and how those business processes interact with market conditions which generate firm performance in a dynamic feedback system. We conducted simulation analysis to study how various combination of salary, stock options, stock grants and profit sharing schemes influence firm performance overtime. We hope to contribute to the field of Strategic Human Resource Management by providing a model of the causal mechanisms between HR practices and firm performance.

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A System Dynamics Model of Individual Patterns and Strategies for Labor Market Reintegration

In modern societies the labor market integration of each individual demands the central task of integration. Nevertheless job integration or a successful occupational life course depends not only upon his or her motivation or attention to the job directly, but is also a function of his or her qualification or biography and of his or her embedding into a preferred social environment. Using a system dynamics model introduced in this paper we demonstrate that an individual re-balancing between his or her job, biography, and social embedding is necessary to guarantee an optimal and sustainable labor market reintegration.

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An Extension of Loop Deactivation in the Behavioral Method

The behavioural method is an important technique for identifying the dominant feedback loops for a variable of interest. The core mechanism of this approach is that deactivating different loops influences the behaviour of the selected variable to various degrees. Through assessing the variance of the behaviour between the reference model and the modified model for all feedback loops, we are able to identify the loops which exert the most significant influence on the variable, i.e., the dominant loops. An important step in the behavioural method is to deactivate a loop by fixing its control variable or a unique edge. However, a drawback is where neither the control variable nor the unique edge is identified. This paper presents another loop deactivation method which is applicable when such circumstance happens. The new method deactivates a loop by modifying its unique consecutive two edges which are able to distinguish this loop from other loops. The long wave model is used to demonstrate the loop deactivation approach and compare the analysis result with other dominant loop identification methods.

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An Eigenvector Approach for Analysing Linear Feedback Systems

Formal analysis plays an important role in understanding how feedback structures drive dynamical behaviour. As we know the state behaviour is determined by a linear combination of behaviour modes (associated with eigenvalues). The weight of each mode is a product of a coefficient and a right eigenvector component. An emerging technique in eigen-based analysis focuses on the behaviour mode weight, together with the behaviour mode (eigenvalue), to identify the dominant feedback structure. The purpose of incorporating the weight analysis is to conduct an overall assessment of how feedback structure influences on the state behaviour. This paper revises the conventional eigensolution to the state trajectory by alternating the behaviour mode coefficient to be a product of the normalized left eigenvector, and the system initial conditions. Therefore, the overall behaviour changes due to the changes in a system element (a link or a pathway) can be fully assessed by calculating the eigenvalue, right and left eigenvector sensitivities. Through studying the eigenvector sensitivity, we observe that the right and left eigenvector sensitivities associated with the same mode cannot be evaluated separately. We present an analytical approach to the eigenvector-related sensitivity computation, i.e., a linear combination of the right and left eigenvector sensitivity.

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A Dynamic Approach for Evaluating the Validity of Mortgage Lending Policies in Korean Housing Market

Recent periodical boom and burst of house price have made mortgage lending issues become the main public interest in Korean real estate market. However, because mortgage-lending issues had not been discussed until then, housing market forecasting associated with mortgage lending has been difficult while using an empirical approach. Thus, comprehensive and systematic approach is required as well as validity of mortgage lending policies should be evaluated. In this regard, this research conducts a sensitivity analysis to validate the proposed policies and estimates the effects of current policies on LTV and DTI ratios with a comparison of another policies scenario. A causal loop and sensitivity analysis using system dynamics confirmed that LTV and DTI regulation is strong clout to housing market. However, to prevent transfer of potential mortgage borrowers to nonmonetary institutions, regulations in loans of nonmonetary institutions should be practiced in accompaniment with regulations of primary lending agencies.

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System Dynamics Model for Transportation Infrastructure Investment and Cultural Heritage Tourism Development

A system dynamics model is proposed to analyze the impacts of transportation infrastructure investment on the tourism development of Xidi and Hongcun World Heritage Villages in southern Anhui province, China. It is shown that both the short and long term impacts of transportation infrastructure investment on tourism development could be well predicted by the model. To achieve maximum tourism revenue, both villages attempt to take an aggressive strategy to continuously increase transportation infrastructure investment and exploit all available land. According to the scenarios results from the simulation, several other development strategies are proposed as well as the prediction of the

perspective of the two villages 20 years later: with all available land being exploited, the sites are still full of tourists that are comprised mainly of mass tourists.

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The Current Debt Crisis – A System Dynamics Analysis

The near meltdown of the world financial system led in almost all OECD countries to a sharp economic downswing. Even though there are signs for a recovery the political leaders have to cope with another problem: the steep increase in national debt. The increase is due to the automatic stabilizers (decline in tax revenues increase in transfers) but also to discretionary spending in order to stimulate the economy. Public, politicians and media talk of a debt crisis because they have doubts that an upswing will lead to a symmetric decrease in national debt. This paper analyzes the dynamics of government debt and demonstrates that economic shocks may have, in fact, long lasting effects with respect to the debt process.

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Investigating through ISI Papers Published in Iran and Their Qualities Using Dynamic Approach

Promotion of faculty members in Iranian universities is mainly dependent on published ISI papers. Faculty members as the most important part of production of science, have strong motivation for making and publishing this kind of papers. In the other hand, produced science should satisfy scientific needs of industry and lead to both industrial and economic growth. But publishing this kind of papers and industrial growth have not the same aims and most of published papers have least relevance to industrial needs and so they are worthless. Because of the easier and faster procedure of producing these papers, there is a great tendency to publish this kind of papers, whereas there will not be enough tendency to publish the papers that can directly (or indirectly) affect industrial growth process. In this paper the effective parameters in producing some main kinds of ISI papers and influences of them in improvement of industrial situation of the country will be investigated, and afterwards continuance of this trend will be discussed. At the end, some policies are suggested to improve the quality of the papers and their benefits for industrial purposes.

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An Investigation on The Process of Modification of Subsidy Policy

In recent years, increase in energy price in international markets has turned paying energy subsidy into a serious challenge, because those countries paying subsidies are in constant pressure (Gupta 2003)[6,7]. Rise in energy price and demand in those countries has resulted in earnest problems in energy pricing (Davis 2001)[4]. Besides, subsidy elimination and imparting the resulted money to the society, without planning for solving its short-term and long-term consequent problems, will lead to public dissatisfaction as well as industrial performance downturn and also it will cause inflation[5]. In this paper while offering a comprehensive model for this problem and dynamic analysis of the policies implemented so far and also investigation of those policies in short-term and long-term frames, another policy is suggested for solving this problem which not only guarantees industrial development and increase in public welfare level but also will gradually remove energy subsidy from government budget and thus will help the government to get rid of this intolerable burden.

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Developments in System Dynamics Pedagogic Techniques

A number of papers have been published describing various pedagogic techniques for the dissemination of the System Dynamics (SD) approach at various Education institutions and academic levels ranging from schools (K-12 in the US) to higher education. This paper builds on previous papers by this author that provided a catalogue and classification of this work in order to highlight potential areas of research in this field of study and to identify system archetypes at different hierarchical levels and discover new ones. It is a contribution to the developing research agenda of the Education SIG. The taxonomy is work in progress comments and suggestions are welcomed.

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Developments in System Dynamics Models of Educational Policy Issues

A number of papers have been published describing various System Dynamics (SD) models of various Education institutions and issues, on topics including the role of SD in Corporate Governance, Planning, Resourcing & Budgeting, Teaching Quality, Teaching Practice, Microworlds and Enrolment Demand. This paper builds on previous papers by this author that provided a partial catalogue and classification of this work in order to highlight potential areas of research in this field of study and to identify system archetypes at different hierarchical levels and discover new ones. It is a contribution to the developing research agenda of the Education SIG. The taxonomy is work in progress comments and suggestions are welcomed.

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Raising the Quality of Human Life – A Least Cost Route to Reducing Carbon Emissions: Insights from a System Dynamics Model

As the Kyoto Protocol approaches the end of its validity and as the international community prepares for designing its successor, the pressure to act, for both developed and developing countries, is inexorably building up. Developing countries emphasize that their total emissions may be significant and growing, but their per capita emissions are still very low -- far below those of the developed world. On the other hand, the industrialised countries claim that without some reduction in future emissions from emerging economies, global change cannot be contained within the limits that are considered safe. This paper looks at how rapid improvements in quality of life among the worlds poorest, and specific, carefully designed interventions, through their impact may provide the one common platform that would attract and bring together almost all parties. These interventions would identify leverage points in societies which have the greatest impact for the least cost and disruption. This paper presents a possible win-win strategy that can bring the competitors in the current game to play to agreed, logic- based and consistent rules. These rules would be derived from a systems analysis that attempts to overcome the northern consumption vs southern population related stand-offs that exist today.

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Using System Dynamics to Estimate Reductions in Lifecycle Costs Through Investments in Improved Reliability

Doing more with less has become a long-running and recurring theme across the globe. Affordability is now a key metric for operations and sustainability, and reliability is now seen as a key driver of these lifecycle costs. A system dynamics model has been developed of an aviation supply chain that enables evaluation of alternative cases in which investments are made to improve reliability, lower total demands, and reduce spending on new procurement and overhaul over the lifecycle. It is shown that the payback potential of an investment depends upon annual demand for the part, cost of the part, percent improvement in reliability achieved, and any increase in cost of the part due to the re-design. The analysis show that returns can be high and payback periods can be fast, particularly for investments to improve reliability of items with high demand and high cost. The research also indicates that close coordination is needed between program management, procurement planning and acquisition in order to fully realize savings. Ongoing research is developing reliability investment strategies and estimates for lifecycle costs under differing demand, manufacturing and overhaul scenarios.

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The Role of Overhaul in Reducing Lifecycle Costs and Maximizing the Return on Investments to Improve Reliability

Maintaining military aircraft in a high state of readiness requires a non-stop flow of spare parts. These replacement parts can either be new parts from procurement or repaired parts coming from overhaul. The cost of these replacement parts is a major component of total lifecycle operating and sustainment costs. Improvements in reliability can potentially reduce removals and these on-going costs. The overall cost reduction depends upon the interaction over time of any increase in the cost of the new improved part, the increase in reliability, changing demand levels and the role of overhaul. Three overhaul scenarios are examined for cases of improved reliability: (i) old parts improved in overhaul; (ii) old parts not improved in overhaul; and (iii) no overhaul. A system dynamics supply chain model including financial performance metrics is developed to investigate these scenarios through simulation. It is shown that all three scenarios reduce total lifecycle costs and that these reductions can be very significant. The first overhaul scenario is shown to have the greatest returns but the third scenario is only slightly lower. All scenarios are shown to have diminishing investment returns and share a common level of investment that maximizes the percentage reduction in lifecycle costs.

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Combination of Cooperation and Competition for Organizational Productivity Improvement

One of the main goals of both public and private organizations is to maximize their productivity under limited resources. An important part of maximization is to decide what resources to use and how to combine them. In this regard, cooperation and competition among actors in organizations is regarded as important resources for maximizing organizational productivity. In reality,

organizations however have overemphasized cooperation, and rather, ignored competition because the formal is recognized positive and the latter is perceived negative. Relevant studies also classified them in this way. However, there are two things to consider in depth. Firstly, although the degree and duration of the productivity is less or much less than that of cooperation, competition relates the productivity of organizations positively to a degree; cooperation does not improve productivity indefinitely. Therefore, the proper combination between cooperation and competition can overcome their own weaknesses and help achieve the level of the productivity that organizations expect. This paper built a model that considers both cooperation and competition based on the isoquant-isocost production approach and system dynamics approach. The model shows some insights into why the combination between cooperation and competition is needed, and how the combination can be operated an applied in the model.

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Understanding System Dynamics with Eastern Philosophy

In this paper, I discuss how to teach system dynamics and systems thinking from the perspective of the eastern philosophy, especially in Korea and China. Based on my experience of teaching system dynamics to Korean people for 15 years, I present some kind of fundamental similarities and linking pins between eastern philosophy and system dynamics. Presentation of their similarity usually provided Korean students a kind of familiar feeling with the system dynamics and facilitated their understanding of its key concepts. Also I explain my experience on presenting research outcomes of system dynamics to Koreans with the help of linking pins between system dynamics and eastern philosophy.

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HIV Transmissions by Stage under Dynamic Sexual Partnerships

Most models assessing relative number of transmissions during different progression stages of human immunodeficiency virus (HIV) infection assume that infections are transmitted through instantaneous sexual contacts. In the real world, however, HIV is likely to be transmitted through repeated sex acts during partnerships that are not only dynamic but also last varying lengths of time. We sought to understand how dynamic and enduring sexual partnerships would influence transmissions during different progression stages of HIV infection: primary HIV infection (PHI) and chronic stage infection (CSI). Using a dynamic model with a pair approximation technique, we developed a model of HIV transmission in a homogeneous population in which sexual partnerships are formed and broken. The fraction of transmissions during PHI has a U-shaped relationship with the rate of partnership change. The fraction falls as the rate of partnership change decreases, but rises again as partnerships become almost static. Our results show that dynamics of sexual partnerships strongly influence HIV transmissions by progression stage. Models that assume instantaneous contacts will likely overestimate transmissions during PHI for real, dynamic sexual partnerships with varying (non-zero) durations.

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Automated Assessment of Learners' Understanding in Complex Dynamic Systems

Research on learning via system-dynamics-based learning environments depends on good measurement of learning. Most such research considers at least two aspects of learning, the participants understanding of the models and problems,

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and the partici-pants' performance in the environment, e.g., quality of decision making. The former, understanding, is much more difficult to measure than the latter, performance. Meas-urement of understanding is often done by eliciting verbal protocols from participants about the problem situation (i.e., the underlying model) and their planned solution strat-egy (i.e., decisions). Coding and analysis of participants verbal protocols is very sub-jective and time-consuming. To facilitate measurement and analysis of understanding via verbal protocols, we investigate the utility of a software application which performs such analysis automatically. We assess this automated analysis methodology using data from two different system-dynamics-based learning environments, including how par-ticipants understanding compares to experts, how it changes over time, and how it cor-relates with performance.

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Fishing Industry Dynamics: Is fish farming sustainable? An Exploratory Study of the Chilean Salmon Industry

In recent years, there has been an increase in the interest for fishery dynamics in the System Dynamics field but most of the work has been related to the management of wild fish stocks. In this paper, we present an exploratory study of the effect of fish farming on the stock of wild fish stocks based on the case of Chilean Salmon industry. Fish farming does not reduce the impact of fishing activities but it increases their effects since it is necessary almost 6 kilograms of wild fish for each kilogram of salmon produced.

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Dynamics of Lean Accounting Innovation on Future Performance: May “Accelerated” Accounting Lead Astray?

This research explores the effects of implementing a lean production system in a government facility that is formally governed by accounting practices which delay recognition of production savings but which informally promotes its lean efforts through attention-getting, off-the-books, innovative accounting. We state three propositions relating to customers effects of the lean improvements and the financial approaches. We then state four hypotheses relating to unintended effects of these measures as a facilitys workload varies, and test the hypotheses employing a system dynamics simulation. We identify minor effects upon customer behavior and labor rates oscillation, thereby filling gaps in the literature relating to government productivity improvements, and expanding knowledge relating to lean labor savings, work demand, and employment effects.

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Policy Agenda Setting Process and Causal Map Analysis: a case of the Green Growth in Korea

Recently there has been a dramatic increase in worldwide attention to environmental issues based on climate change and global warming. This effort has resulted in advances toward a new paradigm, 'sustainable development'. Especially, Green Growth has risen as a new alternative to earlier problems. Korea has focused on the Green Growth, and several plans have been presented by the current administrations. The main purpose of this study is to find what steps are included in the agenda setting process of the Green Growth in Korea, using both time series analysis and system thinking approach. To conduct a time series analysis, the paper examines articles of newspaper and government reports.

And, to build a causal map, the speech of current president of Korea is analyzed. The study concludes that the political consideration has played a major role in the policy agenda-setting process of Green Growth in Korea. In addition, it is identified that causal map analysis, as a qualitative approach, can complement the existing method for analyzing the policy agenda setting process.

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Adaptive Care Systems

Understanding the dynamics of planning and providing accommodation services for people with Intellectual Disability

Accommodation support for people with Intellectual Disability is a major component of public expenditure in the Australian welfare setting and over the past three decades there have been major shifts in the philosophy of care which have had impact upon funding policies and the allocation of resources. The signing of the UN Convention on the Rights of Persons with Disabilities has prompted a review of current programs and more comprehensive planning for improvements. A community prevalence of approximately 0.6% was established, with a baseline of approximately 0.1% of the population requiring formal accommodation support. Modeling of changes in level of intellectual impairment and levels of dependency in four age groups over the next forty years predicts a rise in the numbers of middle aged and older adults with Intellectual Disability needing accommodation support. Changes in the three forms of adult accommodation (private, state-funded disability accommodation and commonwealth-funded aged care accommodation) were also predicted by the model. There will be a substantial rise in the intensity and demand for state funded disability accommodation, as the clients themselves and their parents age. Changes in the levels of demand in each form of accommodation were estimated by what-if experimentation with changes in eligibility criteria.

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Modeling Causes and Impacts of Greenhouse Gas Emission in a City

Global warming is one of the most significant issues that humans face in todays world. Even small changes in the earths average temperatures can increase severe weather events such as storms, floods and droughts, change in ecosystem, adverse impact on health and lives of human and other species. Global warming is caused by increasing concentration of greenhouse gases (GHG) in atmosphere, and cities are major contributors of greenhouse gas emission. All cities have a responsibility and a role to play in controlling the GHG emission, confronting climate change and its potential impacts. We develop a system dynamics model that can help cities better understand the causes and impacts of GHG emission within various subsystems of cities, and formulate and test effective policies for controlling the GHG emission.

