Hawaii's Mass Transit, Education, Labor, Retirement, and HMO Futures: Initial Exploration of Local-Global Dynamics Using the International Futures Simulation (IFs)[1]

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Abstract

A global model (IFs) is used to examine change in Hawaii's demographics in a global context. Projecting out the "system drift" scenario (a system in which current public policies remain in place) to 2025, one finds a 23% decline in school age population, a 10% increase in the workforce, and an 94% increase in persons over 70 years of age. If this trend is realized, implications for Hawaii's public policies in education, transportation, labor, construction, and health maintenance organizations are enormous. This paper reports the results of using a version of the IFs simulation with an embedded Hawaii database. Future research is called for using IFs not only in public policy analyses for Hawaii, but for virtually every country and region already embedded in IFs.

Introduction

A few years ago, Barry Hughes[2] and I embarked on a project to understand what was needed for his global model, the International Futures simulation (IFs), to be more useful for exploring local development issues from a policy planning perspective. The central methodological question was how to relate global change to local decision-making concerns and decision-making. An IFs application to Hawaii is used as an exemplar for futures research with global models. This essay focuses on only two or three of the dozens of variables IFs generates describing Hawaii's political economy, in particular demographic and economic projections under only one of a wide variety of alternative possible futures, to 2025. These trends are discussed in terms of their possible public policy implications. Saaty's analytic network process software is used to suggest how discussion for policy-making purposes might proceed.

Some Background about Global-Local Connections and the Need for Modeling

The global-local interface has been the subject of considerable discussion since the decolonization period following World War II and through the modern era of globalization. Many cultural facets of global-local tensions are of great current interest, such as impacts on cultural worldviews (Mignolo, 2000), local marketing and global management (Johansson, 2002), impacts on theology (Schreiter, 1997), and media and pop culture (Thussu, 1998).[3] Similarly, military and security issues have drawn considerable attention, as has the environmental dimension (global warming, resource scarcities, pollution and so on).[4]

Much less media and scholarly attention, however, has been focused on making improvements in our ways of making decisions—our decision framing and decision making subcultures—at local community or substate levels (e.g., local government, industry and community organizations—the civic culture). One of the few innovations in

the latter half of the 20th Century that could potentially integrate short term, small scale frames of reference with longer term, larger scale ones, was the development of global modeling. Notwithstanding the fact that the development of global modeling has been a slow and difficult process, it remains one of the few methods capable of analyzing and interpreting the meaning of truly global processes for local decision-making.[5]

Having a tool available for alternative futures policy analysis is one thing; getting it used and accepted as part of decision making processes is quite another. Unless the ethos of global modeling can reach into local, civic culture, national and international bodies employing the latest data and models, are likely to be unpersuasive and thus unlikely to be able to take effective action.[6] As the old adage would have it, all politics is local. Similarly, at a recent conference of the International Symposium on the Analytic Hierarchy Process (ISAHP),[7] Saaty noted that unless advances in decision sciences, represented by the analytic hierarchy and analytic network processes (AHP, ANP), reach the civic culture level, the work is in vain. These two levels, the macro level at which global modeling is focused, and the micro level of individual and group decision making, don't seem ever to meet in the literature of either field. As Saaty pointedly remarked several times at the symposium, the most critical element for application of the ANP, viz., the structure of political decisions, remains the most problematic to specify.

An Exemplar for Glocal Analysis Using IFs and ANP: Hawaii 2025[8]

At one level, this is a pilot exercise in employing an IFs forecast for Hawaii as a device to do some speculative "what if" planning for local changes in the Hawaii political economy. At this level it is asked: what are the implications of the IFs forecast for local decision making? Should we welcome the trends and adjust to them, or should we resist their implications and attempt to steer a different course? At another level, however, this exercise sketches a paradigmatic exemplar (Kuhn, 1969)[9] for decision analysis employing global models as necessary tools for constructing alternative futures in a globalized civilization. "Action in the face of uncertainty," as Hughes puts it, requires "glocalization," that is, attention to identifying what geopolitical trends are amenable to decision making and policy change, and at the local level what implications of those trends are amenable to local decision making and policy change. I'll call this exemplar "Hawaii 2025," representing a roughly 20-year look into the future via IFs' "base scenario."

