



Unravelling Complexity

Learning Portfolio: Part One
2925 Words

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Week One – Unravelling Complex Problems

Dr Richard Baker, Prof Lawrence Cram, Prof Kent Anderson, Prof Gabriele Bammer, Dr Kate Reynolds

This week was the introduction to the course. For me, the themes of the challenges, rewards and processes to interdisciplinary collaboration combined with an analysis of problem solving were especially important.

The challenges and rewards of interdisciplinary collaboration

One of the recurring themes stressed throughout the first week concerned the value of working across disciplines. This entire course is based on this philosophy, and I believe it is one of the most positive features of the course. The more we discover, and the more complex our world becomes, the more we need to work at an interdisciplinary level.

While Kate Reynolds suggested that some of the most interesting areas of research in psychology is currently occurring at the interface of two sub disciplines of the area, Gabriele Bammer suggested that there may even be a need for a new discipline, 'integration and implementation sciences', a field which is based on bringing together different types of understandings.

Despite the need to work across disciplines, navigating the processes between different disciplines and perspectives does not seem like an easy task. In the panel, Lawrence hypothesised that the different epistemologies and processes between each discipline would lead to 'uncomfortableness'. He thought that those studying science would have their 'deeply held notions of realism challenged', whilst those in the humanities would be perturbed by the conviction apparent in those from the sciences.



Figure 1 What do you do when you get an urban planner, a geographer, an engineer and a landscape architect working together on a project?

The challenges arising from working in interdisciplinary teams were something I recently experienced when I was in Denmark, attending an IARU Global Summer School. In the program, we were required to work in interdisciplinary and international teams. This process highlighted the very divergent and sometimes conflicting approaches. For example, some group members felt an intense need for data, even though time constraints meant the availability of data was limited, whilst I was used to looking at things in a more abstract, conceptual way.

However, our first tutorial elucidated that although there are differences between our studies, seemingly divergent disciplines still used similar approaches in different areas.

For example, while a physicist and a lawyer might seem to be working in completely different fields, they both have a need for evidence in a lot of areas. The law and physics can sometimes be quite reductionist and yet, there is a need for creativity and lateral thinking. I think this is important to remember when it comes to dealing with complexity – sometimes it may be useful and helpful to find common ground and working with similarities to promote understanding – as well as utilising the differences.

“Problem solving” vs “expansive learning”

Finally, one of the key points from Lawrence was from the Finnish philosopher-psychologist Yrjo Engestroem, who stresses the importance of ‘expansive learning’. Problem solving is a reactive process, and thus it is often ‘too late’. Lawrence challenged us to be more ‘proactive’, expansive and creative in this course in an attempt to go ‘beyond’ problem solving...

Question (to Gabriele Bammer): what would the study of ‘integration and implementation’ sciences consist of?