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Controlling Workforce in Response to Demand Disturbances in Services Supply Chains

Ineffective policies of the resource management in services businesses can produce undesirable effects such as oscillation between acquisition and release of workforce, and amplified oscillation of workforce level through the stages of the

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service processes. We apply control theoretic principles in managing workforce to see how various PID feedback control schemes can improve costs, utilization and stability of workforce in response to demand disturbance in services supply chain. Our study through a system dynamics model indicates that effective combination of PID feedback control schemes can produce desirable policies of workforce resource management.

Modeling and Simulation of Ecological Footprint of Macao

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In this paper, the ecological footprint of Macao from 2000 to 2020 is studied using Stella modeling and theories of system dynamics. From our modeling, the value of EF per capita of Macao increases from 3.3ha/capital in 2000 to 4.6ha/capital in 2020. It is the first time that such values are reported and they are valuable to policy makers in Macao. In details, the model consists of three modulesecological footprint (EF), city and tourism modules. According to the simulation results, the EF per capita is increasing continuously. Population increases from 434, 070 in 2000 to 562,600 in 2020, and tourists increase from 2,175,800 in 2000 to 9,731,180 in 2020.It is shown that fossil energy land is the key factor influencing the EF of Macao and is affected mainly by city development. Besides, city development is limited by two factors, namely population and available land. The available land for business and housing is becoming scarce. On the contrary, energy price has limited affect on city development. Consequently, it also has limited effect on fossil energy land.

A Conceptual Framework for Dynamic Modeling of Sustainable Development for Local Government in Latvia

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This article presents a concept and theoretical specification for a system dynamics based model of sustainable development for local government of Kuldiga municipality in Kurzeme region, Latvia. Although Latvia aspires to the principles of sustainable development, there exists a relatively small number of theoretical studies and practical results in the area of simulation modeling of sustainable development. Therefore the proposed framework presents a novel approach in the context of spatial and regional planning in Latvia. The modeling framework is based on the concept of sustainable regional development as an unending process defined neither by fixed goals nor by specific means of achieving them. A sustainable region demands a mutual balance among economic, social, political and naturally environmental development. The dynamic modeling framework is considered as a useful tool in assisting decision-makers in development planning allowing to evaluate alternative scenarios and planning options.

Dynamics of Business Models – Long-ranging Impact Assessment of Business Models in the Capital Goods Industry

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In recent years, new business models are becoming increasingly more important for manufacturers in the capital goods industry. However, manufacturers of plants still hesitate to offer these customer-oriented solutions, due to existing uncertainties resulting from economic risks. The offer of innovative business models requires a stronger integration of the supplier into the life cycle of a plant

and hence into the production phase of the customer, leading to the consequence that manufacturers have to restructure their previous activities extensively. Due to the financial risk connected herewith, decision models are required, which identify and assess the impacts resulting from the implementation of these innovative business models. Aspects like time delay, due to the reorganisation of the service department or the set up of adequat human resources have to be considered. Therefore, the aim of this contribution is to develop a system dynamics model for the analysis of long-ranging consequences due to the implementation of an exemplary business model.

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Dynamic Decision-Making, Learning and Mental Models

Bounded by limited cognitive capabilities, decision-makers use mental models (reduced versions of real world dynamics) for decision-making and interventions in complex tasks. As such mental models are constantly updated with new experience and knowledge acquired, facilitating a learning process. Through this learning process, mental models can be refined to better represent real world dynamics. Systems theory suggests that updates of mental models happen in continuous cycles involving conceptualisation, experimentation, and reflection (C-E-R), which represents a dynamic decision-making process (DDM). This study investigates the learning process of decision-makers in DDM tasks. Participants involved in simulated environments (Management Flight Simulators and Microworlds) are observed, with proceedings of their DDM tasks recorded and analysed to trace and identify any patterns of learning. Updates of mental models are recognized in changes of their performance, and their perceptions towards performance indicators and systems behaviour, before and after the decision tasks. Findings of this study show significant changes in mental models after participation in DDM tasks. However, the level of learning is questionable.

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Impacts of Corporate IT Investment Strategies on Operational Performance Based on Intellectual Capital Framework

In recent years, due to fast development of information technology and fierce competition, information technology investment strategies are significant factors to sustain business operation. Furthermore, rival investment strategies and allocation of complementary assets should be taken into account so as to achieve maximum efficacy of the strategies. This study adopts the intellectual capital structure and complementary asset theory, and investigates Taiwans information-intensive services. A research model is presented to discuss the impacts of information technology investment strategies on organizational performance based on intellectual capital framework. This study introduces a system dynamics method to analyze a case of two rival companies, and interprets the effects of different IT investment strategies on operation performance through simulation and scenario analysis. The simulation results can help companies making information technology strategies and evaluating their overall performance. The results indicate that different information technology investment strategies and matching degree of complementary resources have different impacts on the organizational performance. Moreover, this can help companies to make IT investment strategies. The studied results can provide important theory and practice implications for organizational IT management.

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Using Dynamics Modeling to Promote Effective Tobacco Treatment Practices in Community-Based Primary Care Settings

This paper describes preliminary field work to develop and test the utility of a system dynamics modeling intervention intended to promote evidence-based tobacco treatment practices in community-based primary care settings. Brief counseling interventions by primary care providers have been shown to effectively promote tobacco cessation among patients who smoke, yet many physicians are inconsistent in the way they intervene with their patients. Too little time, poor training, lack of third-party reimbursement, competing clinical problems, and the belief that their patients are not able to change explain, in part, why some physicians do not adhere to evidence-based guidelines for treating tobacco use and dependence. Via a protocol for on-site visits to selected primary care practices in Queens, NY, we test the hypothesis that primary care providers exposed to the simulation tool will demonstrate better understanding and progress towards full implementation of the US Public Health Service Guideline for Treating Tobacco Use and Dependence. In addition, our fieldwork documents primary care providers impressions about how best to present model output to convey a dynamic picture of the costs and benefits of various scenarios of tobacco treatment, over time, in their unique practice environment.

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Global Network of Learning Laboratories for Sustainability (Global LLab NET)

Complex problems such as sustainability, energy and water shortage, biodiversity food and global security are impacted by many stakeholders and have multiple drivers and interconnected dimensions: social, economic, environmental, political, behavioural, governance and leadership. Traditional linear, single-dimensional, symptom focused solutions are insufficient to deliver sustainable outcomes. These challenges require systemic and collaborative multi-stakeholder responses. Learning Lab (LLab) is a unique process and methodology for integrated cross-sectoral decision making, planning and collaboration in dealing with complex multi-stakeholder problems. The LLab comprises six cyclical steps whereby decision makers and stakeholders come together to develop a shared understanding of complex issues and to create innovative and sustainable solutions. The Learning Lab methodology is a generic process which can be applied to solve complex problems and to create consensus in a variety of domains and contexts, social, economic, environmental and cultural. The wide range and diversity of the global LLabs is both a challenge as well as a rich source of mutual learning and progress. This paper discusses the theory of the Learning Labs and demonstrates its application in UNESCO Biosphere Reserves in Viet Nam and Cambodia. The implications of this exciting development for the system dynamics community are also discussed

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Conflict dynamics in a dam construction project: A case study

Interface conflict is identified as a major problem in dam construction projects. Proper management of conflict can determine success or failure of a project. Thus, it is crucial to identify the causes of interface conflict in projects to avoid such problems. Qualitative data gathered from case studies and interviews conducted in Nepal have been used to develop and test a system dynamic model of interface conflict in a dam construction project. Three viable policies to avoid and minimize interface conflict in the construction stage of a dam project have been tested. Public participation, adequate compensation and resettlement and information sharing with the affected people have the potential to reduce conflict during the construction phase.

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Systems thinking for sustainable tourism in the Cat Ba Biosphere Reserve of Viet Nam

Cat Ba Archipelago in Viet Nam has been recognized as a world biosphere reserve. This biosphere is identified as the highest biodiversity in the country and a priority for global conservation. Cat Ba, the largest Island in the archipelago, features diverse topography, remarkable historical heritage and archaeological value. Because of these unique features, the Island has become a popular tourist destination. Cat Ba is experiencing a strong growth in tourism. However, a number of challenges pose threats to sustainable tourism development in Cat Ba including environmental degradation, high poverty level, overuse of underground water, lack of fresh water and electricity, lack of skilled labours, and poor infrastructure and recreational facilities. This paper seeks to explain how a complex and dynamic tourism systems model can be developed and used as framework for decision making and capacity development for local government and private stakeholders who share the responsibility of sustaining the system. The causal loop diagrams and stock and flow models have been developed with participation of diverse stakeholders. Alternative scenarios will be analysed to explain how tourism in the biosphere may change in the next 10-20 years as a result of both multiple investment strategies and changes in the external environments.

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Using System Dynamics and Agent-based Modeling to Simulate a Proxy War for Resources

We explore the dynamics of a proxy war for resources using a mixed approach to enhance our understanding of the phenomenon and our understanding of possible complementarities of aggregate and highly disaggregate modeling approaches. We present a system dynamics and an agent-based model of a proxy war for resources motivated by the Tajik Civil War and compare and contrast the two models and approaches.

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Dynamic Assessment of Rural Dairy Cooperative Feasibility to Improve Livelihoods in South-Central Mexico

An SD model of biophysical and socioeconomic processes represents the aggregate community goat flock and a processing and marketing cooperative in highland communities near Xalapa, Mexico. Developed through a group model building process with researchers from Mexicos Instituto Nacional de Investigaciones Forestales, Agrcolas y Pecuarias, the model is used to assess strategies to increase net income from caprine production through cooperative processing of aged cheeses. Our analyses indicate that manufacture of goat milk products by the cooperative could increase community net income from caprine activities under a variety of environmental and market conditions, including significant demand shocksif these shocks occur after the cooperative is fully operational. These analyses also indicate potential risks and factors that could limit cooperative success: market size and reliability, cooperative management policies, production costs, and flock composition and productivity.

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An Integrated Framework For Designing Speed Management Strategy

Generally a speed management strategy encompasses measures related to engineering, education, and enforcement. The ultimate objective of these measures is to control the speeding problem and eventually improve road safety. More often traditional approach adopted for speed management strategy includes implementation of generic, familiar, and faster to implement measures because such measures are ready-made and appears to provide immediate improvements. It is argued that the traditional approach addresses only symptoms of the speeding problem and dissolves the perceived necessity of investigating actual causes of the problem to pursue the fundamental solution. This paper highlights the reasons that makes a speed management strategy ineffective, and presents an integrated framework that could assist in designing an effective and robust speed management strategy. The speeding problem of the Emirate of Abu Dhabi will be considered as a case study for demonstrating the potential benefits of the proposed framework. The proposed framework emphasizes that the strategy should be tailored to addressing the local causes of the speeding problem, and efforts of the stakeholders should be integrated and coordinated to provide a collective power for supporting and facilitating the implementation of speed management strategy.

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Essential Skills for System Dynamics Practitioners - A Delft University of Technology Perspective

There is little consensus on the skills set required of a system dynamics practitioner. In this paper we use the teaching approach and learning goals of the system dynamics courses at the Delft University of Technology as a starting point to explore the development of system dynamics modeling skills. System dynamics is embedded in the curriculum of students at the Faculty of Technology, Policy and Management (TPM) of the Delft University of Technology. The staged approach by which real world complexity is introduced in the system

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dynamics curriculum is first explained and the learning goals of the system dynamics education at TPM are described. The role of the quadruple jump approach to system dynamics education in achieving the learning goals of the curriculum is then illustrated using the case of urban dynamics. Finally, we compare the results of the teaching approach, as exemplified in the learning goals, with the skills needed by system dynamics modelers as derived from literature. We conclude that the question of which skills can be taught and which need to be learnt in (professional) practice remains open.

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Going Green Globally with Strategic Sustainability Systems

This paper describes our Going Green Globally effort to bring first-year MBA students and business clients together to create sustainable yet profitable practices. The intensive student experience uses systems thinking to frame strategic decisions with a holistic perspective. Students obtain self-assessments on environmental citizenry, study with environmental scientists and engineers, and collaborate with industry experts to craft green practices for actual clients. This cornerstone integrative experience addresses the recognized need to apply knowledge and successfully innovate in complex situations as well as develop sound green business models for their future.

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IQuaL: a dynamic model for assessing the impact of public policies on sustainable development

This paper is made up of two parts: the first part presents the general structure and technical aspects of the IQuaL (Individual Quality of Life) model. IQuaL is a system dynamic model, built within the capability approach tradition to study the impact of alternative patterns of public expenditure on the well-being of a heterogeneous population. The overlapping-generations structure of the model gives it an intertemporal, long-term dimension, thereby allowing a sustainable development perspective. It focuses on three main functionings (health, education and environment) and studies the various stages leading from public expenditure to functionings and to well-being. The second part focuses on the results of the simulations carried out by the model. The paper shows the key variables that affect the impact on well-being of changes in public expenditure, and explores, with reference to Italy, their crucial role and inter-dependencies. Finally, the implemented analyses provide useful and tangible advices for policy makers who have to implement policies of sustainable human development.

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XLNT Performance

Simulating the spread of resistance to antibiotics

Antibiotic resistance is a major clinical and public health issue causing difficulties in treating infectious diseases and increased risk for complications that lead to fatal outcome. The epidemiology of resistance is a function of the innate characteristics of the bacteria, transmission rates and the consumption of antibiotics. While there are cases where prudent usage of antibiotics leads to decrease in resistant frequency, there are examples where reduction does not lead to reversibility. The dynamics of this complex relationship can be profitably explored by system dynamics simulations. In this paper a generic model

describing the transmission of commensal bacteria within a community exposed to different levels of antibiotics is simulated and analytical expressions describing the conditions for reversibility are derived. It is shown that cutting back the volume of antibiotics is necessary but not sufficient to reduce resistance frequency. The biological cost for sustaining resistant traits (fitness cost) and the lateral transmission of genetic material plays a critical role.

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Specifying main effective factors on domestic steel Price: Case study of Iran steel market

Traditionally, production and consumption of steel are indicators of the development process in a society. In the world village, domestic and world indexes and prices highly affect each other. Differences between the supply and current demand are the main factors determining the steel price. In this paper, by an Artificial Neural Network we specify indispensable variable to identify the supply and demand for steel. Time of Contract, Expected Price, Volume of supply, Prior contract volume, Global Steel Price, Time between contract and transfer, Previous Price, Volume of Demand, Different Between Supply & Demand, Exchange Rate are specified as the main variables. Then, by a System Dynamics approach we analyze intricate system functioning against changing economic parameters in Iran.

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The Examination of Research Trend of a Professor in Iran

The literature of evaluation of professors in educational systems of different countries has widely discussed and different methods for evaluation have been created. Research motivation of a professor in his specialized field of science has major effect on promotion to higher scientific degree. However, this factor has not been reviewed widely and has not been discussed yet. This paper develops a system dynamics model to analyze the dynamics of effect of this factor on scientific promotion of a professor in Iran educational system. In general, a professor receives scientific ratings by considering to his research performance and the amount of research done by him. But when his scientific ratings increase, the motivation for continuing research activities reduces. Since scientific ratings is a finite value, after promotion to full professor degree the quality of research activities of a professor decreases. But at this time his experience is at its maximum value, in comparison with new employed professors with high level of inspiration. The paper also considers motivation for arriving to related industrial fields which can have influence on this behavior. It will be discussed why motivation for industrial activities usually causes less attention to research activities in underdeveloped countries like Iran. The paper concludes with some solutions for improvement of research motivation and more advancement of learning.

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Basin Modeling via System Dynamics Method Considering Dynamics of Water Resources Due to New Operation Policy

The aim of this research is to develop a simulation model via System Dynamics Method, increase the recognition of region and its dynamics, explore methods for

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operating current and future water resources of Zayandehrud basin in Iran , in order to eliminate or minimize the problems below: 1- Instability between supply and demand 2- Instability to supply agricultural demand during drought 3- Falling of groundwater surface due to over using groundwater resources . In this research, the new applied operation policy to the model is based on conjunctive use of surface and groundwater resources and the impact of applying it on water resources, is considered so as to remove or minimize mentioned difficulties. If allocated surface water to each irrigation scheme be upon irrigation demand and appropriate and reliable supply from groundwater,we will have a good reciprocity in use of surface and groundwater. Therefore, six main irrigation schemes of basin were considered and for each, a coefficient named Allocation Factor from S.W. was defined so as to regard above mentions. Finally, considering facilities and advantages of System Dynamics Model, it was concluded that taking better dicisions and operation policies in basin, help us not only prevent falling of groundwater surface due to over using groundwater resources but have stability to supply agricultural demand during drought.

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Infusing System Dynamics to National Climate Policy Model: a case study in Indonesia

This article shows the process of constructing a System Dynamics based national climate policy model in Indonesia. Indonesia has been using national policy model to guide its development since 1950s. Needless to say, the property of Indonesian development relies heavily on quality policy models. The reliability of the model is currently being challenged by the nature of the climate change issue which is inter-related among many aspect of development, countries and continually changing over time. System Dynamics is a modeling tool commonly used for aggregate and long term policy analysis and also suitable to cope with complex issues. It is used to create Indonesian development model in regard to the climate change problems. This paper illustrates experience in infusing Systems Dynamics to such model.