In a globalized civilization, all global modeling has local implications. After all, how can one "think globally and act locally" without basic global data and knowledge of the general drift[10] of the global system? Global modeling offers at least a start in that direction; because unlike other methodologies, global models assimilate and integrate a wide variety of social and biological sciences' findings in a form that is, if not completely transparent, at least accessible to the professional. As such they permit long-term investigation of alternative futures. They enable records to be kept of the data used and assumptions made, for the next generation of users to build upon, substituting their own data and theory as needed or desired.[11]

This version of IFs is divided into seven different sectors: population, economics, food and agriculture, energy, the environment, domestic social and political systems, and the global sociopolitical system. For this report, I will focus on the first, population change and its implications. Clearly more can be done; my own agenda is to proceed

ad seriatim through the list of sectors to the global sociopolitical system at a later date. For introductory purposes, one sector, population, will have to suffice.

Population Dynamics: Implications for Policy

Hawaii's current population is about 1.2 million, excluding the 7 million or so tourists per year currently (2005 estimate) visiting the islands. Hughes provides some very informative graphing capabilities for population cohort analysis as the chart below indicates. Chart 1, below, is a projection of Hawaii's population and population distribution by age cohort. A similar table can be generated for the base year (2000).
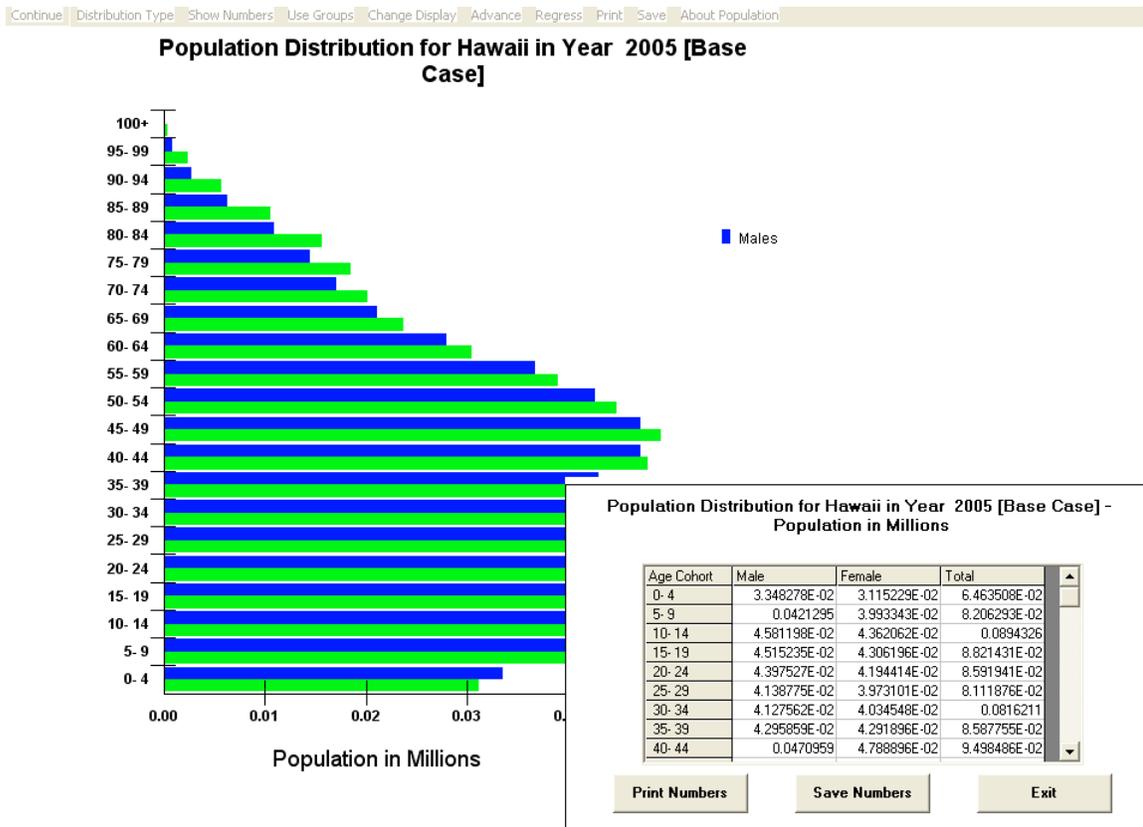
To transform the demographic projections data into what might be termed "glocalized intelligence," I constructed Table 1 below, reorganizing it in order to highlight what I suspected would be the most significant implications for Hawaii's economy. Table 1 suggests a significant increase in Hawaii's population from 1.2 million in 2000 to 1.3 million by 2025 AD, about 6% or 76 thousand people. Even more significant is (1) the decrease in the younger population, ages 0-24, about 23%, (2) a 10% increase in the workforce, ages 25-69, and (3) a nearly doubling, 94%, of the elderly, ages 70-100+. In round number this translates into roughly 99 thousand fewer young people, 71 thousand more workers, and 105 thousand more elderly than currently populate the state.