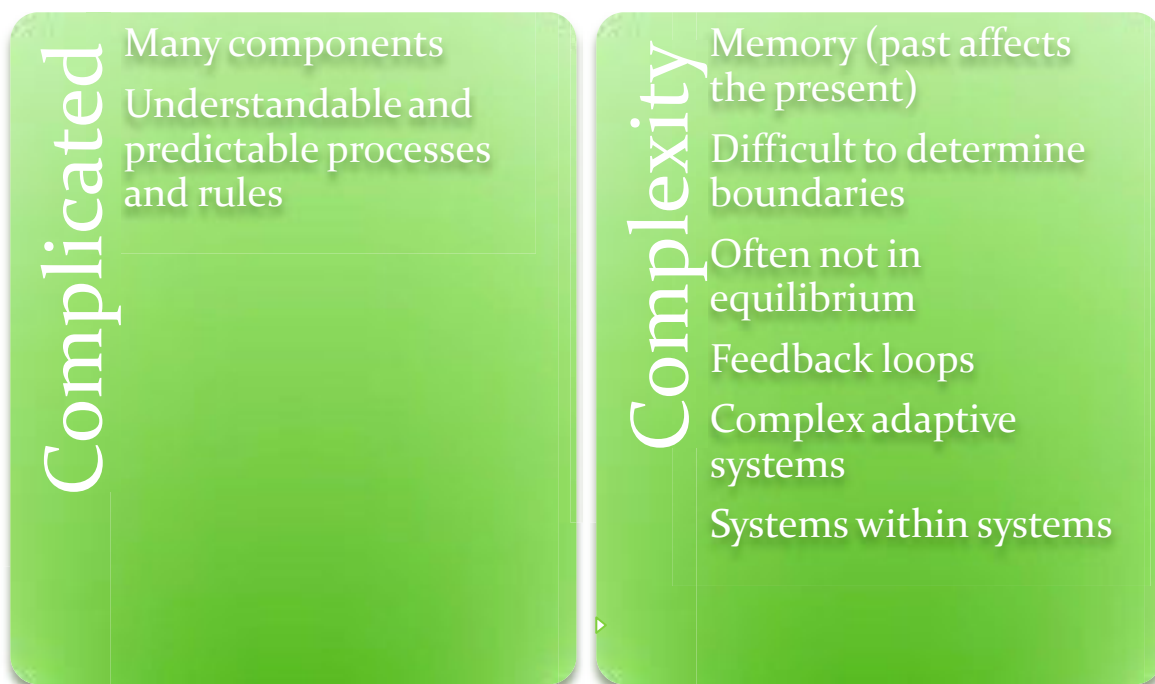
Week 2 – Wicked Problems

Panellist: Steve Cork, EcoInsights

This panel and tutorial gave us some helpful tools and approaches to thinking about complexity.

Defining complexity

One of the important things that Steve talked about was the difference between ‘complexity’ and ‘complicated’:



“Beware of Simplification”

Steve suggested that we need to be aware of the human desire for simplification and reductionism. If we simplify something, the problem is more manageable, understandable and easier to approach and communicate. This may be why Mel instructed us in the wicked problem tutorial to attempt to ascertain some ‘tamer’ problems as well – problems that could be effectively addressed.

However, there appears to be a tenuous balance between the necessity of simplification and the necessity of understanding detail. I think Steve warned us of simplification because when something is simplified, there is the possibility that nuances or subtleties of the situation are overlooked. Acting without an understanding of a problem may have the effect of exacerbating the problem or having unintended feedbacks.

Strategic Thinking

The idea of approaching the future from a 'strategic thinking' perspective – as opposed to merely a planning approach – was pertinent. Strategic thinking involves many possibilities and looking at the problem through a number of lenses and perspectives. Strategic thinking is often more long term.

Despite the importance of strategic thinking, the current electoral cycle (of three years) is not at all conducive to such an approach.

Black Swans

The 'black swan' metaphor was an excellent example of the need for 'expansive learning' and imagination which resonated with me (it seemed to echo the sentiment of Lawrence from week 1). 'Black swans' cannot be 'solved' reactively; this is often too late. Thus, the phenomenon of the 'highly improbable' being most influential underscores the impact that uncertainty can have on complexity.

As Steve outlined, one way to deal with 'black swans' is through scenario planning; when Shell considered the possibility of an increase in oil prices they were more 'emotionally prepared' and able to respond than their competitors.

Understanding World Views

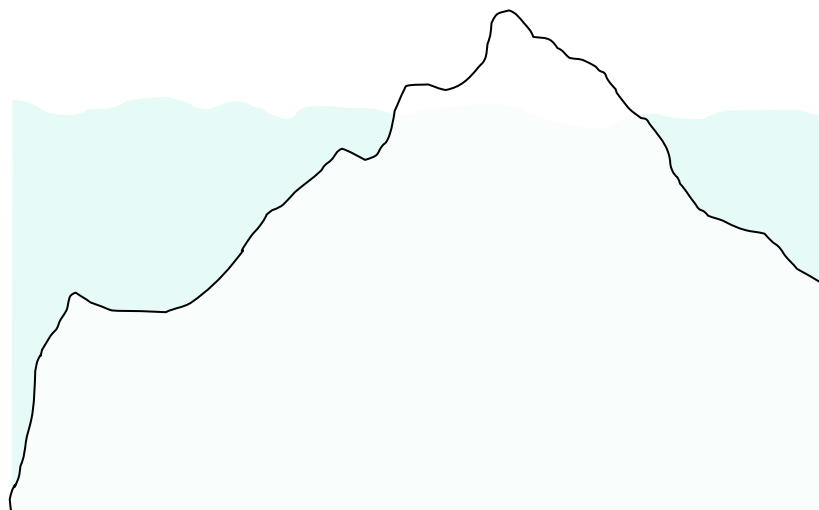
Another helpful approach to dealing with complexity was 'causal layered analysis' from Sohail Inayatullah. The approach goes like this:

What we see

**Perceptions
about what
causes it**

**Underlying
worldviews**

**Myths and
metaphors**



This is where we can attribute the way we see a situation 'at surface value' to differing underlying worldviews and myths and metaphors.