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Modeling Sustainability of Renewable Energies in Rural Areas: A Case Study for Iran

In this paper, we have developed a simple system dynamics model to put forward a perspective for explaining the consumer behavior in energy sector and addressing the obstacles facing the development of new energy systems and their sustainability in rural areas of Iran. In our model, we have presented a mechanism, by which cognitive personal concerns of consumers transforms into behavioral outcomes in rustic society, which was not discussed before this paper. Typically, it is presumed that increasing traditional alternative energy prices and influencing social mind by advertisement and publicity leads to peoples inclination to renewable energies. We observed that in Iran, as the alternative prices are low due to presence of subsidy, the two aforementioned policies shall be implemented collectively and the more effective factor here is price. Furthermore, we have tested the effects of investment on individuals expertise by education and the results are portrayed. A conventional opinion suggests improvement by revenue from surplus production for consumers; however, we have proven it fallacious. Although we have done our utmost to cover the major elements while trying to save simplicity for developing our model, further research might be necessary to make any ambiguities clear.

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System Dynamic Approach for Analyzing Cyclic Mechanism in Land Market and Their Effect on House Market Fluctuations

In this article we have developed a simple dynamic model to portray a cyclic producing mechanism in land market and in the following we have probed the effect of land market oscillation on house market price, which has not been addressed before. In this model, in the beginning two cyclic producing mechanisms in land market are introduced and their effect on house market is elaborated in detail. As we combine the land market model with house market model, to develop an integrated model that offers better understandings of house market trends. The model showed that, in contrast to common perception which presumes house market fluctuations(in supply sector)to be totally intrinsic,they are mainly due to cyclic producing mechanism in land market. Our work uncovers the rich dynamic complexity of the real estate system and can serve as a good example of applying systems thinking principles to complex real world problems. Moreover, we have taken advantage of classic mass-spring systems, to model the house and land market and thus a simple powerful tool is introduced to predict the effect of various mechanisms affecting the house market (e.g. capital market)and it can be a great help to understand the complex house market system, in more depth.

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Formal Modeling, Computer Simulation and Grounded Field Research to Conduct Enquiry in Managerial Sciences

In recent times, computer simulations have recuperated terrain in mainstream management journals. In the attempt to further corroborate the role of formal modeling and computer simulation in the repertoire of research strategies available to social scientists, the aim of the present essay is to sketch out a framework for an enquiry that combines computer simulation and field-based investigation, this latter a typical research strategy in social sciences.

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Managing the Dynamics of Process Improvement: Production, Improvement, and Learning

This paper considers the problem of managing process improvement when resources are constrained. The paper constructs a system dynamics model that formalizes the critical interaction between using resources to produce primary output and investing resources in process improvement as means to increase throughput. The model incorporates learning so that the productivity of doing improvement activities grows as workers accumulate experience with new methods. The model enables a rigorous examination into how the feedback structure of process improvement presents challenges to people in a system facing the dual pressure to produce output and to build capability. Simulation analysis highlights the dynamics of the tradeoff between production and improvement and demonstrates the existence of a tipping point that distinguishes enduring high levels of production from modest or no improvement. Results show the superior performance of counter-intuitive policy orientations that favor learning.

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Policy Analysis for the Transformation of Switzerland's Stock of Buildings to Energy Efficiency. A Small Model Approach

This paper reports on a small System Dynamics model of Switzerland's stock of residential, multi- familiy buildings over the time period 1975 to 2100. It is used to study the dynamic implications of carrying out different shares of renovation strategies on the composition of the stock of buildings. Of particular interest is the question, how the mostly non-energy-efficient stock of buildings can be transformed to a state of higher energy-efficiency. The model is empirically grounded and it was tested in collaboration with experts. The model is used to analyze three ideal-typical scenarios. Model analysis indicates that ambitious energy standards in building codes are of central importance, that the scope of said standards should be broadened to include as many situations as possible and that non-energy- efficient renovations should be avoided. Making renovations mandatory seems a less viable scenario. Finally, the decarbonization of heating systems emerges as an interesting alternative.

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Understanding the implication of investing in biodiesel production in South Africa: a system dynamics approach

This paper presents a Bioenergy Systems Sustainability Assessment and Management (BIOSSAM) model. BIOSSAM model was developed as an assessment tool to provide insights on the implications of developing biofuel production programs in South Africa, which is critical for sustainable energy development. As a case study, BIOSSAM model was applied to simulate biodiesel production proposals in the Eastern Cape Province of South Africa. Development of biodiesel production in the Eastern Cape is associated with the promotion of socio-economic development such as job-creation, which in turn influences the economic growth of the Province. Biodiesel production development is influenced by a number of factors such as producer/supplier profitability, which is influenced by several factors such as: land availability to supply raw materials, feedstock prices, government regulations/incentives. To explore the extent of achieving the socio-economic goals from biodiesel production development, BIOSSAM model provides a framework for understanding the causal-loop/feedback structure and dynamics involved.

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Pandemic Dynamics with Social Effects: Rapid Model Prototyping with Fuzzy Logic

The human behavior aspect of pandemic prevention and mitigation involve uncertainties manifested as a range of responses, from the extreme to the indifferent. Relationships between variables influencing human behavior are usually described qualitatively, and as such do not suffice for stock and flow models. These uncertainties can slow down the modelling process considerably, thus limiting the effectiveness of a model-based approach in time-critical studies such as an impending pandemic outbreak. Our proposed approach utilizes fuzzy modelling concepts integrated within the system dynamics modelling framework to create a rapid model prototyping process of developing a pandemic dynamics

model. This can facilitate quantitative analysis for policy making in pandemic mitigation interventions. We use the recent H1N1 pandemic in Singapore as a case example to demonstrate the practical usefulness of our approach.

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Systems Thinking and the Eastern Martial Arts

Rapid scientific progress over the past century has been largely attributed to the reductionist school of thought. Holism has only re-entered mainstream thought recently via the increasing popularity and advocate of systems thinking. Eastern philosophy, in contrast, has always embraced and manifested holism in every conceivable facet of life: from the quotidian routine of meal preparation; to Taguchi quality control; and to the life-saving application of Eastern medicine. These beget an interesting question: is it possible to relate systems thinking to Eastern philosophy from its various incarnations? This paper seeks to answer this question partially via the delineation of the Eastern martial arts practice, an application of Eastern philosophy. Our findings indicate that the language of systems thinking can potentially be a most natural medium for such cross-cultural knowledge transfer.

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Simulation Modeling of Body Weight Dynamics

This research aims to develop a body weight simulation model for gaming purposes. The model simulates the long term dynamics of the body weight, based upon Hall's body weight simulation model. We perform extensive validation testing of Hall's model by using system dynamics approach to evaluate the validity of the model's causal structure. There are a few modification areas in which our model differs from Hall's original model. Firstly, our model has some simplifications that highlight the causality relationships more clearly, while maintaining the validity. Secondly, our model incorporates a hypothesized process called secondary oxidation to make the system produce valid behavior under very high energy expenditures. Thirdly, we render the modified model generic for any healthy, adult person, and we deduce the formulas of metabolic parameters to customize the generic model to the specific, simulated person. Body Weight Websim allows people to track the changes in their body weight in the long term. The tool should be useful for a person to get a deeper understanding of the body weight dynamics and to build a better dieting and exercising regime for himself.

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Web Based Simulation Game Development Software: Mashap

System Dynamics researchers need a software tool that makes the simulation games easy to access through web user interface. We developed a software (Mashap) that automatically generates and runs a web based simulation game for any system dynamics model. Our software has some important advantages over the existing ones: First, it is an open platform on which new tools can be built. Second, it is built for generating web games for all system dynamics modeling software. Mashap enables the system dynamics researchers to build web based gaming environments for their own models. The purpose of this paper is to introduce you to Mashap. To do this, we will show in detail how to use Mashap to develop a web based game for a body weight dynamics model.

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Estimating the Home-Purchase Cost of Seoul Citizens

Seoul citizens are currently suffering from high housing price. Home prices have risen more rapidly than salaries so owning a housing unit (apartment, condominium, or single-family home) in Seoul is becoming more difficult than ever. Therefore, this research examines the behavior of average Seoul citizen in owning housing unit in Seoul, Korea, particularly in terms of the length of time required to afford a house unit. This research estimates that it will optimally take about 11.5 years after getting a job to own housing unit in Seoul that is currently valued at $300,000 where the optimal growth rate of housing price is 3% in cases where the growth rate of income is 2.97% and consumption prices are increasing at a rate of 2.95%.

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Estimating the number of welfare facilities for the elderly in Korea with system dynamics

This research estimates the number of welfare institutions for the elderly and predicts the shortage of welfare facilities in the future as a result of Korean societys move toward a super aged society. Although the population of Korea is predicted to decrease, the elderly population is expected to increase in the future; thus it is evident that a shortage of welfare facilities will occur. Based on this forecasting result presented within this paper, the Korean government should prepare for entrance into an aged society by expanding the social infrastructure through increased support to residential and medical welfare institutions. An analysis of the results tells us that additional 1,368 residential and 10,956 medical welfare facilities will be needed to satisfy the future demands of the increasing elderly population, compared to the number of the two types of welfare facilities in 2007.

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Theorizing About Crime: Elements for a Contribution of System Dynamics to Criminology

Customary theories of crime follow a cause-and-effect view, that is, crime is explained as a function of various weighted factors. This causal bias is prevalent across supposedly dissimilar theories of crime. Moreover, these theories tend to be universalistic: they seek to explain crime independently of context; crime is supposed to be causally produced in the same way in the United States, Colombia, Norway or Namibia. Moreover, such universality is constant across time, the causes of crime are the same one hundred years ago and today. A system dynamics conceptualization can contribute a different view. Here we show the possibility of having dynamic theories of crime, that is, theories based on feedback structures that explain complex patterns of behavior. Moreover, we also show the prospect of developing indigenous theories according to particular societal environments. The paper illustrates these points with a possible theory of crime for the Colombian society. The benefits of such an approach are discussed.

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Tackling the Mess: Causal-Loop Conceptualization of Solid Waste Management Systems through Cross-Impact Analysis

A common first step for building a system dynamics model is the selection of variables. This is one of the most important activities in the construction process because they constitute the building blocks upon which the explanations for complex patterns of behavior are proposed based on the interrelations of those variables. This work aims to present an option to systematically help to guide the selection of key variables integrating quantitative and qualitative analysis. A current project in Colombia that develops a dynamic conceptualization for Solid Waste Management policy-making is used as an example.

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Understanding Supply Chain Replenishment Decisions

Despite the growing use of supply chain management information systems to automate companies' inventory replenishment decisions, managers are still responsible of these decisions and often have authority approve/modify the final replenishment decisions. There is evidence that biases, e.g., psychological or incentive related, affect these replenishment decisions. In this paper we present the results of study of a retailer that has an automatic store ordering system but that allows category managers to override the system's decisions. Our data consists of over 300,000 decisions made by 60 managers over a period of several months. A more systematic understanding of how and when these biases affect decision making along with their consequences would benefit companies as they seek to improve their inventory decision making capability.

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Cooperation Mechanism for Large-Scale Social Dilemmas Involving Resource Depletion

We design an explanatory mechanism to explain cooperation discrepancies in large-scale social dilemmas that involve resource depletion. The proposed mechanism integrates the main elements of the theory of cooperation for small-scale social dilemmas, referring resource depletion. These include threat perception of inflicting damage to an individual (i.e. punishment) and elements of dynamic complexity. We develop system dynamics models based on our mechanism and test it on three cases: the Colombian electricity crisis 1992-1993, the Californian electricity crisis 2001, and on CO2 reduction. Results suggest that the mechanism explains cooperative behavior in large-scale social dilemmas that involve resource depletion. In these cases dynamic complexity affects cooperation. They also suggested that the perception of damage could be used to promote cooperation within groups that lack a history of cooperation, as people can start cooperating after a period of restrictions. The research finally indicates that under large-scale situations, cooperation requires information feedback of the consequences of collective action.

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Toward a new Federal Police force in México: an analysis of critical processes through System Dynamics

The insecurity crisis that Mexico is facing has taken to a reform in the Federal Law to impel the development of a new federal police, with trained elements in knowledge and tactics that allow them to face the crime of one more effective and coordinated way. The present work shows the results of a project designed to evaluate how feasible would be the implementation of such law. It required integrating a team with officers of the Federal Police force to design a dynamic model to analyze the key processes related to the transition of the current force to a new structure required for the law. This document presents the methodological frame, the design of the model some findings about the process and a scenario analysis to visualize some strategies that could be implemented in order fulfill the requirements of the law.

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Can people learn behaviours of stock and flow using their ability to calculate running total? An experimental study

Stock and flow is basis of dynamics. Understanding of stock and flow is crucial in comprehending and managing problems such as global warming and national debt. Yet previous experimental studies discovered that people performed poorly in simple stock-flow tasks. However, many do have notion of accumulation in terms of calculating running total. Here a pre-test-treatment-post-test experiment was designed to test the hypothesis that peoples understanding of stock and flow behaviours will improve after asking them to verify their expected behaviour using running total calculation and reflect if their expected behaviour was wrong. Comparisons with conventional approach to teach stock and flow dynamics and without teaching were also done, to my knowledge, the first time in controlled experiment. Results show that improvement is not significant; the hypothesis lacks support. On the other hand, conventional approach obtains significant improvement. Possible explanations of the results and their implications for education on dynamics, communication of complex dynamic problems and policy insights are discussed.

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Using Small Models for Big Issues: Exploratory System Dynamics Modelling and Analysis for Insightful Crisis Management

The main goals of this paper are to explain and illustrate Exploratory System Dynamics and Exploratory System Dynamics Modelling and Analysis, which are both useful for exploration of, and decision-making in, dynamically complex issues that are deeply uncertain. First, the need for exploratory approaches is discussed. Second, different exploratory approaches are briefly introduced. Third, a typology of safety and security issues/crises in terms of degrees of complexity, uncertainty and urgency is proposed. Different types of inter/national safety and security issues for which exploratory analyses may be useful are listed too. And the application of these exploratory approaches is subsequently illustrated on some of these issues, more precisely on (i) an acute financial crisis (the concerted bank run on the DSB Bank), (ii) an imminent pandemic flu crisis, and (iii) plausible mineral/metal scarcity crises. The paper ends with some conclusions, lessons learned, and a discussion of future work.

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Making System Dynamics Cool II: New Hot Teaching and Testing Cases of Increasing Complexity

This follow-up paper presents several new 'hot' cases for teaching and testing System Dynamics. The cases were developed between April 2009 and January 2010 for the Introductory System Dynamics course at Delft University of Technology in the Netherlands. These cases can be used for teaching and testing introductory and intermediate System Dynamics courses at university level as well as for self study.

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The Concerted Run on the DSB Bank: An Exploratory System Dynamics Approach

In this paper, an Exploratory System Dynamics model of a concerted run is first of all presented. The immediate cause for modelling a concerted bank run was the mediatised call for a run on the DSB bank. This Exploratory System Dynamics model was developed the morning of the call for the bank run, before the start of the ensuing bank crisis, in order to quickly foster understanding of possible dynamic behaviours of concerted bank runs and to perform rough-cut policy/strategy analyses. The model is subsequently used to illustrate the combination of Exploratory System Dynamics modelling and Exploratory Modelling and Analysis, also called Exploratory System Dynamics Modelling and Analysis. The paper starts with a short overview of the DSB Bank crisis, the description of the Exploratory System Dynamics model and some quick exploratory analyses. The model is then used as a scenario generator for Exploratory System Dynamics Modelling and Analysis in order to analyse and deal with deep uncertainties surrounding the issue and its modelling (parameters and functions). The paper ends with some applied and methodological conclusions, policy recommendations, and venues for future work.

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The New Flu Pandemic (A/H1N1): An Exploratory System Dynamics Approach

This paper presents a small exploratory System Dynamics model related to the dynamics of the Swine Flu. The Exploratory System Dynamics model was developed in May 2009 in order to quickly foster understanding about the possible dynamics of this new flu variant and to perform a rough-cut policy exploration. Later, the model was also used to further develop and illustrate the use of Exploratory System Dynamics models for Exploratory Modelling and Analysis. The paper starts with a description of the exploratory System Dynamics model, followed by a discussion of the analyses performed and results obtained. Then, the use of the model as a scenario generator for Exploratory Modelling and Analysis is discussed and illustrated. Finally some methodological and applied conclusions are formulated. A corresponding hot testing/teaching case used at Delft University of Technology is included in the appendix.

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Scarcity of Minerals and Metals: A Generic Exploratory System Dynamics Model

Possible short, medium and/or long term scarcity of minerals/metals may actually pose a threat to modern societies. Its potentially disruptive societal consequences qualify this issue for exploration from a world/regional security point of view. Hence, the forces of System Dynamics modelling and simulation and Exploratory Modelling and Analysis are joined in this paper to explore the dynamic complexity of potential mineral/metal scarcity under deep uncertainty and to create useful scenarios for inter/national risk assessment.

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Proactive vs. reactive investment in information security management: an SD analysis

In information security management, many organizations adopt reactive approaches for investment in incident response capability: invest when increasing number of incidents happen, or invest when severity of incidents reach certain preset-level, or invest when incident cost reaches certain preset-level. We use system dynamics model to study how these reactive approaches might cause problem in the long run. Through simulation analysis, we identify that the problem of reactive approach lies not only in the delay of building incident response capability, but also in the reinforcing loop that traps the management into the blindness to the security risks. With the simulation result, we see that proactive approach works effectively in reducing severity of incidents. We hope to promote the idea of proactive information security management through SD model simulation and analysis.

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System Dynamics Analysis of Water Resource Carrying Capacity in Shandong Province of China

Water Resource Carrying Capacity (WRCC) is an important metric for regional water management in China. Shandong Province of China faces a serious water shortage if WRCC is not managed at a sustainable level. This study focuses on applying system dynamics methodology to evaluate different development scenarios and their associated WRCC for Shandong. System characteristics of local water resources and demand in Shandong are captured and modeled using system dynamics within VENSIM software. The dynamic model of Shandongs WRCC consists of 5 subsystems: agricultural development, population growth, industry and tertiary industry, water resources, and water pollution. Historical data are used to calibrate model parameters. Impact on the WRCC is assessed through three growth scenarios: modest industrial growth, aggressive industrial growth, growth combined with wastewater recycles. Based on simulation results, WRCC that most likely can sustain economic growth without overstressing the water supply is one with modest growth combined with wastewater recycle.