What are the local policy implications for Hawaii of such a shift in the age structure of its population? To address this question, many facets of Hawaii's political economy need to be addressed, facets that could easily be but are yet not embedded in either an IFs database or its theoretical assumptions. I will explore several broad implications: those for (1) the housing industry, (2) change in the educational system, (3) opportunities for the elder care industry, and (4) transportation.

1. Housing

Hawaii has an extremely tight housing market, with steadily increasing costs of housing in all forms. Given the large increase in the elderly population, it is likely that the construction industry will be busy building new condominiums and homes, remodeling existing stock, and providing more health care facilities, at a rather steady pace for the next two decades. Currently Hawaii has the lowest unemployment rate in the USA (just under 3%), so this aspect of population dynamics should also be very good for business, for the anticipated expansion of the local labor force, and for attracting labor from the continental USA and other countries (as it does already). If overall economic trends are positive and unemployment remains low, some degree of upward pressure on real wages and living standards would be expected. Graph 1 below and the PQLI graph that follows are consistent with this inference. We see that GDPPCP (per capita income at purchasing power parity) grows from about $25K to $36K, albeit with some flattening of the trend between 2020 and 2025.[12] The PQLI[13] (physical quality of life) graph shows Hawaii in comparison with some key countries for Hawaii's tourism trade. Hawaii and Japan sustain a high, steady and nearly equal PQLI, with the continental USA next. Germany maintains its position. China as widely anticipated at present, evidences very substantial improvement.[14]

Age Cohort	Year 2000			Year 2025			2000-2025 Difference	Percent change
	Male	Female	Total	Male	Female	Total		
0- 4	42	40	82	34	32	66	-16	
5- 9	46	44	90	35	32	67	-22	
10- 14	45	43	88	34	32	66	-22	
15- 19	44	42	86	34	31	65	-21	
20- 24	42	40	81	33	31	64	-17	
Subtotal 0-24			428			329	-99	**-23%**
25- 29	42	40	82	42	40	81	-1	
30- 34	44	43	87	45	43	88	2	
35- 39	48	48	96	44	43	87	-9	
40- 44	48	50	97	42	41	84	-14	
45- 49	44	45	89	40	39	78	-10	
50- 54	38	40	78	39	39	78	1	
55- 59	29	31	61	40	41	81	20	
60- 64	23	25	48	42	45	87	39	
65- 69	19	22	41	40	44	85	44	
Subtotal 25-69			678			749	71	**10%**
70- 74	17	21	38	34	38	72	34	
75- 79	14	19	32	26	31	57	24	
80- 84	9	14	22	17	21	38	16	
85- 89	4	8	12	10	13	23	11	
90- 94	1	4	5	6	8	14	9	
95- 99	0	1	2	3	5	9	7	
100+	0	0	0	1	2	3	3	
Subtotal 70-100+			111			216	105	**94%**
Total			1,217			1,294	76	**6%**