This underlines the need for understanding differing causes, perspectives and worldviews when addressing a problem.

I think this is linked to Steve's idea of 'cliché hunting', where common assumptions we make about our world are identified and challenged. Assumptions are dangerous because they limit what we can perceive and imagine. Throughout my four years at university, I have had both assumptions created and challenged. Studying a lot of environmental science, I have often viewed the protection of the environment as almost 'inherently good'. Nonetheless, one of my readings from Anthropology, (Culture and Development) challenged the benefit of conservation. In her book "The Will to Improve" Tania Lee wrote of the negative effects government interventions promoting conservation was having on the livelihoods of local people in the Central Sulawesi highlands. This reading reminded me of the importance of questioning and approaching ideas from multiple perspectives (as is often required by 'wicked problems').



It is also worth noting that, perhaps what constitutes a "black swan" can vary depending on your cultural and disciplinary background and understanding. When I was in Denmark (not long after the Steve's lecture) I found myself taking photos of the swans which were white. As an Australia, white swans were not the norm for me. Thus the understanding of different worldviews may constitute a type of 'scenario planning' of its own.

Question: Would there be any changes that you would make to our current democratic system to better allow for 'strategic thinking' (as opposed to planning?)

I would be interested to gain Steve's perspective as to what measures could be taken to encourage strategic thinking in policy making in the public service, and what impact short electoral cycles has on the capacity to think strategically.

Week 3 – Engineering

Dr Shayne Flint – College of Engineering and Computer Science

In this week we looked at complexity through a ‘networks and systems’ perspective often utilised by engineering.

Method of simplification

One of the key themes approaches that engineers take to dealing with complexity is to make the system simpler. Shayne spoke of a decomposition of parts, or a ‘separation of concerns’. This is where different components of a system are separated into discrete entities and each entity or individual focuses on a separate speciality, life cycle phase or specific part of a system. However, as Shayne acknowledged, simplification can be both beneficial and disadvantageous (as discussed in week 2).

The practicality of engineering

Before the tutorial, I was under the impression after the reading Yaneer Bar-Yam¹ that perhaps engineers can be paralysed in search of the right answer. Bar-Yam outlined that the process of innovation in air traffic control is ‘very slow because of a need to extensively test any proposed change’ (2004:233) due to the high safety requirements. However, despite this, Richard suggested that for engineers, their priority is not to get ‘the right answer’ is to get *an (acceptable) answer*.

Instead of being paralysed by complexity, the approach of engineers is to think laterally, practically and take action. This is one of the most positive aspects of the engineering discipline.

Focusing on Relationships

Shayne stated that sometimes a problem with engineering is that engineers falsely assume:

- That a problem is isolated
- That solving the problem is good
- That problems can be solved through construction

Instead, engineers need more focus on relationships instead of things. This reminds me of a story told in Culture and Development where there was an engineering project for the provision of water in Tanzania. The engineering company favoured large-scale technical solutions, such as the construction of large dams. However, this solution neglected the fact that it was the women who were the collectors of water, and a construction of large scale dams significantly further away from villages would make it more difficult for the women to collect water, and perpetuate gender inequality. A more appropriate solution may have been to build localised water pumps instead.

¹2004, Making Things Work: Solving Problems in a Complex World

This story illustrates the importance of understanding the relationships, not just within engineering but more generally, highlighting the need for systems thinking and cross interdisciplinary collaboration (as discussed in week 1).

