REFLECTIONS ON A CAREER IN SYSTEM DYNAMICS

Dr Brian Dangerfield

Department of Management

University of Bristol

(brian.dangerfield@bristol.ac.uk)

University of BRISTOL

GENERAL OVERVIEW

- Three main external projects
- HIV/AIDS (1987 – 2001) [EU Concerted Action 1994 -1997]
- Sarawak Economic Modelling project (2003 – 2005)
- Construction Industry competitiveness [EPSRC project] (2005-2008)

HIV/AIDS RESEARCH

Multinational Scenario Analysis Concerning Epidemiological, Social & Economic Impacts of HIV/AIDS on Society, 1994-97

Twenty teams from eleven nations were represented in this research coordinated by RIVM, Bilthoven, The Netherlands.

No other team used SD: statistical epidemiologists & others using deterministic models based upon differential eqns

Compare with situation now in modelling obesity and climate change

TWO IMPORTANT JOURNAL ARTICLES

"Optimisation as a statistical estimation tool: An example in estimating the AIDS treatment-free incubation period distribution", *System Dynamics Review*, 1999

Cited in: *AIDS Patient Care & STDs* (2015); *New Journal of Physics* (2010); *International Journal of STD & AIDS* (2005); *Procs of the Royal Society – Biological Sciences* (2002)

"Model-based scenarios for the epidemiology of HIV/AIDS: the consequences of highly active antiretroviral therapy", *System Dynamics Review*, 2001

Cited in: *American Journal of Epidemiology* (2016); *Epidemiology & Infection* (2015); *AIDS Patient Care & STDs* (2015); *Current Opinion in HIV & AIDS* (2010); *International Journal of Electronic Healthcare* (2009); *Emerging Infectious Diseases* (2006); *Journal of Acquired Immune Deficiency Syndromes* (2004 & 2006); *American Journal of Public Health* (2006); *AIDS* (2002); *PLoS One* (2013); *PLoS Medicine* (2012); *Mathematical Biosciences & Engineering* (2009); *International Journal of STD & AIDS* (2007)

SARAWAK: Economic Development Modelling (2003 – 2005)


N
0
100
200
SOUTH CHINA SEA
SULU SEA
CELEBES SEA
JAVA SEA
SELAT KARIMATA
MAKASSAR STRAIT
KUDAT
KOTA BELUD
TUNKU ABDUL RAHMAN MARINE PARK
KOTA KINABALU
CROKER RANGE
MT KINABALU
PORING
RANAU
TURTLE ISLANDS
SANDAKAN
TAMBUNAN
SEPILOK
LABUAN
BEAUFORT
TENOM
MT TRUSMADI
SUKAU
BRUNEI
SABAH
LAHAD DATU
LAWAS
BORNEO RAINFOREST LODGE
BATU PUNGGUL
SEMPORNA
MIRI
TAWAU
SIPADAN ISLAND
NIAH CAVES
MT MULU
BARIO
BINTULU
SARAWAK
TARAKAN
SIBU
SANTUBONG
KUCHING
SRI AMAN
BATANG AI RESORT
TALOK
PONTIANAK
KALIMANTAN
SAMARINDA
BALIKPAPAN
BANDJAMASIN

SARAWAK: Economic Development Modelling

- Contact was the State Planning Unit (SPU) in Kuching
- Almost 2 years between the project first being mooted & the contract signed with U of Salford
- They wanted to understand what SD was & what it could offer (knew a little about econometrics)
- Great benefit in that two local academics were seconded to the SPU and acted as our ‘local champions’
- Approx first 2 visits included a comprehensive tour of Sarawak so as to experience the State and its economy …..
- When they realised that Vensim offered an easy-to-use interface (Venapp) they insisted that the model be available for use in this format …..