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Understanding the Dynamics of the Adult Female HIV AND AIDS Situation in Canada

This paper presents the development and application of a system dynamics model to study the dynamics of infectious disease through computer simulation. The case study concerns the growing number of women who are being infected with the HIV and AIDS virus through heterosexual contact in Canada. This research provides an assessment of the existing situation and two simulation model-based scenarios that offer alternatives to current policies to affect and improve the long term outlook of this situation. This research finds support for those policy solutions that focus on addressing the problem situation prior to infection.

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Testing Pecking Order Theory and Trade-off Theory-A System Dynamics Approach

The fundamental objective of this paper is to present a dynamic framework to test the two competing theories; the Pecking Order Theory (POT) and the Trade-off Theory (TOT); that explain the capital structure behavior of firms. For this purpose we use System Dynamics (SD) method to develop a generic simulation model of a manufacturing firm based on generally accepted accounting principles. We model the capital structure decision conforming to POT and TOT to test the two competing theories, in isolation and in combination. The firms may pursue POT or TOT for their capital structure decision, but it is generally agreed that while doing so their prime objective is to maximize the firm value. Hence we presume that the managers stick to the core objective of firm value maximization. Literature generally suggests the two competing theories as substitutes. We, however, demonstrate the firms following synergy of the two theories would outperform the firms following two theories independently in their pursuit of firm value.

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Refinement of Supply and Demand Model for Vulnerability Black Market

Vulnerability black markets (VBMs) are sites for trading malicious tools targeting software vulnerabilities. VBMs enable different actors to access malware and use them to attack vulnerable computers. This article presents an economic rationale for the existence and continuity of VBMs. It is assumed that buyers and sellers decision to trade in the black markets depend upon their perceived costs and benefits. As long as the expected utilities of engaging in the black markets are higher than the costs, buyers and sellers will continuously trade in VBMs. A system dynamics (SD) model is developed to capture such problem. Concepts from market-for-crimes theories are adopted into the model, since they provide a useful perspective for explaining criminal behavior such as in VBM. Two scenarios are developed for simulating and testing different policies: to limit the opportunities for illicit involvement in VBMs and to introduce stricter law enforcement for discouraging participants from engaging in black market. The simulations show that unless the disruptions toward VBM forums are strong enough, sporadic market closures are followed by re-opening. . Stricter law enforcement may be effective to cause the participants discontinuing their activities if the punishment increases the financial or psychic price of involvement in the VBMs.

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Configuring Understanding of Complex Systems

This study takes the first step towards understanding complex systems. Constructing a conceptual equivalent of an actual system and coinciding their behaviors through simulation and observation referred to as `model validation' must be the point for system understanding to start with. It takes an example of `Building Heat Transfer System' to carry out this step. To keep the complexity under control this study has taken a simple system consisting of single room with two windows and an external environment. This study maps example system in Structure-Behavior-Function framework and constructs simple, aggregated system dynamics model of the system. This study compares the model behavior with the actual behavior of the system and revises the model accordingly until it succeeds in coinciding their behaviors. Several attempts were made and each attempt led to a certain change in perception of the system and each inference drawn led to a change in the way the system is modeled to allow for new information to be absorbed into the model. Repetitive iterations of the entire cycle led to gradual learning about system and improvement of model until a desired accuracy was achieved. This exercise was carried out to illustrate just that.

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Dynamics of Organizational Learning in Catching-Up Process

In this work the role of organizational learning in catching-up process is studied by means of system dynamics modeling. This model includes major transform/creation phases of knowledge, i.e. internalization, socialization, externalization and combination and shows how these mechanisms cause increase of organizational knowledge level and its catching-up with the level of pioneer organizations. This work is the first step of dynamical modeling of catching-up process by means of system dynamics and will be followed by future works on how intelligent policy making can be modeled and implemented practically in organizations.

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A Game-Theoretic Frame Work for Studying Dynamics of Multi Decision-maker Systems

System Dynamics (SD) main aim is to study dynamic behavior of systems based on causal relations. The other purpose of the science is to design policies, both in initial values and causal relation, to change system behavior as we desire. Especially we are interested in making systems behavior a convergent one. Although now SD is mainly used in situations of single policy maker, there are major parts of situations in which there are multi policy makers playing role. Game Theory (GT) is an appropriate tool for studying such cases.GT is the theory of studying multi decision-maker conditions. In this paper we will introduce GT and explain how to apply it in SD. Also we will provide some examples of microeconomic systems and show how to use GT for studying and simulating dynamics of these example systems. We will also have a short discuss on how SD can help GT studies.

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Investigation on dynamics of structure change in organizations: The Cultural aspect

Implementing a successful change in organizations usually needs critical considerations.Numerous changes in organizations did not triggered or did not stabilized as managers did not consider different aspects and dynamic effects in the change process. In this paper a change in the hierarchy of a specific company is investigated. This change leads to setting new routines and rules, therefor some of the employee's norms and habits should be altered. Thus , cultural aspects of this change are studied. A dynamic model is built and some insights are concluded from the model to implement a more effective change.

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May Economic Bubbles be Good Sometimes? A Theoretical Investigation of How Bubbles Affect Privatization in Developing Countries

In this paper, we develop a model dealing with how economic bubbles arise and how they may affect privatization process in non- or little-privatized countries. After running the developed model and analyzing the results, we suggest two main propositions: First, the mechanisms inhering in the investment structures may form a structural barrier to the process of privatization in its very initial stages. Second and more interesting, while harmful to the economy from other aspects, the economic bubbles can help activate the process of privatization. The findings are supported mainly by theoretical justifications rather than empirical evidences. This work, we believe, is not necessarily a conclusive and ultimate one out of which ultimate privatization policies should be drawn. It is, rather, a directive setup based on which a modeling process can be founded so as to obtain the best policies.

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Modeling a National Power Crisis in Support of A Crisis Lifecycle Model

Society is dependent upon electricity. In the last decade international scale outages have occurred with unfortunate regularity. While the impact of these outages has been limited to a few hours or days, they have been expensive and prompted fears that more severe failures could occur. While crises are perceived as events, their true origins come from the pre-crisis and post-crisis phases, where preparations and learning set the stage for the successful management of unusual events. A power crisis of a few weeks duration can set the policy agenda for many years. In this paper we describe a crisis model that captures the dynamic state of a power grid, the effects of failure on clients, government, and the public. The

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model was developed in concert with and validated by a panel of crisis managers. These factors combine to determine the post-crisis policies and socio-political factors that influence policy over much longer timeframes.

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Stakeholder Dynamics

Recent group modeling projects involving the authors have come to include eliciting stakeholder goals and the sanctions stakeholders might implement if their goals are threatened. The facilitated, computer-supported group conversations have tended to focus on discrete events (changes in system conditions that stakeholders are monitoring) and resulting stakeholder decisions (reactions intended to protect or reassert favorable conditions). The discrete character of the sequences of events and decisions emerging in these facilitated group modeling conversations creates two kinds of problems for the group modeling effort: first, they make it difficult to move to the more continuous perspective characteristic of system dynamics modeling, and second (related to the first), they tend to draw the attention of participants away from longer-term, deeper systemic issues and pressures that ought to the be the focus of strategic planning. Motivated by these concerns, this article explores stakeholder dynamics from a system dynamics perspective, with the purpose of contributing ways to facilitate group conversations at the familiar event-decision level and simultaneously to move to the level of more continuously accumulating pressures and resources underlying strategy dynamics.

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The Relevance of Urban Dynamics to Singapore's Success Story: Lessons for Moving Beyond the Crisis

This paper seeks answers to a question implicit the 28th International System Dynamics Conference Program theme, how can humankind move Beyond the Crisis towards political economies that are more resilient, sustainable and humane? Its focus is cities, which are seen both as principal loci of the crisis and pointing paths to moving behind it. Those concerned with urban challenges need new ways of viewing the problems they face. In seeking new ways, they should consider what Louis Alfeld has called perhaps the most insightful System Dynamics application every developed, Jay Forresters urban dynamics model. This representation of cities as living systems, seeking equilibrium with their environments, offers lessons that are timeless, and needed. A notable development success story, Singapore, illustrates applications of these lessons by leaders who were not even familiar with Forresters work. This further highlights the value and contemporary relevance of Urban Dynamics worldview.

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Improving operations management by synthesizing participant knowledge and system data

With the advent of Enterprise Resource Planning (ERP) systems, availability of data is no longer the bottleneck to decision making in many organizations. Instead the reverse seems to apply more frequently. Integrated organization-wide computer systems overwhelm managers with data to such an extent that it becomes difficult to assess relevance for managing operations. A number of

methodologies attempt to help management to distill meaning from large amounts of data. These methodologies enable managers to identify multiple performance indicators and determine tradeoffs between effects of proposed improvements. Implementation of improvements however entails organizational change. Methodologies are commonly used in an expert mode, which makes them prone to many of the potential traps of change management, such as lack of commitment due to the not invented here syndrome. Alternative methodologies such as group model building enable problem owners to identify problems and combine knowledge and system data in solving these are available. In this paper we explore three group model building projects in an ERP context. We address the context in which the projects were carried out and the process of client participation and model construction. We describe effects in terms of end products, quality of solutions and outcomes of system changes.

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The Structural Crisis of Capital Accumulation in the USA and Its Causa Prima

This paper re-defines three hypothetical laws of capital accumulation including endogenous rate of accumulation and capital-output ratio as state variables. An original non-linear relationship relates their growth rates. Other state variables are output per worker, employment ratio and relative labour compensation. A comprehensive Phillips equation, governing real labour compensation, is an element of the initial law (HL-1). HL-2 substitutes the former equation by a new one that reflects a long-term tendency of relative labour compensation to fall. A capital strive to maximal profit alters HL-2 in 2008. Extended Kalman filtering is applied for identifying unobserved parameters of these laws. An alternative control law (HL-3) determines a growth rate of surplus value by a gap between target and current employment ratios while an integral absolute divergence of relative labour compensation from the average one for 1979-2008 is minimised. HL-3 could alleviate severity of the current crisis in the restructured US economy compared to evolution based on altered HL-2. The recovery from the present structural crisis of capital accumulation, worst after the World War II, will last until 20112013 when the pre-crisis maximum of net output is restored and until 20142017 when the pre-crisis maximum of employment is reached again.

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A System Dynamic Approach to Integrated Water Resources Management of West Jazmourian (Halil) Basin, Iran

Water scarcity, growing demand, low productivity, and water and land-resources degradation are major threats to sustainability and equity principles are main water resources management challenges in arid and semi arid regions in general and in Iran in particular. The increasing demand for water in recent decade has put the water resource systems in instability. Moreover the future water demand will definitely bring critical condition for the sustainability of water management. The objective is to define a conflict resolution mechanism for present and future demands in a complex water resources system with the objective of system sustainability subject to uncertainty in natural phenomenon and management strategies. Results show that demand management as well as other management policies is essential for sustainability of the system. System Dynamic (SD) approach is employed and interactive user friendly media bring possibility to visualize the outcome of each management strategy, stakeholder behavior and probable hydro-climatic condition.

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Competition in the shipbuilding industry: sustaining competitive advantage in the global economy

For many decades, Korean shipbuilders have been the leader of the global market. They offer cost effective and high quality vessels based on their advanced production technologies, good management and process control which helps them utilize their economies of scale and learning effect. Korean shipbuilders top the industry with highest market share. However, China is a powerful rival with the low labor cost and huge amount of domestic demand. Chinese shipyards are rapidly closing the gap with Korean companies. This research is conducted to explore how the Korean shipbuilding industry can sustain its competitive advantage in the long-run. The methodology used was the use of classical strategy analysis framework which involved analyzing the industry structure and conducting macro-environmental analysis, SWOT analysis and value creation frontier analysis. The paper attempts to provide a detailed analysis of the Korean shipbuilding industry stressing the competitive advantage strategy of Korean shipbuilding firms.

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Modelling the Effect of the Allocation of Social Worker Duties on Delayed Discharges using System Dynamics in the UK

Delayed discharges have become a common problem within hospital, predominately within elderly care. Patients become blocked unnecessarily along the patient pathway. Historically allocation system policies were needed acting as coping mechanisms when there was a lack of social workers to carry out patient assessments and set up services. These allocation policies helped to reduce delayed discharging of elderly patients when resources were scarce. This paper examines the formal priority and informal proportional staff allocation system used by Social Services managers to allocate patient assessments and set up of post hospital services to social workers. The priority system involves social workers prioritising one duty over another and is an alternative to the standard policy of allocating social worker duties proportionally among patients waiting for social workers along the patient process. System dynamics is used to test the effect of these allocation systems on delayed discharges and the effect of an alternative integrated information system policy. Priority policies are routinely used by Social Services. Research has shown that they are disruptive to work schedules, as social workers change priorities to cope with a situation of diminishing capacity. Proportional policies are a less disruptive way of coping with situations of low capacity.

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A Systems Thinking Approach To Investigating Delayed Discharges In The UK

Outlined is the systems based process used to investigate delayed discharging, which combines parts of the Soft Systems Methodology (SSM) with Systems Dynamics (SD).At the early stages use of hard system approaches were inappropriate to investigate this type of complex problem. SSM was used to consider the soft problems present, expressing the problem situation as a rich

picture. This informed construction of a SD model to investigate policy interventions for reducing delayed discharges. This process had practical implications for structuring qualitative data to inform the SD methodology.

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Dynamics of CO2 Mitigation in Electric Power Industry

EP industry is expected to play a central role in climate change mitigation in many countries. With its rich clean energy potential, Turkey is a particular example. Being a developing economy, Turkey contributes to about one percent of global GHG emissions, and its per capita emissions are equal to and now exceeding the world average. The EP industry in Turkey is responsible for 28 percent of the national CO2 emissions. If a viable and sustainable global climate treaty develops in the near future, as a party to the UNFCCC, Turkey will have to assume national abatement targets and face the challenge of shifting its heavily fossil fuel based EP production towards renewable energy sources (RES), decentralized generation (DG) and increasing efficiency gains. In this paper, we create a dynamic simulation model of EP industry in Turkey so as to analyze the options for CO2 mitigation through replacements with cleaner energy resources and fuel efficiency retrofits. The model focuses on the supply side of EP sector and represents the investment, production, pricing and financing structures of coal, gas, hydro and wind power plants as well as the existing natural potential for the renewable resources.

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What is learned in system dynamics education: a competency-based representation based upon Bloom's taxonomy

System dynamics is progressively taught in different levels of education systems. There are challenges as for integrating it into the curricula of different professions and at the same time striving to grow it into a profession on its own. This paper starts recognizing that no representation of what is learned in system dynamics has been published in a way compatible with mainstream curricular tools. Specifically the need to integrate system dynamics into a competency-based curriculum has lead to a search in the field. We have opted for Blooms taxonomy as a widely shared reference frame and thus have expressed cognitive resources and development indicators in Blooms terms. The result is now a valuable resource for incorporating elements of system dynamics across different courses of undergraduate programmes in our university. Even so, the result has to be critically revised, for there are several open questions concerning the development stages of the learning process and the best form of representing them in order to facilitate the design and development of learning and assessment activities.

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Automating the comparison of mental models of dynamical systems

The comparison of mental models of dynamical systems can help understanding they way individuals understand dynamic situations and how their understanding changes. Current approaches like the Distance Ratio and the Closeness Ratio have been criticized for not taking into account feedback loops and delays; an improved comparison method has been proposed, specifying an Element Distance Ratio, Loop Distance Ratios and a Model Distance Ratio. We are advancing in the automation of the computations in order to take this burden away from analysts.

This paper describes the essential computations. It briefly presents the comparison method for the different ratios. Then it introduces the conceptual architecture of the software tool, its main data structures and algorithms. The tool shall be put to use in mental model research.

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The System Dynamics of Forest Cover in the Developing World: Researcher vs. Community Perspectives

Efforts to increase forest cover in the developing world will only succeed if the root causes of deforestation are addressed. Researchers designing reforestation initiatives tend to emphasize macro-level drivers of deforestation, such as population growth and federal policy. On the other hand, local people have knowledge of social and cultural dynamics that may be critical in the successful implementation of reforestation efforts. The perception gap between researchers and community members has led to many failed or insufficiently implemented projects. An emerging toolgroup model building with system dynamicsshows promise in its ability to integrate different perspectives on a complex problem such as forest cover loss. In this study, I use system dynamics modeling methodology to compare causal loop diagrams of forest cover dynamics on Negros Island, Philippines generated by researchers working for the World Wildlife Fund with causal loop diagrams generated by community members in upland Negros. The diagrams were significantly different, with very few variables in common, but both illuminate critical aspects of the deforestation problem on the island. I conclude that reforestation initiatives in the Philippines would benefit from incorporating all relevant information into a single, coherent model.

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Towards a Social Theoretical Foundation for System Dynamics in Organisational Consultation

The purpose of this paper is to discuss the relevance and the utility of basing system dynamics work in organisational consultation settings on social theory. As a major example of such a social theory, we present Luhmanns ideas and argue for their usefulness within an SD context. The paper is based on an extensive literature review and on six semi-structured interviews with experienced SD consultants. The study implies that the effectiveness of system dynamics in organisational intervention projects could be improved when a social theory is used to embed the SD work within it. The extension of the discussion to other social theories can be identified as a point for advancing the paper.