Table 1. Hawaii 2025 Scenario: Actual, Estimated and Difference by Age Cohort (1,000s)

2. Education

Let us now turn to the educational system. As noted, the forecast suggests a decline in the 0-24 age cohorts of about 23%, about 99 thousand people. Fewer children in school can be reacted to in a variety of ways, depending on the age of the children and the type of institution they attend (from preschool at ages 2-5, through graduate school and professional internships). Here are some possible (and likely) responses.

- The decline might be seen as an opportunity to reduce class size, improve the quality of education, and thereby strengthen the workforce to move into higher paying jobs, while less educated labor continues to be imported as migration.

- It might be seen as an opportunity to save government funds for other expenses such as housing the homeless and providing for public support for medical care, counseling and adult education.
- Different school levels (primary, secondary, and higher education) might see it in different ways.
  - If primary and secondary education institutional leaders see it the first way, conflict would seem inevitable with legislators eager to use the money elsewhere.
  - Private preschools might be strained and have to reduce staff size.
  - Higher education institutions might see this trend as a threat to their survival or at least their budgets, and embark on a combination of recruitment and cost saving strategies. They could also put a program in place of gradually increasing tuition to relieve pressure on public expenditures—a process that already has begun at the University of Hawaii (UH). By far the largest higher education institution in Hawaii, the UH system has about 2/3rds of all higher education students in Hawaii, so a local recruitment campaign for more students would not in all likelihood be cost effective. However, by embarking on a significant student recruitment policy throughout Pacific basin countries (both in Asia and the Americas) emphasizing its research strengths, it might well reverse the effect of domestic demographic pressures.
  - The UH is one of the top research institutions in the nation (currently ranking 6th in the total value of research grants received) and has instituted a policy of further strengthening itself, a policy which could attract more students.
- Some of the elderly might wish to take advantage of senior education programs at universities. This would contribute to increasing enrollments but not necessarily increasing tuition payments because such programs are heavily subsidized and regulated; in many cases courses are offered free of charge to the elderly.
- The changing demographics might affect private and public institutions differently. Because of the low unemployment rate, it may be that private schools will not be as affected because parents could afford tuition increases (about half of Hawaii's primary and secondary students are educated in private schools). Public schools may therefore face the most difficult choices.