Vensim Application Environment

System Dynamics Analysis Tool for Sarawak KE Development

Main Menu

- Acknowledgement
- View Stock and Flow Diagram
- Baseline Simulation and Historical Data
- Set and Perform Scenario Runs
- Analyze Causal Relationships

The software you are using allows you to explore the behaviour and sensitivity of the Sarawak model developed in CORAS, the University of Salford. The software allows you to explore the model by means of buttons, menus, and output screens. To activate a button, or to select a menu item, click on it.

Exit the tool

Vensim Application Environment

System Dynamics Analysis Tool for Sarawak KE Development

Scenario Setup

Fraction terminating after/during primary education

[0.11]

fraction of development expenditure on R&D

[0.015]

Fraction terminating after F3

[0.26]

fraction of k-firms in manufacturing

[0.7]

Enter a new name for the scenario (<8 chars): current

Anything you type will appear as the name of the scenario.

Run the scenario and see the simulations

Exit back to main menu

The *Borneo Post* article:

Senior officials had bought into the project, but this worried junior staff in the SPU.

Always consider the lowest level of staff who might be required to work with your model.

Govt to introduce system dynamics model, says Aziz

Borneo Post 20/8/05

SIBU: The State Planning Unit will soon introduce the system dynamics model as a tool for policy formulation and scenario building for the State's macro economic planning, State Secretary Datuk Amar Abdul Aziz Husain said.

He said this was necessary in view of the great challenges posed to governments and policy planners by the globalised world economy and liberalised trade regimes that had emerged since the end of the last century.

Aziz said events that occurred across the globe brought about great impact on domestic economies through trade and international exchanges.

"It is therefore vital that government officers enhance their skills — both soft and hard skills — through training and exposure to new knowledge in their line of work as it lent credence to their authority as senior officers of the government," he said at a dinner held to mark the closing of the three-day state-level Civil Service Day celebration on Thursday night.

Among those present were Chief Minister Pehin Sri Abdul Taib Mahmud, Deputy Chief Minster Tan Sri Datuk Patinggi Alfred Jabu and Second Finance Minister Dato Sri Wong Soon Koh.

More than 350 civil servants from throughout the State also attended the dinner gathering.

Under the system dynamics model, Aziz said it could be used to understand and simulate the economy's model behaviour and structure.

Aziz said the Chief Minister had constantly stressed the need to develop a thinking civil service.

"The challenge for us is not only to be able to think outside the box but also to be able to see and think the whole system and the relations that exist within the system."

Aziz said system thinking would enable the civil servants to use system dynamic model more effectively.

Elaborating further on this system thinking concept, Aziz said "all of us live in and are influenced by systems surrounding us — from the natural environment to health care, education, government, family and organisational life".

"Understanding and fathoming how these open systems work let us function more effectively and proactively with them. The more we build our understanding of system behaviour and work with the system, the more we can shape the quality of our own lives."

Systems thinking, Aziz recalled, had its foundation in the field of system dynamics, founded in 1956 by MIT professor Hay Forrester.

"In a nutshell, system thinking is viewing the world from a broad perspective, be it structure, patterns and events, rather than just the events themselves.

"Thus this systems perspective is actually adjusting our minds to be attuned to processes, patterns and relationships."

Construction Industry competitiveness [EPSRC project] (2005-2008)