Networks and systems

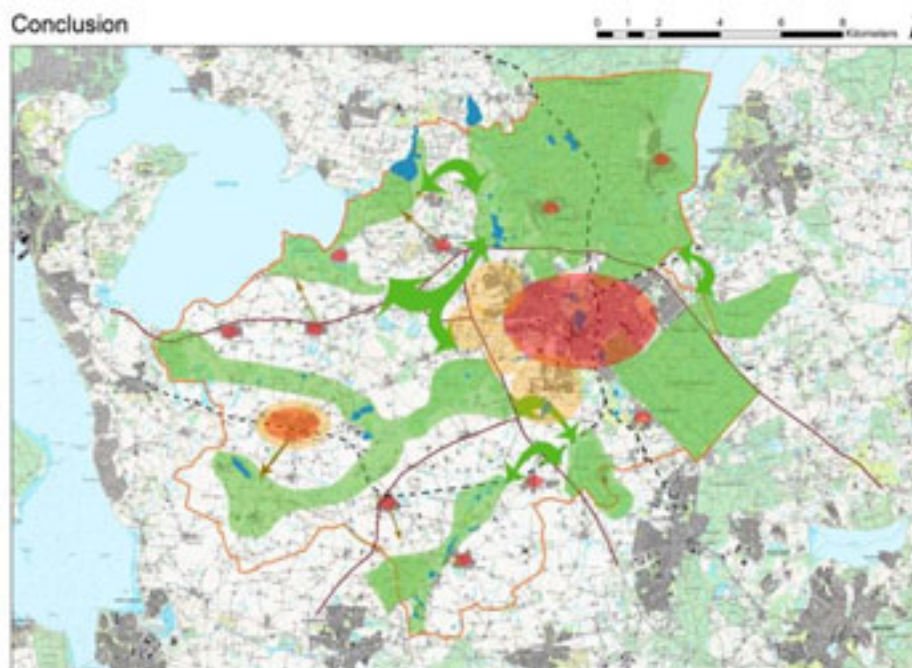
I found the discussion and reading on networks and systems elucidating. Being able to quantify relationships and visually represent these relationships is a highly useful tool to understanding complexity.

Mapping our social relationships in the tutorial enabled me to get a better grasp of who was connected to whom and in what way. Attributing numbers to these connections (such as an average path length or clustering coefficient) also gave rise to an easy method of describing the relationships.

When I was studying in the GSP, our group took an approach of strengthening physical networks and connections in our planning. I was surprised to discover how useful imaging a

Figure 2 Below is a regional plan for the peri urban region of Hillerod municipality. The red ovals represent the suggested areas for urban expansion and green patches represent the protected forest. These are the 'nodes' of the network. The green wildlife corridors and dark red roads represent the connection of these nodes, providing for increased economic, social and environmental sustainability.

plan as a physical network was to promoting sustainability and resilience in the system (see figure 2).



Question: What frameworks are needed to enable engineers to better engage other disciplines? What is the best way to maintain the 'depths' of knowledge silos whilst still promoting interdisciplinary understanding?

Week 4 – Collapse of Empires

The Collapse of Rome

The collapse of Rome highlighted the complexity in history. According to A Demandt (1984) there are 210 reasons for the collapse of Rome; many of these reasons are directly in conflict (eg. Both celibacy and sexuality are both listed as reasons for Rome's collapse).

However, maybe we need to be asking the right questions, such as why did Rome last so long?

One of the dangers with looking retrospectively concerns 'presentism' where the historians view the past through the lens of the present. This was demonstrated by the example of the collapse of Rome being caused by climate change. This links to the need to challenge current worldviews, or assumptions (as discussed by Steve Cork).

Ten second sound bites

One of the challenges for Joan was in explaining causation. What caused Europe to be so successful? However, as Joan pointed out, there may be multiple causes for the success or failure of an empire.

Joan made the comment that, given the complexity in the historical analysis how much of this complexity can be conveyed to the public in a ten second sound bite? If complexity is simplified to make policies, then the policies are simplified to the public, then the complexity is distilled, simplified to the point where it loses its meaning?



The need for integration and foreign policy

It seems like here, taking an overly simplified polarised view is counter-productive. As Dr Jim George suggested, in the past Australia's foreign policy viewed the nation as being in the centre of a hostile region. It is better to be integrated in the region, instead of using simplistic mechanisms of power and force. For Australia, and international relations generally, taking a reductionist, simplistic perspective can be dangerous.

Question: Is presentism ever regarded as a helpful tool to view the past in a new light?

Week 5 – Development

What is development?

One of the questions inevitably surrounding development concerns what the goals of development are. There are a myriad of perspectives concerning development. Sometimes development is defined in terms of construction and economic growth.

When I was in Denmark, I was struck by the differing perspectives as to what constitutes development in attempting to create a regional plan. My friend Oliver, from China, had a completely different perspective to me. Perhaps this can be illustrated through an adapted ‘causal layered analysis’ framework (see week 2).