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Technological Innovation Project Management: A SD model in Italian Public Administration Environment

The paper describes the definition of a simulation model built to be capable in evaluating the possible policies in order to increase the diffusion of technological innovation projects in the Italian Public Administration (PA). In particular, the model aims to trace guidelines to identify specific "decision-making levers" that can help to improve efforts so to promote a network of institutional stakeholders able to provide advice, technological experimentation and innovative services in support to PA governance. The methodological basis through which the

decisional tool has been build is the System Dynamics (SD) approach. Applying SD methodology to such a naturally complex process, where the traditional management way is not anymore adequate to manage it, offers the opportunity to acquire supplied elements in order to better understand the logic by which the variables that contain the collaborative network, interact with each other. The SD approach has been very useful in order to describe and systematize the variables that form the structure of relations among the players in a collaborative network and focus on key elements that influence this network. The simulation model has allowed to observe how the key elements have an impact on the whole system and how they can develop alternative scenarios.

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Controlling the Direction of a Model Helicopter

We developed a feedback model for the control of the angular position of a model helicopter that has a single main rotor and a single tail rotor. Basically, there are two mechanisms involved in the control of angular position in the horizontal axis; the torque resulting from the rotation of the main rotor and the opposite direction torque created by the tail rotor. For the purpose of this study, the angular velocity of the main rotor is kept constant. The angular position is solely controlled through the change in the tail rotors angular velocity. Tail rotors angular velocity determines the net torque on the fuselage; the net torque determines the angular acceleration; the angular acceleration changes the angular velocity; the angular velocity changes the angular position. Therefore, the angular position of the fuselage is indirectly controlled by the tail rotors angular velocity. The delay introduced by the indirect control process makes it difficult to control the angular position of the model helicopter. After developing the model, we also developed a dynamic decision-making heuristic that imitates human decision makers. Finally, we developed a second decision heuristic in order to improve the control of the angular position of the model helicopter.

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National mapping of biomedical research resources through voluntary researcher participation - a mixed design study

Background Although the sharing of research resource information could optimize collaborations and avoid unnecessary resource redundancies, research stakeholders tend to shun voluntary sharing of data and meta-data about research resources. We evaluated the barriers and incentives affecting the voluntary sharing of research resource information from the bottom-up, i.e., among biomedical researchers. Methodology/Principal findings This project used a mixed design, combining qualitative and quantitative methods and a policy model. We asked research stakeholders to share information related to study databases owned or managed by them and point us to other sources of information. Major concerns were related to loss of confidentiality and the imminent conflict with institutional policy. Respondents who shared requested information delivered it in less than 5-8 weeks, while others pointed to alternate sources of information. Conclusions Our policy model points us towards an overall system of behavior that favors the use of combined top-down and bottom-up policies.

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A system dynamics analysis to determine willingness to wait and pay for inclusion of data standards in clinical research

The objective of this study was to evaluate the value of the extra time and cost required for different levels of data standards maturity and the corresponding likelihood of researchers complying with data standards. System Dynamics analysis was used in pursuit of this objective. Ten Brazilian and 18 American investigators were presented an online questionnaire with possible scenarios regarding options for data standards implementation, and asked to choose one of the two options presented. A preference for minimal (low cost) standards compared with both intermediate and full standardization was observed. A similar result was observed for time delay in project start-up. Investigators were more likely to incur costs than to accept a time delay in project start-up, and would prefer to implement the lowest possible level of standards that will make them compliant. Their preference is swayed when they are presented with a free alternative versus an expensive one.

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Assessing the effect of systems simulations on systems understanding in undergraduate environmental science courses

This paper describes the results of a paired experiment testing the effect of system dynamics simulations on systems understanding in undergraduate environmental science courses. The performance of 298 students in four sections was measured at several points during the semester. Half the students used system dynamics simulations in their assignments; the other half did not. Results of regression analysis show that performance on systems questions immediately following the intervention was significantly better for the experimental group than the control. The study also highlighted some problems in the assessment framework we used and led to suggestions for improving both the systems interventions and the assessment tools.

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Construction Industry Forecasting System Dynamic Model

Construction branch forecasting model allows estimate the industry development problems. The main attention is turned to the living area construction. The model consists of several sub-models: amount of apartments, real estate prices, needs for apartments and living area forecasting models. The apartments amount forecasting model bases on principle if there is insufficient number of apartments in the economic system, then, first of all, apartments with small areas are financed and constructed, i.e., multistory buildings with one-room apartments. The increase of apartments amount depends on the financing that is intended for construction, as well as from the average apartment area and construction costs per square meter, in other words, from funding and construction costs. The real estate prices influential parameters are the increase or decrease of the housing fund, the total apartment market influence on separate segments in apartment market (and vice versa). The apartments needs influential factors there are an increase of apartments amount; depreciation of apartments (reduction of amount);

improvement of living conditions. In paper shown, that in Latvia the balanced amount of apartment construction is approximately 1800 apartments per the year, but considering the fluctuations of surplus and needs, it can temporarily fluctuate from 1434 to 2019.

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Policy Planning For Quality Improvement in Technical Education-A System Dynamic Approach

In the present paper an attempt has been made to study the impact of various parameters of technical education system on its quality by sub dividing the technical education system into sub-sectors and studying there dynamic behavior by constructing causal loop diagrams of various sectors . The main theme of study is to construct a system dynamic model which can be taken as a frame work for planning long term policy for enhancing the quality of technical education system.

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Organizational Flexibility: A dynamic evaluation of Volberda's theory

It is no longer only necessary to achieve and to exploit efficiently a competitive advantage along the enterprise lifecycle, but also to explore new combinations or ideas by means of organizational flexibility management. In order to improve our understanding of organizational flexibility, we examine Volberdas theory on organizational flexibility (Volberda, 1998) in detail analyzing its consistency and effectiveness, especially in terms of its causal explanation of organizational adaptation to changing environments. To accomplish with this objective, we developed a causal model to understand the dynamics of the transformation strategies about organizational flexibility proposed by Volberda (1998). The causal model is used to develop dynamic hypothesis that will be tested in further research. In our research on organizational flexibility, we aim to improve management decisions related to managing capabilities related to organizational flexibility and refine the organizational actions to adapt to the environmental turbulence.

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Dynamics in economic growth: A perspective from System Dynamics

Evidence shows that the paths of growth followed by different countries are diverse. While some countries present a fast growth, other countries show a moderate or even, a slight growth. The first behavior could be justified by means of positive feedback loops that provoke strong accumulations while the second one could be explained through interrelationships of positive and negative feedback loops. To generate process of growth, this paper constructs a system dynamics model considering a causal structure that gathers decisions of consumers, firms and a government in an economy. A simulation exercise obtains different paths of growth taking into account both different governmental strategies and boom and bust cycles. Due to the possibilities that the model offers different political aspects tied to governmental strategies, such as distribution of wealth, degree of corruption or level of education, are examined.

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Terrorist incidents and counter terrorist policies: A System Dynamics model

According to the Global Terrorism Database, Asia was the continent that suffers the highest number of terrorist attacks and the highest number of casualties during the period 1998-2007. One of the numerous terrorist organizations operating on its territory is Lashkar e Taiba (LeT) that was created in 1999. From its inception to 2007, it has staged ninety attacks generating 1,945 casualties. This paper presents a system dynamics model to try to reproduce the number of monthly incidents of that organization. The construction is carried out adapting to the organization those feedback processes that explain the survival over time of a terrorist organization. Comparing the data series and the data obtained by simulation, the paper examines the degree in which the model reproduces the incidents of the organization. After checking the usefulness of the model, different counter terrorist measures are tested in order to assess their effectiveness.

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An Adaptive Statistical Data Processing Algorithm Applied to SD Modeling of Iran's Demographic Transition

There are different official estimations about current and future growth rate of Irans population. Inadequacy and unreliability of data in addition to usage of unsuitable forecasting methods are the main reasons for existence of this variety. To have accurate estimates for year on year growth rate, in this research, a population system dynamics model is implemented. To run the model, total fertility rate and other needful fertility parameters are calculated by processing raw data. In the next step and to resolve the statistical inconsistencies in census data which have been revealed by calculation of survival fractions and death rates, an appropriate adaptive process is proposed and applied to modify the parameters. The result of applying model shows that the next ten-year average growth rate will be about 1.9. Finally, simulation results of three possible scenarios on the fertility factor are obtained that warns on exceeding of population over 100m by 2020.

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The importance of keeping engineers and knowledge workers inside on organisations' performances

Most business organisations attach great importance on intellectual property and knowledge today, because the property and knowledge are considered as source of competitiveness. In order to protect them, businesses have tried to control the source of intellectual property and knowledge, to say engineers and knowledge workers. This has been working well to enable the businesses to be competitive especially in manufacturing companies and IT companies in early days. The environment around businesses especially in information communication technology and service industries is now changed. Since needs of customers, government regulations and market environments are changing rapidly, knowledge and skills of engineers and knowledge workers need to be quickly updated. Falling behind competitors can lead to withdraw from the market. Nevertheless, businesses seem to continue their protective control on their personnel in old style. This can eventually cause not only lowering workers condition but also aggravated result of businesses because of obsoleteness of

knowledge and loss of competitiveness. In order to examine this possibility, this paper shows simulation model based on existing research concerning employment and knowledge management. The result of simulation suggests overprotective policy would reduce businesses competitiveness and protecting knowledge workers job choice supports their companies development.

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Dynamics of Technology Spillover through Foreign Direct Investment in Thailand under R&D Consortia Policy

This paper studies the effect of R&D consortia policy and the consequences of the policy implementation process on technology spillover through Foreign Direct Investment (FDI) in Thailand using a system dynamics method. The results show that the R&D consortia policy increases the level of technology spillover and improves the economy of Thailand by boosting the productivity and GDP per capita of Thailand. The R&D consortia policy also amplifies the level of FDI which adds up to the productivity growth. When considering the policy implementation process, shortening the implementation time significantly increases the benefits in the short run but in the long run the additional benefits from shortening the implementation duration diminished. The FDI signaling effect reduces the benefits of the policy. However, when accounting for the signaling effect, Thailand is still better off if the R&D consortia policy is implemented.

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System Dynamics Implementation of an Extended Brander and Taylor-like Easter Island Model

We provide a system dynamics implementation of an important ecological economics model. Such models are typically constrained to use functions chosen conveniently to allow for analytic solution, such as the Cobb-Douglas function. This function however has the undesirable attribute that the elasticity of substitution is one. Fixed elasticity does not allow for the substitutability between man-made capital and natural capital to change, which is vital for economic sustainability. Using system dynamics removes this constraint and enables more realistic ecological economics models containing functions not amenable to analytic solution. The base model is the natural resource and population growth model developed by Brander and Taylor (1998), which employs a Lotka-Volterra type structure, and strictly follows economic theory in all aspects of its formulation. To make the model more realistic and to enable the consideration of important environmental issues, we discuss and employ model extensions inspired by modern economics theory. One extension is to use a CES production function, which incorporates a dynamic substitutability parameter that enables the study of long-term economic sustainability. The model does not have an analytic solution, necessitating a simulation approach. Importantly, the system dynamics implementation robustly returns to equilibrium after disturbances.

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Subtantiating endogenous models on induced technology change

In this paper we reflect on effective research strategies for building helpful system dynamics models on induced technology change that are substantiated in the relevant literature and empirical data sources. The paper positions the innovation system literature within the overall field of induced technology change as a

distinct systemic approach that offer relevant conceptual starting points for a system dynamics modeling experiment on induced technology change analyses. Innovation system research is interested in identifying the processes underlying innovation, industrial transformation and economic growth. Also, the interest in the functional dynamics of innovation systems creates an opportunity for system dynamics researchers that are applying a scholarly developed modeling approach aiming to identify the structure and processes that explain behavior patterns of induced technology change. The paper summarizes the main modeling steps applied by system dynamics scholars and compare it with research approaches of innovation system scholars based on literature research. An unifying research strategy framework for a scientific modeling approach is introduced that highlights the main necessary requirements in order to be most useful for a real world problem situation and for theory building and refinement in general and specifically for system approaches on induced technology change.

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University-Industry partnerships with a focus on BRIC countries: A systems perspective on the good, the bad and the ugly

National Innovation System (NIS) is the term used by scholars and policy makers to describe the emerging scientific and technological structures and processes of a nation that influence economic and social development through industry-university partnerships. The last decade has seen a growing research interest in the innovation systems of different economies in order to better understand the factors that determine their economic and social development. This paper addresses the complex industry-university relationship using as theoretical framework the NIS concepts and as an analytical method, System Dynamics (SD) which is specifically designed to evaluate complex systems. Later, some international comparisons between Brazil, Russia, India and China (BRIC) are introduced in terms of industry-university partnerships.

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Comparing Discrete Simulation and System Dynamics: Modeling an Anti-insurgency Influence Operation

This paper contrasts the tradeoffs of modeling the same dynamic problem at a micro scale and at a macro scale of analysis: discrete system simulation (DS) versus continuous system simulation or system dynamics (SD). Both are employed to model the influence of entertainment education on terrorist system decay, with implications for field application. Each method optimizes different design, scope/scale, data availability/accuracy, parameter settings, and system sensitivities. Whether the research served by the computer model is applied or theoretical, DS tends to be useful for understand low-level individual unit/step influences on system change over time, whereas SD tends to shine when a wide-angle focus upon sociological/aggregate change is required.

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SD Approaches for Feedback Dynamic Complexity Analysis

Feedback dynamic complexity is an important feature of complex systems. Professor Jia Renan and his SD group began their study of the theory and application of SD feedback dynamic complexity analysis method since 1985, and

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proposed a series of approaches successively, which have constructed an approach system of SD feedback dynamic complexity analysis of complex systems. Four major functions of SD feedback dynamic complexity analysis were extracted in this paper, which are formulating feedback model for the system problem; constructing feedback model for Successful case; simulation; feedback loops calculation and management policy analysis. Many questions and further study on each of the four functions were respectively proposed. The paper is also a SD research summary of the group for nearly three decades. We believe that there will be many benefits for the system dynamics community in developing the method system of SD feedback dynamic complexity analysis.

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Regional System Dynamics Conference---A Way to promote the Application of SD in Developing Countries

Institute of development study, Tongji University, is a center for system dynamics research in China. From year 2005, it has organized the Conference on Systems Science, Management Science and System Dynamics (SS-MS-SD) every other year. Till 2009, three SS-MS-SD conferences have been held, which have offered great opportunities for SD researchers from China and the rest of the world to discuss their researches and share their ideas. In this poster, we provide information about the system dynamics researchers participated in these three conferences, together with a summary of their research focuses. Such information can serve as a channel through which we can observe how system dynamics is developing in China. One necessity to have regional SD conference is the fact that not all SD researchers can participate in the ISDC, especially for developing countries. A trip to the US or Europe is not affordable to many researchers, Ph.D. students, and others in these areas. Regional conference is much less expensive. The SS-MS-SD conference has received great participation and the researchers advocate having it annually. In this poster, we share our experiences and ideas on how to make regional SD conference more effective and successful.

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China Water Dynamics – Modeling of China's Water Resources

Sustainable water resources management is an interdisciplinary approach to deal with water crisis on different scales. System dynamics modeling proves to be successful in integrating theories and techniques grown out of multiple disciplines. Based on system dynamics modeling, this paper builds the ChinaWater Model as a tool for sustainable water resources management in China. Current status and prospects of the countrys water resources are simulated by the model. Four classic scenarios for development are also explored through model simulations. Results of the paper demonstrate that 1) surface water resources in China are being extracted excessively, which could result in severe water shortages within ten years; 2) fast urbanization is a driving force for more water consumption; 3) a potential population decrease in the future could lead to an abrupt reduction of water demands in China; 4) strengthening science and technology capability and enhancing wastewater treatment capacity can increase water use efficiencies, reduce water consumption and increase water resources by industrial and domestic uses; 5) effective measures have to be found and taken immediately before severe and unrecoverable problems are caused by water shortage and pollution directly or indirectly.

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Growth and Competition Dynamics of Online Game Market in Taiwan

In recent years, Taiwan government has offered incentives and supportive policies such as tax reduction with a hope to foster the development of domestic online game industry. However, domestically developed online games are failed to dominate the online game market. Over seventy percents of the market share is occupied by foreign games, especially those from Korea. In this paper, a system dynamics model is built to explore the growth and competition dynamics of the online game market. The model shows that multiple reinforcing feedback loops and limited market size together led to the rapid but temporal market growth. The market reached its limit so quickly that Taiwans domestic game developers lost the opportunity to grow because of unavoidable time delays in R&D capacity expansion and game development and commercialization process. The online game case shows that market growth and R&D expansion that contrast sharply in lead times could cause tough barriers that are far beyond late entrants abilities to conquer, even governmental support might hardly be useful.

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Water resources planning and management based on System Dynamics: A case study of Yulin city

In this study, a complex system dynamic (SD) model focusing on water resources management, termed as YulinSD, was developed for the scientific management of the water resources of Yulin based on System Dynamics theory, water demand and supply and water price theory. The interactions among 139 components were divided into water supply subsystem, water demand subsystem and price adjustment subsystem. The results indicate that the relative error is small, which shows that the model is reasonable for the actual situation. Then according to the socio-economic development and situation of water resources utilization in Yulin city, three management types were chosen, current development pattern, water supply pattern and the price-control pattern. Results show that current development pattern is difficult to balance supply and demand due to serious waste of water resources; with the implementation of the projects in water supply pattern, marginal cost of additional water is higher and higher. Moreover, environmental impact is also an serious problem. These economic and environmental reasons eventually make it difficult to achieve sustainable development; with awareness of water-saving is increasing in price control pattern, water market gradually matures, and it will finally turn water demand management to achieve balance between water supply and demand eventually.