Graph 1. IFs Hawaii 2000-2025 Compared with USA Average

● GDPPCP[0](Hawaii)   ▲ GDPPCP[0](USA)
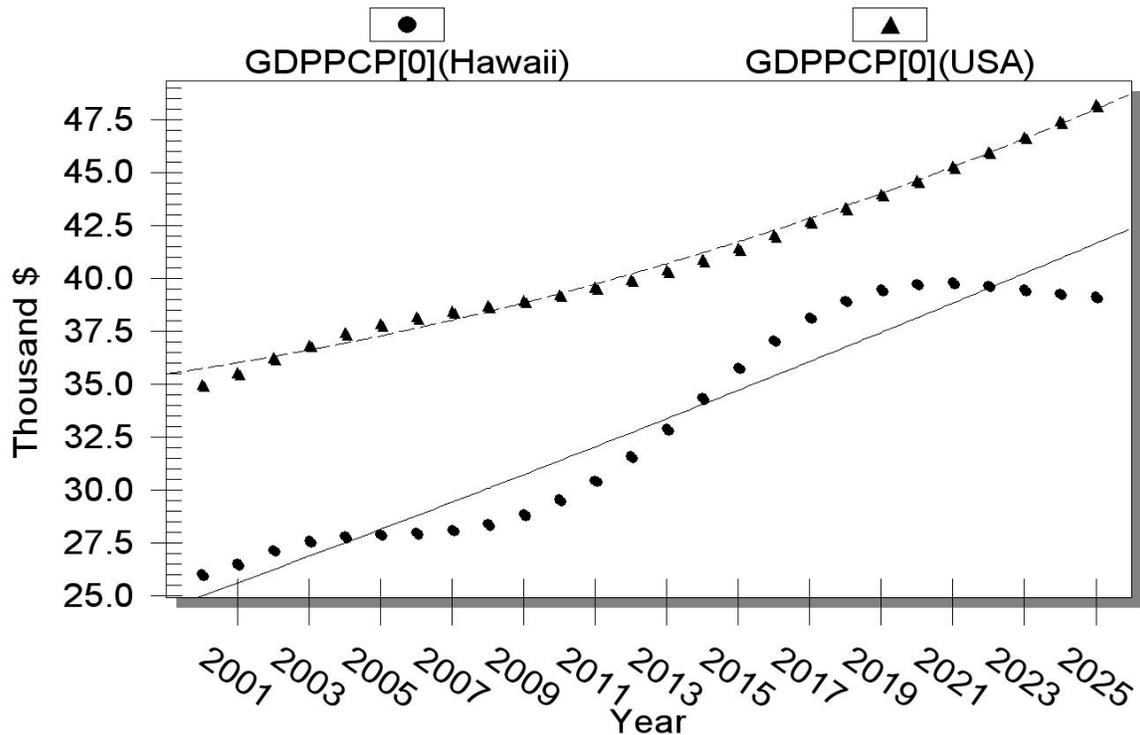
3. Opportunities in Elder Care

There are broader implications for the workforce. The predicted workforce increase of 10% with a sustained unemployment rate of 3% implies the likelihood of being able to bargain heavily for salary increases above what is needed to keep up with inflation. Because living standards are high and possibly increasing, inflationary pressure might be offset by productivity. It isn't clear whether the expansion of the workforce and possibly productivity will keep up with retirees' demands, but the trend surely helps.

There are further implications. The 94% increase in elderly (70-100+) puts pressure on both government spending and private investment. 105 thousand more elderly will need, and most likely be able to pay for, new assisted living facilities, hospital and HMO treatment, and a wide variety of activities ranging from recreational education to cultural activities, from sunning to concerts.