Layer	Viewpoint One	Viewpoint 2
What is seen	Green space in regional area	Green space in regional area
Causes	It hasn't been adequately developed yet.	Green space retained to provide public amenity/environmental benefits
Worldview	Catering to large scale populations, development as a way of escaping poverty	Sustainable development; environmental protection
Metaphors/Myths	Development as urban and economic growth	Sustainable development; triple bottom line

These different perspectives would be influenced by our country of origin: in China, the focus of catering for large scale populations and economic growth in a developing country would be different compared to that of Australia.

It seems that issues surrounding development create classic ‘wicked problems’ where there are often conflicting values and interests, and often neither the problem nor solution is known.

Issues of scale

Dr Sango Mahanty discussed the way craft villages were developing in Vietnam. She says that in many ways this is a success story, where the change in institutions and opening of the market in Vietnam has been conducive to growth. However, significant environmental problems have arisen from the growth, scale and type of production.

This case study highlights the importance of recognising differences in scale. Actions at a national level (such as *doi moi* – the opening up of the Vietnamese markets) have had a positive effect on growth and development in Vietnam; however, this has meant increased localised pollution in the craft villages. On a national level the pollution from craft industry in Vietnam may be small scale, but for the local villages it is significant.

The importance of Institutions

Steven Howe stressed the importance of institutions in a development context. Institutions concern and create the rules of the game: they create trust, property rights, and enable people to interact and do business. If institutions are weak, sustainable development will be hard to achieve. This is linked to the occurrence of too many countries providing too many grants of tied aid to a particular state, effectively 'driving them to distraction'. In order for any system to deal with complexity, streamlined processes and capable institutions are imperative.

The importance of institutions is also a theme that arose in week 4 (collapse of empires) where John Ikenberry raised the importance of the US maintaining a strong international order in light of the rise of China, if China is to accept and uphold current liberal systems².

My question would be Dr Mahanty: To what extent do you think strengthening the local institutions in villages/regions in Vietnam would address the problems arising from the intensification of production?

² See John Ikenberry, "The Rise of China and the Future of the West" 87 Foreign Aff, 23, 2008

Lecture: A new landscape planning concept to adaptively manage changing landscapes in Japanese cities

Makoto Yokohari

This was a fascinating lecture I had while was in summer school in Denmark (IARU Peri Urban Sustainability: New Visions and Strategies). Makoto Yokohari is from the University of Toyko.

The lecture was about what to do with the 'brown fields' in Tokyo which are arising due to shrinking populations. Since the population of Tokyo is decreasing, there are more areas of empty or unused land in the middle of the city which are unable to be sold.

Consequently, these areas of empty land have been increasingly cultivated for agricultural purposes by Tokyo residents. As Professor Yokohari outlined, turning the land into agricultural areas is beneficial for many reasons:

1. It provides food within the city;
2. It provides food in the event of an emergency;
3. It has ecological resilience benefits;
4. It has a cooling effect on the city;
5. It enables retirees to feel as if they are giving something back to the community by cultivating the land.

I think that this lecture has several important things to say about complexity, including:

1. It is an excellent example of challenging assumptions and clichés (as Steve Cork suggested). The stereotypical urban/rural divide was an unhelpful construction. Once we perceive the city and the 'country' as not bipolar opposites, we can think about the issues in new ways.
2. There are significant relationships and causes and effects, arising from this plan. It underscores the necessity of understanding the relationships between historical contexts, ecological services, social, engineering and planning spheres (as discussed in week 3).

My question was: given the benefits of urban agriculture, can this concept be applied to cities which have expanding populations as well?

Professor Yokohari replied that he had never considered this suggestion before. Although there are benefits of urban agricultural, the prices of land, politics, development opportunities and economics can be prohibitive. This suggests that every situation can vary and thus must be considered in context (as outlined by the historians in week 4).

Appendix:

Tutorial Tickets

Week One

In 100 words or less give an example of an issue that involves great complexity from the academic area you intellectually most identify with and the insights this academic area has to offer in understanding this issue.

There are many issues which involve great complexity in law: there is sometimes complexity in interpreting legislation, surrounding human rights issues, legislating according to policy and balancing the separation of powers between the judicial and legislative systems.