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Understanding the Effects of Rework and Change of Scope on Productivity and Project Performance Using Systems Thinking

Identifying the effects of change in construction has been a topic of discussion and debate for several years, especially those changes that delay contractors and disrupt productivity. Managing projects consists of a complex and integrated array of decisions, actions, and communications necessary to complete projects successfully. A project is a system requiring fully functioning processes and procedures, tools and resources, and when any of these aspects are not working efficiently, resulting from unanticipated changes, a cascade of problems can and

does occur. Samual Johnson once noted many years ago that 'Change is not made without inconvenience, even from worse to better' (Pickavance, 2005, page 409, citing the Dictionary of the English Language, edited by Richard Hooker, quoting Samuel Johnson, from the year 1755). This feeling regarding change remains the same in today's world; especially in the construction industry. When changes are introduced prior, during or after construction work has been executed, the synergistic effects of these changes can dramatically affect project performance. Identifying and quantifying the cause and effect relationships between changes in order to mitigate or avoid their impact is vitally important to the construction industry.

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Community Driven Modeling of Social-Ecological Systems: Lessons from Andhra Pradesh, India

Human and environment interactions are complex,cross-scale, and temporal in nature. Drivers of socioeconomic and ecological systems and feedback mechanisms between the two are multiple and hard to reduce to a core representative set. Our paper describes the use of participatory rural appraisal techniques and their integration with group model building methods to develop models of community and local ecosystem interactions and feedback mechanisms in rural natural resource dependent communities in India. The goal is to build system dynamics models to understand: 1) the mechanisms through which people, governments, and natural resources interact and change the condition of these resources; and 2) the changes in livelihood strategies of households tied to changes in vital natural resources. Methods described in this paper have been developed in forest resource dependent communities in the state of Andhra Pradesh in India in collaboraiton with Foundation for Ecological Society. In this paper, we will highlight the participatory process leading up to our model building; and the critical nature of participatory appraisal technologies for systematic development of dynamic models of social-ecological systems. We outline field identifaction of the dynamic problem, associated reference modes, and model building and confidence testing with villagers.

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Competitive Dynamics of Business Process Improvement

We offer a theory of competitive process improvement to explain the process of how best business practices emerge through dynamic interactions between competing processes. Grounded on the history of the interaction between two distinctive competing processes, Mass Production System vs. Toyota Production System, we employ the lens of competitive dynamics to develop a formal model. Three insights emerged: for sustainable competitive advantage, (1) a firm needs to invest in explorative activities at an early and continuous fashion; (2) external competitive tension plays a vital role in managing internal tension of organizational learning; (3) a firm may commit perception biases when interpreting others learning (re)actions.

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Inductive Modelling of an Entrepreneurial System

We describe the development of a novel approach to generating theory about the behavior of an entrepreneurial or start-up system. The new technology business creation system in and around the cities of Bath and Bristol in the UK was analyzed using an inductive modeling approach that hybridizes grounded theory

with system dynamics; a technique we have called grounded systems modeling. Three models that represent the stages of development of an idea through to successful exploitation have been derived from the data i) Spotting an opportunity, testing and validation; ii) Realistic equity position, and iii) Scale up and exit. From these models a number of useful dynamic hypotheses have been developed which can be tested by suitable longitudinal studies. The results are discussed in the context of entrepreneurial research and a critique of the methodology is offered.

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Using System Dynamics to Investigate How Belief Systems Influence the Process of Organization Change

As an enterprise starts to grow larger, management will activate a series of activities of organizational development for creating a better performance. Prior researchers mainly focused on the relationships among organizational structures, those activities which can stimulate the organizational performance at least in a short term, and organizational performance. How organizational changes create superior performance is a popular issue, but the effects of leaders' beliefs are relatively ignored. This study explores the process that how a leaders belief directly affects the organization structure and indirectly drives organization performance. We developed detailed simulation model of General Electric, including human resources, financial and cost accounting, research and development, and operations. Historical information and archival data was used to specify and estimate the model. The results show that a leader's belief system can impact a company's tradeoffs between short term and long term effects. In the short term, leaders' beliefs influence the strategies of the company and can be beneficial to financial outcomes. In the long term, leaders beliefs may prevent the company from failures in the future.

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Exploring the management of social enterprise from systemic perspective: the application of Deleuze's Theory of Assemblage

Exploring the management of social enterprise from systemic perspective: the application of Deleuzes Theory of Assemblage Jae Eon Yu, Business School, Korea University, Seoul, Korea Jeong-Woo Lee, Seoul School of Integrated Sciences & Technologies, Seoul, Korea Abstract In this paper, we wish to evaluate a soft systems approach to action learning that takes place in exploring the management of social enterprise in Korea. To do so, we appreciate and present Deleuze s theory of an assemblage in order to explore social complexity as researchers rethink the value of participatory action learning through the process of problematization. It allows participants to be critical thinkers on the given situations. To be critical thinkers, what is important for the process of action learning and research is not so on what is true of scientific knowledge being appreciated, but it is on our thought and learning to what the narrative knowledge produces in particular, local contexts. In this sense, we reappreciate the value of a soft kind of systems approach from the poststructuralist thought of Gilles Deleuze. Key words: action learning, social enterprise soft systems approach, Deleuzes theory of an assemblage.

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An Institutional Dynamics Model of the Euro zone Crisis: Greece as an Illustrative Example

The current turmoil in the financial markets forces us to question the validity and relevance of the present economic theories. Complex dynamics characterized by bounded rationality and strong impact of expectations on the markets provides an independent source of fundamental uncertainty and this one can lead to speculative bubbles in assets markets triggering growth of public debt. The neoclassical methodology based on logical empiricism and deductive reasoning has failed to show what is going on in the real world. We will employ the institutionalist's view and focus on the behavioral aspects of the system modeling decision making process. We illustrate this approach with a model drawn from the current Greek sovereign debt crisis and its bailout discussions. The main benefit expected is the increased realism of the model itself. The discrepancies between theoretical predictions and observed behavior have had a major negative impact on economic models and system dynamicists can contribute a significant amount of value to institutional economics.

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Extending System Dynamics approach on web-based application with higher then index one DAE's

The aim of this paper is to describe a project of creating a web-based tool for making on-line simulations of System Dynamic models. Currently, the market of System Dynamics software is dominated by a few key companies which deliver professional, strictly client-based solutions. While trying to teach a System Dynamics, a problem with number of licences occurrs quite often. To solve this problem, a project for creating a web-based simulation tool was started. This type of solution enable us to populate a Forrester methodology in much easer way, independently from geographical location. As a basic platforma a Java Eclipse environment was chosen. During the work a also some new issues were defined. Beacuse traditional approach foceses only on systems of index 1 DAE's the most significant proposition is to extend the System Dynamics approach to higher index DAE's. In the last section, a simple model of index 3 DAE with exact solution is proposed.

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A Generic Model of Organizational Inertia, Attention, and Change

There exist many examples of organizations which failed to react to environmental change. Polaroid and Digital Equipment Corporation (DEC) are just two of them. While existing literature in particular focuses on organizational inertia and routines as impediments to change, attention to stakeholders has not received much consideration outside the area of business ethics. Since attention proved an influencing factor at Polaroid, DEC, and in a change process of the New York Stock Exchange, the interrelationships between inertia, attention, and change will be analyzed in the present paper. Stakeholder attention proved to be influenced by stakeholder pressures as well as an influencing factor on the perception of stakeholder pressures. Additionally, sensitivity analyzes revealed how different policies for managerial intervention work by themselves and in interaction.

Meetings, Special & Convened Sessions

Listed alphabetically by Session name

Australasia Chapter Annual Meeting

Mark Heffernan
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The Australasian Chapter will have a meeting to dicuss what's going on in the region, see how we can help foster the update of SD and welcome anyone interested in joining our little club. Nominations will be called for President.

Barry Richmond Scholarship Award Announcement (External Award)

The Barry Richmond Scholarship Award is given annually by isee systems to a deserving Systems Thinking or System Dynamics practitioner whose work demonstrates a desire to expand the field or apply it to current social issues. This year Mark Heffernan, Evans & Peck Pty Ltd, will announce the winner of this award at the banquet on Tuesday evening.

Business SIG Annual Meeting

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Business activities have been described using system dynamics for more than fifty years. Planning and scheduling, product adoption, corporate profitability, job satisfaction, the economic impacts of government policies, and many other parameters have been simulated. Yet system dynamics has not really been widely adopted as a tool within the corporate world. It might be argued that system dynamics finds its way into the business world in much the same way that viruses enter the body through a carrier in this case, consultants. Business consultants certainly have found this field to be very helpful in guiding and assisting clients; however, upon their departure, the client may not see value in continued use of the tool. The question has been asked many times how do we as practitioners assist in increasing the use of system dynamics within businesses? Perhaps this is not the correct question for us to ask. If that is so, then what is the correct question? How do we show businesses the value of system dynamics and system thinking as tools for addressing a diverse and complex set of problems? This meeting will be an open discussion of this concept.

China Chapter Annual Meeting

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The China chapter consists of 33 members registered in SDS so far, including researchers, educators, consultants, and practitioners in corporate and public sectors. The China Chapter will hold this annual meeting and all are welcome to attend. In this annual meeting, we provide the information on the regional SD conferences, the current events and membership growth over the past year.

Conference and Program Debriefing Meeting

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All are welcome to attend this meeting to talk about what worked and what needed improvements at the conference. Also, please remember to complete and return the conference survey. Post-conference, you may complete our online survey at: http://www.surveymonkey.com/s/3FV79H6

Dana Meadows Award Announcement

The Dana Meadows Award was established in 2001 to honor the late Dana Meadows and encourage the next generation of students in the field of system dynamics. The award is given annually for the best paper by a student presented at the annual System Dynamics Conference. Students can self-nominate any manuscript that has been submitted for inclusion in the conference. This year, John Sterman, MIT, will announce the winner who receives a cash award of $500 as well as conference registration plus travel expenses (up to a combined maximum of $700).

Economics Chapter Annual Meeting

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The Economics Chapter will hold its annual meeting. All are welcome to attend.

Education Roundtable and Education SIG Annual Meeting

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This Roundtable is the place to come to discuss substantive education issues, whether you are part of the Education SIG or simply exploring possibilities. The Ed SIG is establishing an agenda which embraces both elementary and secondary education and high education. We also deal with both management and public policy issues. We will continue working on the intellectual and operational challenges to system dynamics of the PK-20+ concept of lifelong learning from prekindergarten to continuing adult education, reaching beyond the usual silos separating the domains. Come tell us what you are working on, or just ask questions.

Energy Roundtable and Energy SIG Annual Meeting

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The Energy Roundtable and poster session will have two main purposes this year. Firstly, we will update all interested parties on past and present activities and will collect ideas on possible next steps for the Energy SIG. Secondly, specific relevant energy issues will be discussed, to identify what critical contributions the SD community could provide.

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Environmental Roundtable and Environmental SIG Annual Meeting

The Environmental SIG welcomes everyone who likes to join their efforts in simulation modeling and analysis of dynamic, concurrent environmental and ecological problems. In the roundtable, the members will first settle the technical SIG issues such as groups representation and communication. After that, the research priorities, prominent methodological challenges and cross fertilization with other modeling and socio economic analysis methods will be discussed.

Exhibitor Demonstrations

Exhibitor demonstrations will be held during breaks to showcase products and services in practice.

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Health Policy Special Interest Group Business Meeting for Exploring Collaborations

The Health Policy Special Interest Group formed more than seven years ago and has grown to around 300 members. We are a worldwide SIG with active collaborations that use dynamic analyses to advance major policy initiatives. Current activities include gathering on-line teaching materials, fostering international collaboration in understanding health system change, and assembling a library of SD health models. Regardless of whether you are new to the field or a veteran modeler, we welcome your participation in exchanging ideas about how SD can better engage and support health policy leaders around the world. HPSIG at ISDC2010 will run a Sunday Session and Business Meeting, covering Highlights of Health Policy Modeling Around the World, with brief summaries of significant activities, including Africa, Asia, Europe, Latin America, North America and Oceania. We will discuss ways of balancing demand, supply and quality in health policy modeling, priorities for practitioners, funders, educators, peer reviewers and the like. The Business Meeting will explore collaborations and elect new office bearers. The Lupina Young Researchers Award in Health System Dynamics and the winning paper will be delivered.

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Inter- and Intranational Conflict Roundtable

An opportunity for those interested in applying system dynamics to the understanding of intra- and international conflict.

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SYstem Dynamics Italian Chapter (SYDIC) Annual Meeting

The Chapter activities during the year will be discussed and future steps to manage the chapter will be planned.

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Japan Chapter Annual Meeting

Japan chapter was founded in 1990 by researchers who had been working on SD modeling since 1960s and has been active since then, hosting the Tokyo SD conference in 1995. Currently the chapter has137 members, an increase of 10 members since 2009. This years annual meeting was held on April 24 at Gakushuin University in Tokyo, and new executive members were elected. Its nation-wide annual research seminar was also held in Kyoto at Doshisha University on Nov. 21, 2009. Besides these two annual meetings, the chapter has two SIGs; Business Process Modeling (based in Tokyo) and Dynamic System Modeling (based in Nagoya), and they have been actively holding their seminars quite often. As to the publication, the chapter has so far published 8 volumes of its journal; each volume accepts 6 to 10 referee-judged papers in average. The next volume will be planned to be issued in June this year. Please feel free to contact us to get involved in our activities in case you plan to be in Japan in the near future.

Jay Wright Forrester Award Ceremony

The Jay Wright Forrester Award is presented as often as once annually for the best contribution to the field of System Dynamics during the preceding five years. The recipient receives a commemorative plaque and US$5,000. Papers, articles, books, research or consulting reports, theses or other written material that have been published or are in publishable form in the English language, in the original or after translation, are eligible for consideration. Winner(s) will be announced at the conference by John Sterman, MIT.

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Latin America Chapter Annual Meeting

The annual meeting that will take place at Seoul Conference will allow Latin-American practitioners to gather and newcomers to get in to touch; we are planning our annual meeting in Lima, Perú during November 2010 so we are open to ideas to have a wonderful conference as well new proposal for incoming venues. Also this meeting is the opportunity to get involve with the Latin-American Chapter activities and develop the networking we need to develop the System Dynamics field in our countries.

Lupina Young Researchers Award Announcement (External Award)

The Health Policy Special Interest Group (HPSIG) of the System Dynamics Society is proud to announce the Lupina Young Researchers Award for work in health system dynamics. The award is sponsored by the Lupina Foundation of Toronto, Canada, and will be accompanied by a check in the amount of CAN$5000. Mark Heffenan, Evans & Peck Pty Ltd, will present the award to the recipient (or recipients) during the HPSIG meeting at the Sunday afternoon meeting just preceding the conference. This award will be given to people at early stages of their careers to encourage them to do further work in health system dynamics.

Modeling Assistance Workshop (Tenth Annual)

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Modeling assistance is available at the conference to enable people to receive one-on-one coaching with an experienced system dynamics practitioner. Opportunities include two scheduled sessions, as well as the possibility of assistance at any time during the conference. Assistance is available for modelers at any level of modeling ability, from beginner to advanced, with questions about a specific model, methodology, or software. Questions may address problem identification, dynamic hypothesis development, model formulation, model testing, or policy design and evaluation. Modelers should bring whatever materials they need to describe their modeling question, including pencil and paper, articles, books, or laptop computers. Spectators are welcome to observe, and even contribute their own ideas, during the scheduled modeling assistance sessions.

Newcomer Orientation

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The Newcomer Orientation Session is a special event for newcomers (first-time conference attendees) scheduled for either a half hour on Sunday afternoon or at Monday lunchtime (refer to the conference schedule). Newcomers and veteran attendees (guides) will be brought together based on their topics of interest. The guides will answer questions and provide information to help the newcomers get the most out of the conference. The orientation session will "self-organize" into groups to cover general topics, such as: Business, Education, Energy & Environment, Health Policy, Information Science & Information Systems, Security, Economics, Psychology, Public Policy, Social Science, Strategy, and Organizational Change. Newcomers will also be advised of the Society Chapter meetings and the Special Interest Group (SIG) meetings that might match their interests. If you are a newcomer and would like to participate in this program, please check the box on the registration form for first-time participant.

Outstanding Service Award Presentation

The System Dynamics Society Outstanding Service Award recognizes individuals that have, on a volunteer basis, made exceptional contributions to the Society over an extended period of time. The Society has a long and proud tradition of volunteer service, and Julie Pugh, who volunteered as the first Executive Director, has inspired this award. Even after establishing a central office with a paid professional staff in 1996, the growth and development of the Society has been heavily dependent on the work of volunteers. To acknowledge this work, emphasize its importance in achieving Society goals, and highlight efforts that can inspire others, this service award was established in 2009. It is awarded as often as once per year during the annual conference.

Peer Review Dialogue Meeting

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Since 2005, there has been an opportunity for joint reflection about the quality of the peer review process at each conference. In the subsequent conferences, discussion became more structured and this year, a substantial effort has been made. Still there remains work to be done in order to arrive at a policy that would achieve a satisfactory balance between paper and presentation quality on one side

and other goals of the conference on the other. This years meeting is the opportunity to review what has happened since last year's meeting and its recommendations, also we can assess up to which point the new policies have yielded improvements. Reviewers, chairs and organizers are especially invited to give their input.

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Burcu Tan
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University of Texas at Austin

PhD Colloquium

The PhD colloquium, which became an important piece of the International Conference of the System Dynamics Society, is a one-day event devoted to the works of the PhD researchers working on foundations, techniques, tools, and applications of the System Dynamics approach. We warmly invite PhD students especially in the early to middle stages of their research to present their research proposals and progress at the colloquium. You will receive valuable feedback from the experienced researchers in the field as well as from fellow students. Even if you are not presenting your work, you are still more than welcome to join the PhD Colloquium for the day. It is a great opportunity to meet fellow students from around the world and exchange ideas.