4. Transportation, the Elderly and Youth

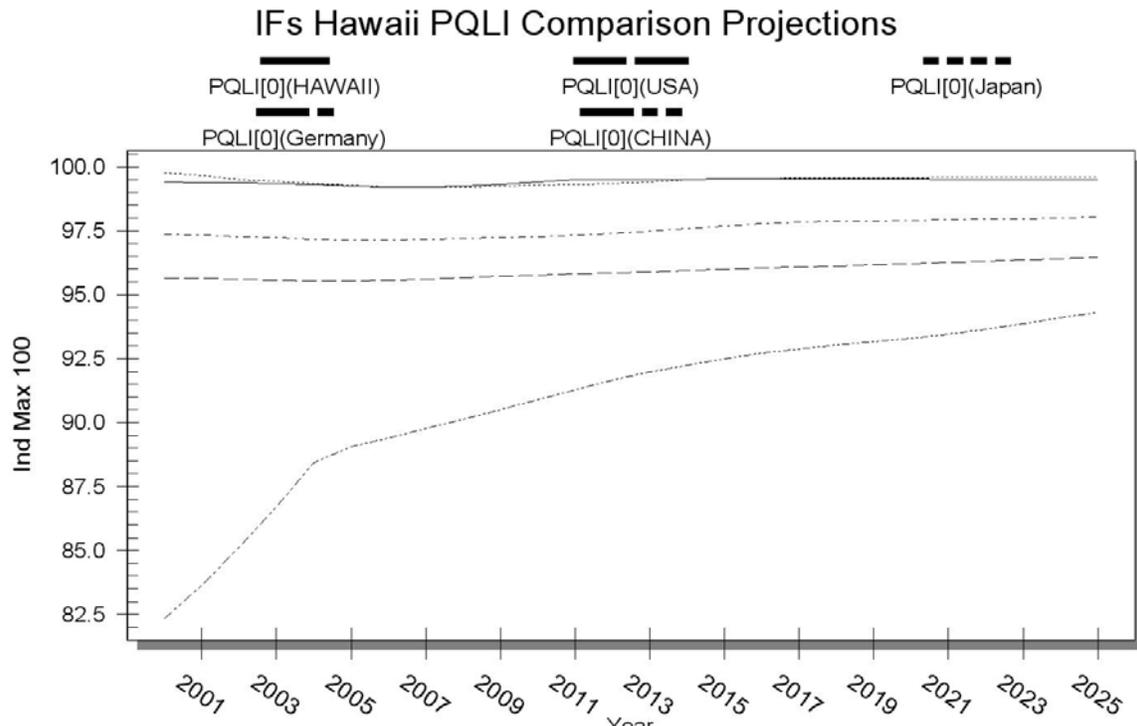Transportation is likely to be affected.   Let us speculate a little about alternative scenarios.
• Fewer children and young adults in schools would result in decline in ridership in public transportation in this category. If this trend emerges, further increase in public transportation to and from major schools and university campuses would not be necessary.

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- Many elderly will not be driving, giving rise to the possibility that the public transportation system might experience a substantial increase in elderly ridership. Hawaii currently one of the best public transportation systems in the country and would seem well prepared for this eventuality; e.g., many buses are equipped with wheelchair ramps and stoop-down capabilities. Such an increase might offset the loss of youthful riders, and necessitate some rerouting and rescheduling of bus routes.
- A 10% increase in the workforce would be expected to increase traffic congestion in major corridors during peak periods unless roads are provided for about 70 thousand more workers on the road. But whether public transportation could offer a more attractive alternative is questionable. Also, major increases in the workforce may not be evenly distributed across Oahu. If attractive, affordable housing is provided near new or expanded workplaces, for instance, it's not likely that expenditures on current major corridors would be needed. Housing might be redesigned around the concept of elder care villages with mini malls, satellite health care facilities, housing for health care providers and so on.
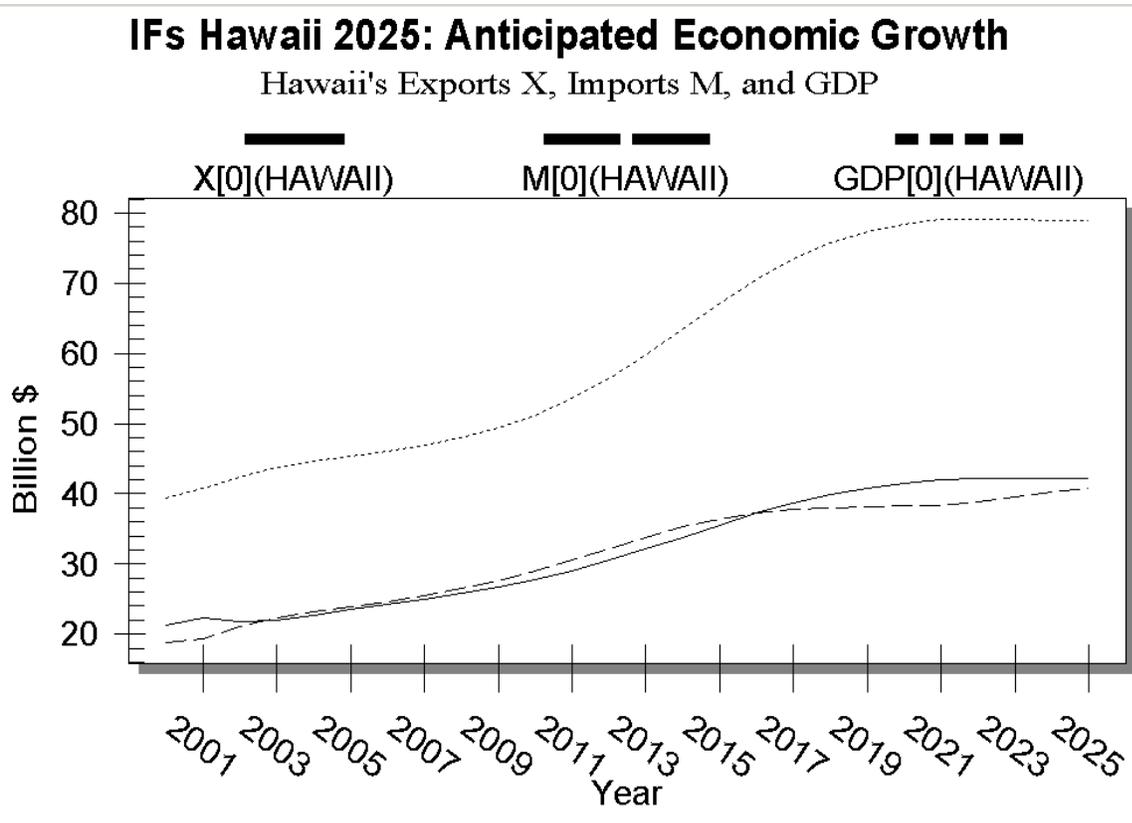
5. Tourism