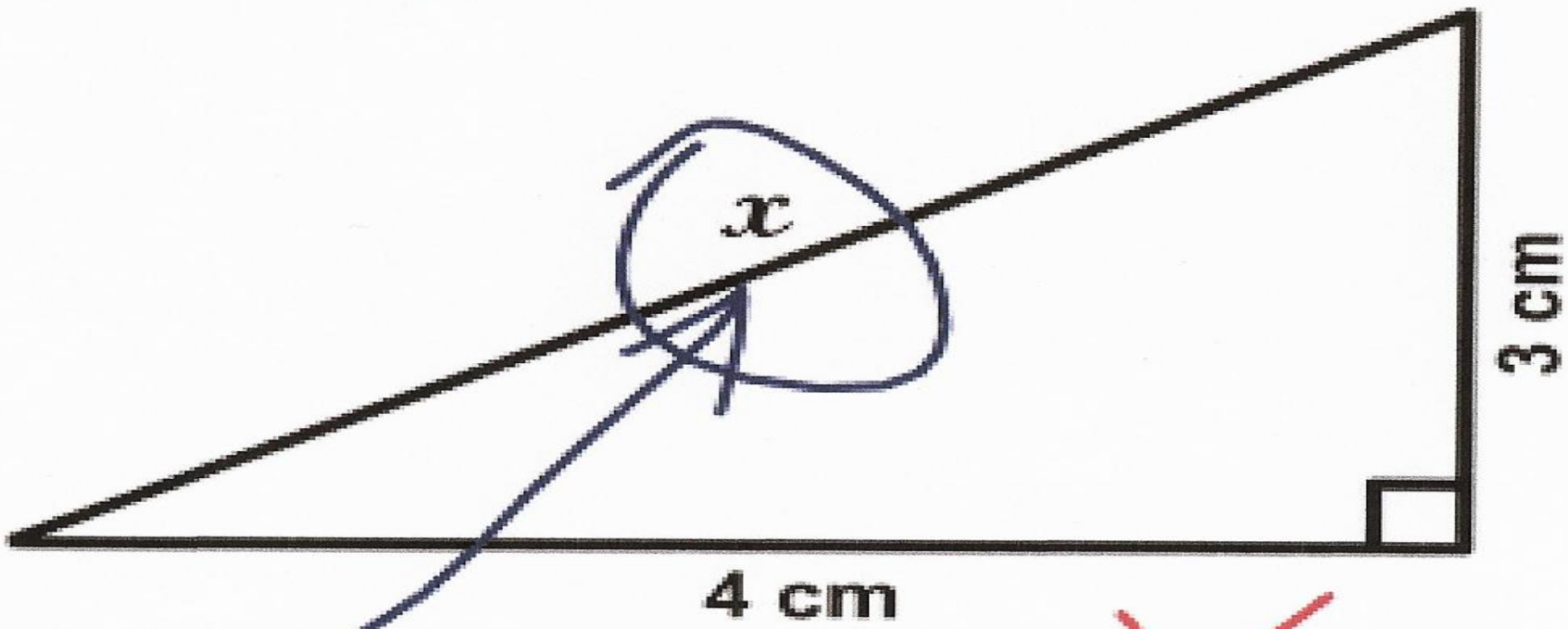
The ‘Big Ideas’ project

- Collaboration with Salford, Reading & Loughborough universities
- Again hit the knowledge gap: ‘What is system dynamics?’
- Construction not renowned for modelling & analytics c.f. with financial services & consumer goods
- But strong links between industry & built environment departments in universities
- We concentrated on modelling competitiveness at the level of the firm (contractor)
- But also dipped into SD modelling at the project level; industry level & even national level (trades skills)

REFLECTIONS ON TEACHING

- Taught SD at all levels: UG, PGT and PGR (Graduated 8 PhD's in SD)
- Students find it difficult to grasp elementary notions such as the difference between stocks & flows and the associated units of measure; this feeds into dimensional analysis (e.g. units for productivity)
- Has the transition from teaching through the academic year, with only one set of exams, to the semester-based approach where all material is covered in 10 weeks or so, affected learning in subjects like SD?
- Over the past few years have had opportunity to observe at close quarters 3rd year UGs completing both a DES project (using SIMUL8) and then an SD one (VENSIM) – in total over something like 8 weeks.
- Seems in general that the DES project is accomplished more easily.
- Model conceptualisation in SD is a major obstacle: they can grasp drawing CLDs; drawing SF diags; even writing equations… but to fashion a model structure *ab initio* can be daunting

3. Find x.



Here it is