Etiënne A. J. A. Rouwette
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Radboud University Nijmegen

Proposed Benelux Chapter Meeting

The Proposed Benelux chapter of the SD society aims to bring together practitioners and researchers working in Belgium, the Netherlands and Luxemburg that share an interest in system dynamics. The purpose of meeting is to assess the interest in forming a chapter and to bring together volunteers to help organize the chapter and lead special activities. A first workshop after the conference is planned in autumn in Delft, the Netherlands. We will discuss other activities the chapter should support and welcome all those interested to attend the meeting.

Etiënne A. J. A. Rouwette
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Proposed Participatory Modeling Special Interest Group Meeting

The Proposed Participatory Modeling Special Interest Group (SIG) is a community formed by scholars and practitioners interested in participatory SD approaches to model development and use. The SIG to be has a listserv and bulletin board, has been active in organizing the program thread on participative approaches in the annual conferences and has had informal meetings in the past. In this years meeting we want to make the step to a full SIG and focus on two things: a) collect signatures in support of a formal SIG, and b) ask for volunteers to help organize the SIG and lead specific activities. Activities may include organizing the annual thread, meetings in or separate to the conference, joint publications or others that further the exchange of knowledge on participatory modeling. We welcome all those interested to join.

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Radboud University Nijmegen

Roberta L. Spencer
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System Dynamics Society

Prospective Conference Host Meeting

The annual conference is the most important activity of the Society, and therefore hosting it is a very important contribution to the Society. In addition, being a host for this event can bring fame (sorry, no fortune) to the hosting individuals and organization, and attract local interest in the field. In this meeting we will discuss

the timetable and activities involved in preparing a bid to host the conference, the requirements for a successful bid, and the requirements for a successful conference. We will also discuss the Society's schedule for conference site rotation, the new society's policy on default conference sites, and the role of SIGs and Chapters in conferences. Please attend this meeting if you have any interest in hosting a future conference.

David W. Lounsbury
david.lounsbury@einstein.yu.edu
Einstein College of Medicine, Yeshiva

Ralph L. Levine
leviner@msu.edu
Michigan State University

Psychology Roundtable and Psychology SIG Annual Meeting

The Psychology SIG cordially invites you to its annual business meeting and roundtable, which will feature a discussion facilitated by SIG Co-Chairs Ralph Levine and David Lounsbury. The focus of the round table will be the use of soft variables and the application of psychological, behavioral and social theories and processes in system dynamics modeling. Modeling of a wide range of clinical, public health and community problems and issues are welcomed. Participants are encouraged to share information about their work and to bring questions for group discussion.

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Empatika

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University of Warwick

Dmitry Katalevsky
dkatalevsky@yahoo.com
University at Albany

Russian Chapter Annual Meeting

The Russian Chapter (SDRus) continues its growth and attracts new participants. Moscow State University's (MSU) annual Winter School on Simulation Games and Modelling has become a popular event for demonstration of system dynamics models. MSU offers formal courses on system dynamics and is developing a Russian language text book on SD. Russian Chapter plans to create SD teaching centres in major business schools in Russia and develop collaborative research projects with other members of SD community. XJtek continues successful performance. The latest version of AnyLogic 6.5 has been released and is available for Mac and Linux users. Active work continues at MSU, State University of Management and other centres in Russia and CIS states. This year SDRus members produced a number of publications in the field of SD in Russian and in English.

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University at Albany

Ignacio J. Martínez-Moyano
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Argonne National Laboratory

Security/Military/Insurgency/Terrorism (SMITe) Roundtable

Modeling strategic and tactical issues in the Security, Military, Insurgency, and Terrorism domains presents special problems for modelers and analysts. Concerns about confidentiality, problem uncertainty, data availability, theory adequateness, and inter-organizational conflicts all contribute to the modeling challenge. Additionally, once models are crafted, their distribution is often restricted and the dissemination of insights is limited to particular sponsors. The SMITe roundtable provides a forum for modelers interested in the challenges of this modeling domain and that are willing to share insights from their experience in past and current projects through an open dialog concerning elements such as: Establishing the problem boundary and choice of modeling paradigm; Using SD to identify critical scenarios for expert examination; Eliciting and capturing expert insight from confidential data; Modeling problems that span the multiple organizations

responsible for security; Creating and disseminating open models; Publishing opportunities in security research. The participants at this years meeting will help set the agenda for the SMITe Thread and its associated special interest groups activities. We look forward to seeing you at the roundtable.

Tae Hoon Moon
sapphire@cau.ac.kr
Chung Ang University

Society Program Oversight Committee Meeting

The Society Program Oversight Committee is an ad-hoc committee that is responsible to provide a means for dealing with program issues and to provide continuity of policies between conferences. The Society Program Oversight Committee (SPOC) will rotate membership annually at the conference. The SPOC is chaired by the Program Chair for the current calendar year and having as members the Program Chair for the upcoming year, the Program Chairs from the past two years, the VP Meetings, the VP Publications, the VP Electronic Presence and the Executive Director.

Erling Moxnes
erling.moxnes@ifi.uib.no
University of Bergen

Strategic Development Committee Meeting

Strategy Committee Meeting will take place during the conference. Committee Members are Erling Moxnes (President ex-officio and chair), Jim Lyneis, Kim Warren, Khalid Saeed, Jim Thompson, Rogelio Oliva (President-elect ex officio),and David Lane (Next President-elect ex officio). The meeting is open to all.

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MIT

Jessica Bolson
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University of Miami

Burcu Tan
burcu.tan@phd.mccombs.utexas.edu
University of Texas at Austin

Student Chapter Annual Meeting

All graduate students are welcome and encouraged to participate in this meeting. Snacks will be provided. The annual chapter meeting for the SDS Student Chapter will accomplish: 1) Discussion of prior year's activities and initiatives, 2) Election of new leadership for 2010/2011 academic year, 3) Discussion and preliminary planning for 2010/2011 event. This is the key meeting of the year for the chapter and accomplishes all our major planning objectives.

Rogelio Oliva
roliva@tamu.edu
Texas A&M University

System Dynamics Society Business Meeting

All members and interested parties are invited to attend the annual System Dynamics Society Business Meeting.

Peter S. Hovmand
phovmand@wustl.edu
Washington University in St Louis

System Dynamics Society Membership Roundtable

Each year, the Diversity Committee hosts a discussion with members to get feedback from members at the conference, discuss ways that the System Dynamics Society can increase diversity of membership, and provide input to the Policy Council. This year's focus will be on increasing career opportunities. Please join us for a rich discussion about how the System Dynamics Society might serve you better.

Brian C. Dangerfield
b.c.dangerfield@salford.ac.uk
University of Salford

United Kingdom Chapter Annual Meeting

The UK Chapter have regular meetings in the UK and annually at the international conference. (See www. systemdynamics.org.uk) In February we held the 2010 Annual Gathering. The theme was Environmental Challenges, the Copenhagen summit having been held only two months previously. We had three speakers: Nick Mabey (E3G), Professor David Fisk (Imperial College) and Dennis Sherwood (Silver Bullet Company). Over 50 delegates attended and the general opinion was very favourable. Networking and a buffet dinner followed. The following morning Kim Warren hosted a play of the Copenhagen Climate Change exercise and John Morecroft then took us through an analysis of a fisheries problem. We also held our 3rd PhD Colloquium. Congratulations to Sangeeta Sardiwal who won the UK Chapter Student prize for her work on health and social care and to Tommy Ngai who was judged the best student presenter and collected the Wiley-Blackwell book token prize. Our evening networking events have continued: two in 2009. If you are based in the UK and not already on our membership list (membership is free) then please do join us and see what we have to offer. There are between 80 and 100 members active in SD in the UK.

Users' Group Meetings

Software users' group meetings will be held during the Korea conference.

Chapter & SIG Poster Presentations

Listed alphabetically by Chapter or Special Interest Group name

Mark Heffernan
mheffernan@evanspeck.com
Evans & Peck Pty Ltd

Australasia Chapter Poster Session

A collage of Australasian system dynamics work submitted by practitioners, educators & students from the South Pacific.

Jeffrey Boyer
jboyer01@nycap.rr.com
University at Albany

Business Special Interest Group Poster Session

Does your company use system dynamics modeling? Would you like to learn how other businesses are applying system dynamics tools? Would you like some help bringing these tools into your business? The Business Special Interest Group was formed in 2005 to provide a forum for the exchange of ideas, methods, and lessons learned in the use of system dynamics in the corporate world. The SIG has grown substantially in the number of interested members since then. Our members represent a cross-section of industrial, consulting, and academic organizations, offering tremendous depth and breadth in relevant expertise. Our goal is to encourage the sharing of system dynamics best practices in business. Our approach is three-fold: (1) Development of the system dynamics modeling competence of business users through training and consultancies, (2) Sharing recommendations around effective tools and methodologies with immediate applicability to policy and decision making in business, and (3) Encouraging and inviting presentation tracks and speakers to present applicable work and case studies at the annual International System Dynamics Conference.

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Bing Wu
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Tongji University

Ying Qian
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Shanghai University

China Chapter Poster Session

After the founding of the China Chapter of SDS in 1988, it has been well organized and continuously growing in the past two decades. In this poster, we provide the information on the regional SD conferences, the current events and membership growth. From year 2005, in cooperation with other organizations, such as Tongji University, the China Chapter has organized the Conference on Systems Science, Management Science and System Dynamics (SS-MS-SD) every other year. Starting from 2010, we are planning to hold the SS-MS-SD conference annually. Periodic chapter meetings are held quarterly in Shanghai. The latest meeting was to advocate the 4th regional SD conference and the new round of election of System Dynamics committee of the Systems Engineering Society of China. A strong academic team with people who have Ph.D. degree is now taking shape. Their efforts are advancing the development of SD in China. For example, the training programs of Vensim and SD modeling workshops have been regularly organized. Three textbooks on SD were published last year, as well as some important papers. The China chapter has 33 members registered in SDS so far. And we are exerting ourselves to attract more members in the future. Contact email: sytemdynamics@vip.163.com Tel: 86-21-65984562.

Michael S. Kennedy
mike.kennedy@lsbu.ac.uk
London South Bank University

Carol Frances
carolfrances100@hotmail.com
Claremont Graduate University

Education Special Interest Group Poster Presentation

The SDS Education SIG continues to pursue it's twin interests in publicising and enhancing both the contribution of SD to Education Management and the evolution of the contribution of SD to the curriculum - in both cases the interest spans the whole span of education from K-12 to Higher Education.

Andrea Marcello Bassi
ab@millennium-institute.org
Millennium Institute

Energy Special Interest Group Poster Presentation

The Energy Roundtable and poster session will have two main purposes this year. Firstly, we will update all interested parties on past and present activities and will collect ideas on possible next steps for the Energy SIG. Secondly, specific relevant energy issues will be discussed, to identify what critical contributions the SD community could provide.

Ali Kerem Saysel
ali.saysel@boun.edu.tr
Bogaziçi University

Environmental Special Interest Group Poster Presentation

Environmental SIG was established in 2002 as a Special Interest Group of the System Dynamics Society. The Group is interested in systems of any scale that involve human activities and their natural environment. We are interested in investigating the structure and behavior of both natural and human induced environmental dynamics in systems perspective. Our fields of interest comprise systemic policy problems in the fields of resource management and pollution control, human agency and behavioral change in sustainable development, ecology and the environment. Particularly, climatic change, energy transition, global sustainability, renewable resources management, water policy, food security and urban dynamics have been the prime focus of concern. The methods used by the members include the system dynamics method and other dynamic modeling and simulation approaches, simulation gaming and experimentation in decision analysis, and mediated, collaborative approaches to model building and analysis particularly in environmental conflicts resolution.

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Florian Kapmeier
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PA Consulting Group

Markus Salge
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PA Consulting Group

German Chapter Poster Session

The German Chapter advances networking and collaboration among system dynamicists in Germany. The Chapter has over 100 members (of which 4 are corporate members) and keeps more than 270 interested researchers, managers, and students updated through its e-mail newsletter. Frequent events such as roundtables and workshops in various German cities provide a basis for meeting fellow system dynamicists and for discussing modeling projects. On June 24-25, 2010, the Chapter's 4th Annual Meeting will be held in Leipzig. The event brings together modelers from the scientific and corporate world, and by combining talks, presentations, and modeling exercises, it offers a formidable and appreciated platform for establishing links within the community as well as for actively advancing SD skills. More information on the activities of the German Chapter is available from our website at http://www.systemdynamics.de.

Mark Heffernan
mheffernan@evanspeck.com
Evans & Peck Pty Ltd

Health Policy Special Interest Group Poster Presentation

The Health Policy Special Interest Group formed more than seven years ago and has grown to around 300 members. We are a worldwide SIG with active collaborations that use dynamic analyses to advance major policy initiatives. Current activities include gathering on-line teaching materials, fostering international collaboration in understanding health system change, and assembling a library of SD health models. Regardless of whether you are new to the field or a veteran modeler, we welcome your participation in exchanging ideas about how SD can better engage and support health policy leaders around the world. HPSIG at ISDC2010 will run a poster session, Sunday Session and Business Meeting, covering Highlights of Health Policy Modeling Around the World, with brief summaries of significant activities, including Africa, Asia, Europe, Latin America, North America and Oceania. We will discuss ways of balancing demand, supply and quality in health policy modeling, priorities for practitioners, funders, educators, peer reviewers and the like. The Business Meeting will explore collaborations and elect new office bearers. The Lupina Young Researchers Award in Health System Dynamics and the winning paper will be delivered.

Karan Khosla
karankhosla@gmail.com
EarthSafe Products and Services

India Chapter Poster Session

A quick Google Trends search shows that India has the highest volume for system dynamics related queries, yet the practice of systems thinking is almost non-existant in the professional and academic realm. The India Chapter of the System Dynamics Society was approved in principle in May 2010; this session hopes to explore some of the initiatives for projects and collaborations that may be possible with other Chapters to bring systems thinking and dynamic modeling to a wider audience across India.

Habib Sedehi
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University of Rome

SYstem Dynamics Italian Chapter (SYDIC) Poster Presentation

For the period July 2009 - June 2010 the SYDIC (SYstem Dynamics Italian Chapter) Management Committee will present the main activities of its members both in the Academic (Universities & Reseach centers) and in the Consulting (Private & Public Administration) areas.

Kaoru Yamaguchi
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Doshisha University

Japan Chapter Poster Session

Following are the activities of the Japan Chapter in 2009 - 2010. This years annual meeting was held on April 24 at Gakushuin University in Tokyo, and new executive members were elected. Its nation-wide annual research seminar was also held in Kyoto at Doshisha University on Nov. 21, 2009. Besides these two annual meetings, the chapter has two SIGs; Business Process Modeling (based in Tokyo) and Dynamic System Modeling (based in Nagoya), and they have been actively holding their seminars quite often. As to the publication, the chapter has so far published 8 volumes of its journal; each volume accepts 6 to 10 referee-judged papers in average. The next volume will be planned to be issued in June

this year. As a special international event this year, the convention of the COP 10 (Conference of the Parties) on Biological Diversity was held in Nagoya, from April 15 through 20. The chapter took its opportunity to promote the SD method to its participants by specifically displaying panel posters of 14 SD environment-related models that are built by the chapter members at the site near the conference. The site has attracted media reporters as well as general public.

Man-Hyung Lee
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Chungbuk National Univ Urban Eng Dept

Korea Chapter Poster Session

Established in 1999, Korean System Dynamics Society (KSDS) is young but dynamic academic organization. The KSDS is proud of its 150 devoted members. The KSDS has published the Journal of Korean System Dynamics Review over a decade. The KDSDs Journal has been selected as a Candidate Journal for the Registration by Korea Research Foundation. Currently, the KSDS plans to publish the Journal on a quarterly basis. The KSDS has independently or jointly organized academic conferences and fora, in average, 4 times per year. Every year Korean System Dynamics Society (KSDS) and its members have actively joined the international conferences of the System Dynamics Society. In fact, since the very start, the KSDS has tried every effort to invite the international conferences of the System Dynamics Society to Korea.

Gloria Pérez Salazar
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Tecnológico de Monterrey

Martin F. G. Schaffernicht
martin@utalca.cl
Universidad de Talca

Latin America Chapter Poster Session

The Latinamerican Chapter has the mission to help the SD-community grow in the Spanish speaking countries. Founded in 2003, it has Latinamerican members from Mexico to Chile, from Spain and a growing number of Spanish speakers living in other countries. Since 2003, the annual meeting allows practitioners to gather and newcomers to get in to touch; we have been in Mexico, Chile, Colombia and Argentina so far. These conferences are the base of our positive feedback loop: each year the number of works submitted and presented is increased. Since 2005, the Spanish Revista de Dinmica de Sistemas publishes two numbers per year. The sisTEMAS newsletter and a mail list allow keeping in touch. During November, the 7th Latinamerican Conference took place in Santa Marta, Colombia, organized by Industrial University of Santander, National University of Colombia and University of Magdalena. During the 2009 Annual Meeting we met many Spanish-speaking members living outside the Spanish-speaking countries and the wider group continues to grow. This year's meeting will take place in Lima, Per in November 2010. It is an opportunity to welcome new members. If you would like to join us please contact Gloria Prez (gloria.perez@itesm.mx), Isaac Dyner (idyner@unalmed.edu.co) or Martin Schaffernicht (martin@utalca.cl).

Etiënne A. J. A. Rouwette
e.rouwette@fm.ru.nl
Radboud University Nijmegen

Proposed Participatory Approaches to Modeling Special Interest Group Poster Session

This session highlights participatory SD approaches to model development and use.