A sharp closing of the PQLI gap has implications for tourism (see Graph 2 below). Hawaii is currently dependent primarily on tourism for its economy (that and USA military and related spending). Sharply increasing living standards implies more tourism possibilities for Hawaii as well as FDI (foreign direct investment). A little investigation of Hawaii's major tourist population reveals some interesting trends in IFs. It turns out that Hawaii and Japan are and remain for all intents and purposes nearly identical in their PQLI scores (either that or something is awry with the index!). Very close, but below it, is the rest of the USA. Below them are Germany, and catching up, as one might expect, is China. The latter is particularly important because of the potential for a vast increase in the tourism market. Hawaii may be likely to get as many Chinese in the future as it can manage to handle given its tourism infrastructure. Today the largest number of foreign students getting degrees at the University of Hawaii, for instance, are Chinese—most of whom return to China with a very favorable impression of Hawaii because of its multiethnic mix both on and off campus, including American Chinese. Graph 3 indicates both the increase in Hawaii's GDP and its corresponding increase in exports (primarily tourism) and imports.

Graph 2.

IFs Hawaii PQLI Comparison Projections

PQLI[0](HAWAII)   PQLI[0](USA)   PQLI[0](Japan)

PQLI[0](Germany)   PQLI[0](CHINA)

Graph 3.

IFs Hawaii 2025: Anticipated Economic Growth

Hawaii's Exports X, Imports M, and GDP

X[0](HAWAII)   M[0](HAWAII)   GDP[0](HAWAII)

A Decision Analysis Interface: the *Superdecisions* Analytic Network Process

Having speculated a bit on the implications of this baseline IFs projection to sketch some alternative scenarios, let's turn to structuring them a bit using a modern decision aide program, Saaty's *Superdecisions* modeling software.

IFs provides a variety of policy handles ("levers" and "leverage" as Hughes would say), called "parameters" in IFs.[15] However, IFs does not explicitly disaggregate a state into the various political parties, pressure groups, business communities and other entities that make up a state's decision making or political subsystem.   The situation is something like this (see Figure 1 below). The policy parameters manipulated by decision makers are explicitly present in the IFs model, the impacts of policy changes or decisions are explicitly modeled, but the reactions to change in the political, economic, and social environment consequential to those policy impacts are not modeled. Thus real policy analysts, decision makers or decision making groups or community must react to the situation (scenario) which IFs presents to them, make choices about what policies to change or leave in place, take action by changing IFs parameters, and then running the model to derive further implications for change.