Law employs a number of mechanisms to deal with complexity. The parliamentary and advocacy systems are both centred around debate. This is a mechanism that allows all of the 'issues' to be presented and many different policy options to be explored. Although once the law is decided it must be succinctly expressed in either precedent or legislation, there is always the provision for the statute to be amended, or a precedent distinguished if later debate reveals that a better outcome would occur.

Week Two

This week's reading illustrated a plethora of perspectives concerning complexity. Here are some of the things that I believe are key:

- As Michael Smithson notes in "Uncertainty and Risk", western society often views uncertainty as something negative. However, there are many positives of uncertainty. Furthermore, as Nassim Nicholas Taleb highlights in "The Black Swan", it is most often the 'outliers' and 'the unpredictable' which are often of the most significance.
- A common theme is that as humans, we often shy away from complexity; we attempt to deal with complexity by reducing and simplifying complex situations. While this is a good way of dealing with complexity, we must be careful not to obscure the intricacies at the expense of understanding.
- As it seems our world is becoming increasingly complex, it is increasingly important for humans to collaborate across disciplines (as noted in the Seeking Sustainability in the age of complexity chapter).
- As indicated in the "Wicked Problems" article, most problems concerning public policy are 'wicked.' I think one wicked problem facing Australia concerns climate change. Here, there is both a diversity in actors involved and stakeholders affected as well as complexity and uncertainty attached to defining problems and solutions.

Week Three

For your tutorial ticket can you please submit about 100-200 words on how you think the readings on Complex Networks: Small-World, Scale-free and Beyond is related to engineering - specifically how do you think it helps engineers deal with complexity.

As Fang Wang and Chen state, complex networks are ubiquitous. The type of complex networks described by Fang Wang and Chen would be a helpful tool to visually represent and mathematically analyse complex relationships. Since engineering is a discipline which deals with complex systems and relationships, a mapping the networks may assist in identifying links between different parts of a system which may have otherwise been overlooked. This may be helpful in adjusting one aspect of a system because you can get a better grasp of how closely other nodes in the system are related and may be affected.

Such an understanding of relationships may be helpful if a form of 'evolutionary engineering' was conducted, as explained in "Making Things Work". Where different parts of a system are being incrementally changed in parallel, an understanding of connectivity and relationships may assist in analysis and thus, increase the speed of innovation and development.

Week Four

For the tutorial ticket: write 100-200 words on the two interpretations of China's rise outlined in the Ikenberry article and whether you agree or disagree with either or both.

Some observers believe that Western oriented world increasingly dominated by the East.

There are two things that can happen:

As China gets more powerful and the US' position erodes, China will use its growing influence to reshape the rules of the international system to serve better its interests. This will result in distrust, conflict and typical features of transition.

However, because the Chinese have faced a world order fundamentally different from those past, it is also possible that china will continue to be integrated in the current world system and the Western order will live on.

I believe that the current international system is more likely to create the second option. As Ikenberry notes, the Western order is far more liberal than imperial, and thus it is 'unusually accessible, legitimate and durable'. Furthermore, the economic incentive for China to integrate into (instead of overturn the world order) is strong, considering the interconnections arising from globalisation.

However, I can see that is possible that for the system to be fully functioning the US must 're-establish itself as the foremost support of the global system of governance that underpins the

Western order". In the past, the US has been acting outside of the system, for example by not ratifying significant international law instruments, or by going to war with Iraq. For the system to work, the main players must respect it.

Week 5

For your tutorial ticket please write 100-200 words on which theory, tool or classification utilises complexity and which simplifies the issue the most, and why.

It's difficult to say which theory 'utilises' complexity the most: is utilising meant to be seeing complexity in a good way? Perhaps the best way to approach which embraces complexity the most.

Perhaps in one sense, the tool that simplifies complexity the most concerns economics. With economics, everything is measured in GDP and in discrete, quantifiable forms. Gross national development does not take into consideration the 'happiness' of the population (unlike happiness indexes, such as the gross national happiness index). Money also doesn't measure the amount of damage being done to the environment, greenhouse gas emissions or general sustainability of a region.

In contrast, the millennium development goals are indicators which encompass much more than economic growth in considering development. Child mortality, health, gender equality, environmental quality, education, disease and poverty are all considered. This is a much more complex mosaic of what it means specifically to improve the well-being of populations. Although the goals are still summarised into succinct sentences, and the causes of these problems aren't expressing addressed in the millennium development goals, I think it is possibly the most encompassing.