David W. Lounsbury
david.lounsbury@einstein.yu.edu
Einstein College of Medicine, Yeshiva

Ralph L. Levine
leviner@msu.edu
Michigan State University

Psychology Special Interest Group Poster Presentation

The Psychology SIG is a venue for discourse and learning about ways of integrating psychological processes into system dynamics models and to apply system dynamics methodology to the formation of psychological theories. Currently the Chapter has approximately 40 members. Psychology SIG members share the following aims: (1) Building psychological and social constructs and processes into classical system dynamics models, including community-level models, where such constructs and processes would help in understanding the underlying dynamic problem of interest; (2) Developing new molecules or mini-models of psychological processes to promote deeper understanding of existing psychosocial and behavioral theories and to generate new psychological and behavioral theories of psychosocial and behavioral dynamics; (3) Applying system dynamics to a wide range of clinical, public health and community problems to improve therapies and interventions for individuals, couples, families, groups, and communities.

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Empatika

Dmitry Katalevsky
dkatalevsky@yahoo.com
University at Albany

Russian Chapter Poster Presentation

The Russian Chapter (SDRus) continues its growth and attracts new participants. Moscow State Universitys (MSU) annual Winter School on Simulation Games and Modelling has become a popular event for demonstration of system dynamics models. MSU offers formal courses on system dynamics and is developing a Russian language text book on SD. Russian Chapter plans to create SD teaching centres in major business schools in Russia and develop collaborative research projects with other members of SD community. XJtek continues successful performance. The latest version of AnyLogic 6.5 has been released and is available for Mac and Linux users. Active work continues at MSU, State University of Management and other centres in Russia and CIS states. This year SDRus members produced a number of publications in the field of SD in Russian and in English.

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MIT

Jessica Bolson
jbolson@rsmas.miami.edu
University of Miami

Burcu Tan
burcu.tan@phd.mccombs.utexas.edu
University of Texas at Austin

Student Chapter Poster Presentation

This poster will describe activities for the SDS student chapter and membership for the academic year 2009-2010. It will include statistics on the membership body, highlight various research initiatives as well as group activities.

Brian C. Dangerfield
b.c.dangerfield@salford.ac.uk
University of Salford

United Kingdom Chapter Poster Presentation

The UK Chapter have regular meetings in the UK and annually at the international conference. (See www. systemdynamics.org.uk) In February we held the 2010 Annual Gathering. The theme was Environmental Challenges, the Copenhagen summit having been held only two months previously. We had three speakers: Nick Mabey (E3G), Professor David Fisk (Imperial College) and

Dennis Sherwood (Silver Bullet Company). Over 50 delegates attended and the general opinion was very favourable. Networking and a buffet dinner followed. The following morning Kim Warren hosted a play of the Copenhagen Climate Change exercise and John Morecroft then took us through an analysis of a fisheries problem. We also held our 3rd PhD Colloquium. Congratulations to Sangeeta Sardiwal who won the UK Chapter Student prize for her work on health and social care and to Tommy Ngai who was judged the best student presenter and collected the Wiley-Blackwell book token prize. Our evening networking events have continued: two in 2009. If you are based in the UK and not already on our membership list (membership is free) then please do join us and see what we have to offer. There are between 80 and 100 members active in SD in the UK.

K-12 Education Poster Display

Listed alphabetically by First Author

Kong Fanjia
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Nanjing Foreign Language School

Haofan Lu
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Nanjing Foreign Language School

Shiyun Hu
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Nanjing Foreign Language School

Exercise in application of the Nanjing Olympic Sports Center running by 2nd Youth Olympic

Youth Olympic would have influence on the Nanjing Olympic Sports Center (the Youth Olympic venue), impact of resources, financial status, game fares and their relations as well, which comes to make Nanjing Olympic Sports Center the most effective way to achieve a maximum result. Using STELLA software, the author establishes the mode of the Olympic center operations, which includes resource development and habitat destruction issues, ticket prices and cash flow problems. Based on the established model, the author carried out comparison with impacts from several factors so as to obtain effectiveness and efficiency.

Zhou Ge
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Nanjing Foreign Language School

Xiaofeng Zhang
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Nanjing Foreign Language School

Systems Thinking in Physics & Mathematics Teaching in High School

This paper gives examples of teaching in class based on the curriculum about physics and mathematics. The systems thinking and STELLA simulations which display the relationship among variables in complex systems clearly enhance the comprehension of the issues and promote the ability to deal with complex problems for the students. It has been proved to be more meaningful in the high school teaching.

Han Xiao
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Nanjing Foreign Language School

Exercise in application of investigating accumulation of the cars in the crossroad by using a system dynamics model

Traffic jam is a commonly problem that we meet in the daily life. Jams always cause poor transport facilities. This paper seeks to simulate real-life situation in a system dynamics model, and hence find out the causes of the jam, also, to find out the solution. Finally, we will evaluate the limitation of the systems and some parts of the model, which is inconsistent with the facts. The paper will help us better understand and to state the complex traffic jam into a systematic and dynamic form.

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Zhongqin Gan
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Nanjing Foreign Language School

Exercise in application of pests, predators, pesticides and soil on rice growth based on system dynamics

Pests are Inevitable during rice growth. Spraying pesticides is the major means to wipe out pests. First, this paper seeks to simulate real-life situation in a system dynamics model, and hence understand the impact of pest, predator, pesticide and

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soil on rice growth and their inter-relationships. Then some methods which can improve rice yield currently are examined. Finally, the limitations of this system dynamics model are analyzed. This paper is to help us better understand seemingly complex rice growth problems in a clear, systematic and dynamic way. Throughout our study, we use the STELLA software for model construction, simulation and analysis. Because most of the variables in discussion are hard to quantify, some of the values are arbitrarily indicators of real-life variables. For simplification, we have only looked at key areas and factors that are the most strongly related to this topic.

Jun Kong
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High Sch Aff to Nanjing Normal Univ

A Brief Introduction to Teaching "Systems Thinking" in High School

Since 2005, we managed to teach "Systems Thinking" as an independent elective course in High School Affiliated to Nanjing Normal University. During these years, we have tried to find the best way to guide our students the way to get the meaning of Systems Thinking. The students understand Systems Thinking and learn how to use it to solve complicated problems. In these processes, we got a lot of achievements.

Chiang-Kuo Tu
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Da-Yeh University

Teaching Systems Thinking for 3-6 Students: The Practice of Shi-Fu Education Foundation in Taiwan

The Shi-Fu Education Foundation in Taiwan has strived for teaching Systems Thinking (ST) for 3-6 students since 1997. We have always tried to collect new information and find right direction from the ST&DM educator of USA. And we have also developed and practiced some ST curriculums in elementary school. In this paper, we focused on presenting our 2009 ST Summer Camp for 3-6 Students. The theme of 2009 ST Summer Camp was Making Friends with the Whole World. Totally, we have invited more than 300 students to attend our classes and almost 90 parents to listen to our speech about ST education for 3-6 students. In conclusion, we have found some insightful meaning of teaching ST for 3-6 students. We have led 3-6 students to explore an extensive system to see the interrelationship between myself and the whole world. We have found that the theme-focused curriculum design might deepen students learning ST. We have found that there were some basic blocks of conducting classroom to develop students ST skills and values. We have found that teachers needed not only instructing ability but also the ability of leading thinking process and telling stories touchingly. We have realized that improving ST skills needed both critical thinking and soft feeling (empathy).

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Lanxin Wang
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Exercise of Using System Dynamics in the Influence of Population Mobility on the Morbidity of Infection within a Certain Area

By using the System Thinking software Stella, we get the result that the population mobility in a certain area is not the most important cause of the influence on the morbidity of infection. However, the difference between the transient population and the local population would have certain effect upon it. So we advise that the governments should attach importance to medical treatment

and preventing at the same time, especially pay more attention to medical treatment than preventing in large cities as well as pay more attention to preventing in small cities.

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Xu Yang
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Exercise of Using Systerm Dynamics in Researching on the Quality of Lives of People in a Given Region

By using the System Thinking software Stella, we analyze that the development of industry, agriculture and technology all have important but different effects on the quality of lives of people in a given region. This model is applicable to a variety of different conditions, can be used for urban land planning and simulation phase, environmental conditions, government policy adjustments and so on.

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Shen Zheng
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Exercise of Using System Dynamics in researching on the factors affecting the level of education of Chinese people

China has a vast territory and a large population. To rise the China's great power, education should be the lead so that a large population of human can become resources power. We hope that through systematic thinking on the objective situation , development trend of Chinese education and feasible methods to improve. Using STELLA software to build a model of China's education system, including the issue of China's large population, GDP problem (the relationship between spending on education) and the brain drain. According to establish model and comparison on influential several factors, so as to reflect the essence and orientation of the development of education in china.

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High Sch Aff to Nanjing Normal Univ

Exercise of Using System Dynamics in Coldrex Sales

This paper centers around the analysis on the correlations between the production output of medicine, the investment on technology and some other factors with the approach of systematic thinking in order to propose the output volume solution that fits the demand of the market and maximizes the profit. With the assistance of STELLA software, we have established a model simulating the specific medicine output, sales volume and the profit, based on which, we have also put together a comparison among the most influential factors. In this way, we have come up with a profit maximization solution. With the conclusion as such, we have managed to simulate the operation of a pharmaceutical company and to analyze the development of production which has lead to an effective approach to maximize profit.

Workshops

Listed alphabetically by Workshop name

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Build Your Own Free Web Simulation in 3 Hours

Bring your own Ithink, Vensim, or Forio model along with your laptop and by the end of our workshop youll have your simulation running on the web in a free Forio Simulate account. If you dont have a model or a laptop you can pair up with someone during the workshop and collaborate to produce a web simulation. The session will start with a ten minute introduction to Forio Simulate. After the introduction, well divide the workshop into two phases. In the first phase we will help you get your model running on Forio Simulate. Well walk throught the process of importing your model as a group and then give you time to get your own model running on the platform. In the second phase well focus on creating a user interface for your model. Well start phase two with a class introduction on how to use Simulates drag- and-drop interface designer. After the introduction, you will be able to work on your own simulation with help from Forio. Any volunteers can present their simulations to the class. Forio will provide a debrief on the web simulations presented and suggest possible next steps for enhancing those sims.

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Clean Technology Startup Management Flight Simulator

Technological innovation plays an important role in creating a sustainable society. We need innovations in renewable energy production, in energy efficiency, in waste reductionin green products and services throughout society. Many of these innovations will be brought to market by startups. Yet most startups, in any domain, fail. In this workshop, youll have a chance to play the role of the founder and CEO of a startup in the clean-tech/green-tech sector. The workshop provides an opportunity to learn about the dynamics of startups in the clean-tech sector through a management flight simulator. Participants will learn about the dynamic effects of pricing, human resource, financing and compensation strategies. After playing the game for few rounds, we will debrief and reflect on our learning from the workshop.

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Create a Multiplayer Online Simulation Game

This workshop will teach you how develop your own online simulation game using existing system dynamics models and technology readily available online. Youll come out of this workshop with a multiplayer price war game. Massively Multiplayer Online Games have dramatically increased the popularity and awareness of online games and simulations. The problem is that blockbuster games like these require blockbuster budgets. However, there is now an opportunity to create smaller multiplayer games on a limited budget. Instead of a massive multiplayer worlds, system dynamics-based simulations can be transformed online into small multiplayer simulation villages that teach specific lessons to participants through a web browser. We will start our workshop by

collaboratively brainstorming a simple price war model and building it in Forio Simulate. After our model has been constructed and tested we will focus on creating an engaging multiplayer user experience using Forio Simulates drag-and-drop interface designer. The workshop will conclude with volunteers playing our freshly developed game in front of the class. The game will be hosted by Forio and available for all demo participants to play. The content developed during our workshop will licensed under creative common attribution share-alike so it can be easily improved upon by anyone.

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Getting Started with AnyLogic - a Multi-Method Simulation Modeling Tool

We will show how to use AnyLogic - a multi-method simulation modeling tool supporting system dynamics, agent based, and discrete event methods. We will discuss how multi-method modeling helps to efficiently capture complexity of the real world systems we design and investigate: consumer markets, supply chains, project management. Everyone will be given a CD with a trial version of AnyLogic 6.5 for Windows, Mac and Linux featuring 3D animation and other new features.

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Getting Started with STELLA and iThink

This workshop will be an introduction to building and communicating system dynamics models using STELLA or iThink software. The workshop is intended for people who are relatively new to the field or do not have experience using the current version of STELLA or iThink. The session will be conducted as a hands on workshop and demonstrate basic techniques for building, analyzing and communicating simple simulation models. Participants should bring their own computers with STELLA or iThink Version 9.1 installed or arrive 15 minutes early to install the software.

Robert L. Eberlein
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Ventana Systems

Getting Started with Vensim

This one and one half hour workshop will go through the basics of building and analyzing a feedback model using Vensim. The class will center around the development of a simple variation of Jay Forrester's classic market growth model. Participants are encouraged to follow along on their own computers. The workshop can be done using either Vensim PLE or a limited time version of Vensim DSS which will be made available to participants. If possible, participants without computers will be paired with others having computers. It will be helpful if participants can show up ten minutes early to facilitate any setup.

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An Introduction to Macroeconomic Modeling - Accounting System Dynamics Approach

Macroeconomics is one of the core subjects in social science and behaviors of marcoeconomy such as the recent financial crisis affect all of us. With the help of system dynamics method, this workshop tries to explore the macroeconomic system structure and its complex behaviors by introducing a step- by-step construction of macroeconomic models based on the accounting system dynamics approach. Specifically, participants will learn the following modeling methods: double-entry booking/accounting system dynamics (which is itself helpful for

business modeling), money supply by the central bank and creation of credit process through a fractional reserve banking system, Keynesian macroeconomic models, including IS-LM model and an integrated macroeconomic model of real and monetary sectors. All models are distributed in the class, which run on Vensim Model Reader, a free shareware for PC and Mac. Participants are recommended to download it and bring their laptops. Yet no knowledge of Vensim Software is required, not to mention economics. Running the models step-by-step, participants are invited to the world of macroeconomic system, and explore a complex structure of macroeconomic behaviors, through simulation, with their own working hypotheses of macroeconomic scenarios.

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Mediated Modeling of National Innovation Systems

National Innovation System (NIS) is the term used by scholars and policy makers to describe the emerging scientific and technological structures and processes of a nation that influence economic and social development. The last decade has seen a growing research interest in the innovation systems of different economies in order to better understand the factors that determine their economic and social development. The aim of this workshop is to conduct a mediated modeling exercise where attendees will have the opportunity to build a System Dynamics model of a NIS based on data collected by an on-going multinational research project. The consequences of different policy measures will be analyzed by walking through the multiple loops in the simulation model. As a result, attendees will gain a broader comprehension about innovation-driven policy interventions and their impact on a countrys NIS.

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Optimizing with Vensim

This one and one half hour workshop will introduce the process of optimizing dynamics feedback models using Vensim. Working with a simply oil field depletion model the process of optimizing in order to maximize financial performance will be demonstrated. Participants are encouraged to follow the workshop on their own computers, and an evaluation version of Vensim will be made available to those wishing to do so. To close the workshop a simple calibration problem will be presented and the potentials and limitations of calibration using

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System Dynamics Model Documentation Tool (SDM-Doc)

Extending work by Oliva (2001), the System Dynamics Model Documentation Tool (SDM-Doc) developed at Argonne National Laboratory (ANL) creates HTML-based documentation of models developed with Vensim. The model documentation created by the SDM-Doc tool allows modelers to navigate through model equations and views in a very efficient and practical way creating documentation of the model sorted by variable name, type of variable, group, view, module, or module/group/name. The tool also verifies some desirable characteristics of the model helping in model assessment and development. The tool will be presented using several examples. Participants are encouraged to bring their laptops to the workshop to use the tool with their own models as practice during the workshop. A copy of the software will be distributed to participants at the workshop.

Bonus Day Presentations

Listed alphabetically by First Author

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Korean System Dynamics Society

Korean System Dynamics Society meeting aims at disseminating system dynamics theories and technical know-hows to Korean participants joining the international conference. Of course, Korean is mother tongue for this session. Students and non-professionals from the private and public entities are two main targets. Experts from the Korean System Dynamics Society will make two presentations ahead of in-depth discussions. Everybody who is interested in system dynamics theories and application techniques are welcome!

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The Development of System Dynamics in Taiwan

* Discussion of the establishment and development of the Chinese System Dynamics Association (in Taiwan). * Communication of teaching and research in system dynamics. * Promotion of specialized research and application of system dynamics in Taiwan. * Encouragement of interdisciplinary and international cooperation with international system dynamics experts.

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Asian/Pacific SD Meeting

The Asian/Pacific System Dynamics meeting will discuss the possible formation of an Asian/Pacific System Dynamics chapter. We believe that an Asian/Pacific System Dynamics chapter can be a hub organization supporting cooperation among system dynamicists from Asian/Pacific countries. Also, an Asian/Pacific chapter can hold a local conference and publish an academic journal focusing on Asian/Pacific issues and cultures. Future course of actions to form an Asian/Pacific System Dynamics chapter will be discussed in the meeting. This meeting might be a starting point for a historic movement for Asian/Pacific system dynamicists.

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Experiences in France, Switzerland, Italy, Chile : towards new cooperation between SD communities

This meeting is aimed at developing new cooperation across system dynamics/ systems thinking communities in France, Switzerland, Italy, and Chile. During this meeting, historical progress in developing system dynamics communities in these countries will be discussed. Further, participants will try to develop the ways for possible cooperation for data gathering, model building, and in general, helping cooperative projects. A new chapter proposal is a potential outcome this meeting.

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