Figure 1. Decision Making External to IFs and Policy Consequences Internal to IFs.
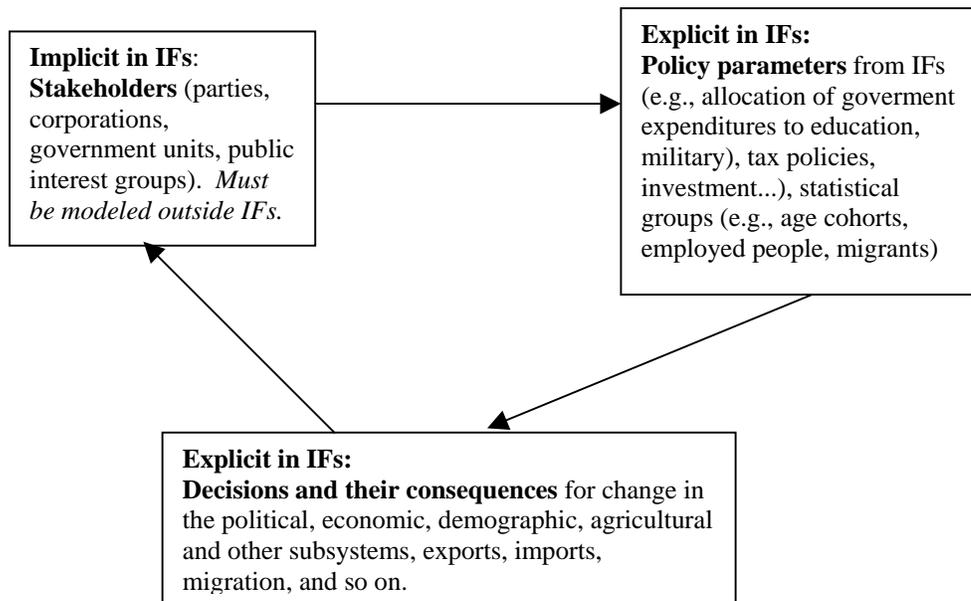

IFs does not provide suggestions for which parameters to manipulate or to what degree; no explicit decision model is embedded in IFs.[16] However, Hughes does provide extensive scenarios for examining alternative futures, each of which represents an alternative policy future.[17]

Thus IFs provides us with an opportunity to construct our own tailor-made, glocal decision model to take advantage of its capabilities.   What it does not provide is

guidance on how to construct the decisions or scenarios. It is fortunate in the extreme that just as IFs is "coming of age" as it were, that a development in the decision sciences provides us with exactly what is needed to take advantage of the opportunity presented in IFs parameter construction. This development is Thomas Saaty's analytic network process, or ANP, as it is embedded in his *Superdecisions* software. Essentially what this software enables is to explicitly represent values, alternatives, stakeholders, and decision scenarios. Further, it provides opportunities to make comparative judgments of alternatives based on whatever values its users wishes to embed in the decision, and allows for inconsistency among such comparisons to reflect real world uncertainties of judgment, misjudgments, or even deception. Further, it allows for interaction of value priorities with available alternatives and actors (decision makers) being modeled—meaning for instance that value priorities may change with the actors and alternatives presented.

We can begin constructing our Hawaii 2025 decision model following Saaty's "analytic network process" (ANP) employing these parameters as decision nodes. Below is an initial decision structure consisting of two goals, a checklist of stakeholders, and a set of issue categories following Hughes' IFs model sectors. While only one, population, is being considered here, it quickly becomes self evident that issues discussed relate to many sectors because of the multiple causal interrelationships across variables in each sector, and the significance of change in each variable for many of the stakeholders, indicated by the arrows connecting the clusters [i.e., the loops above each category indicate that their "nodes" (actors, goals, and Hughes' IFs sectors) influence each other).
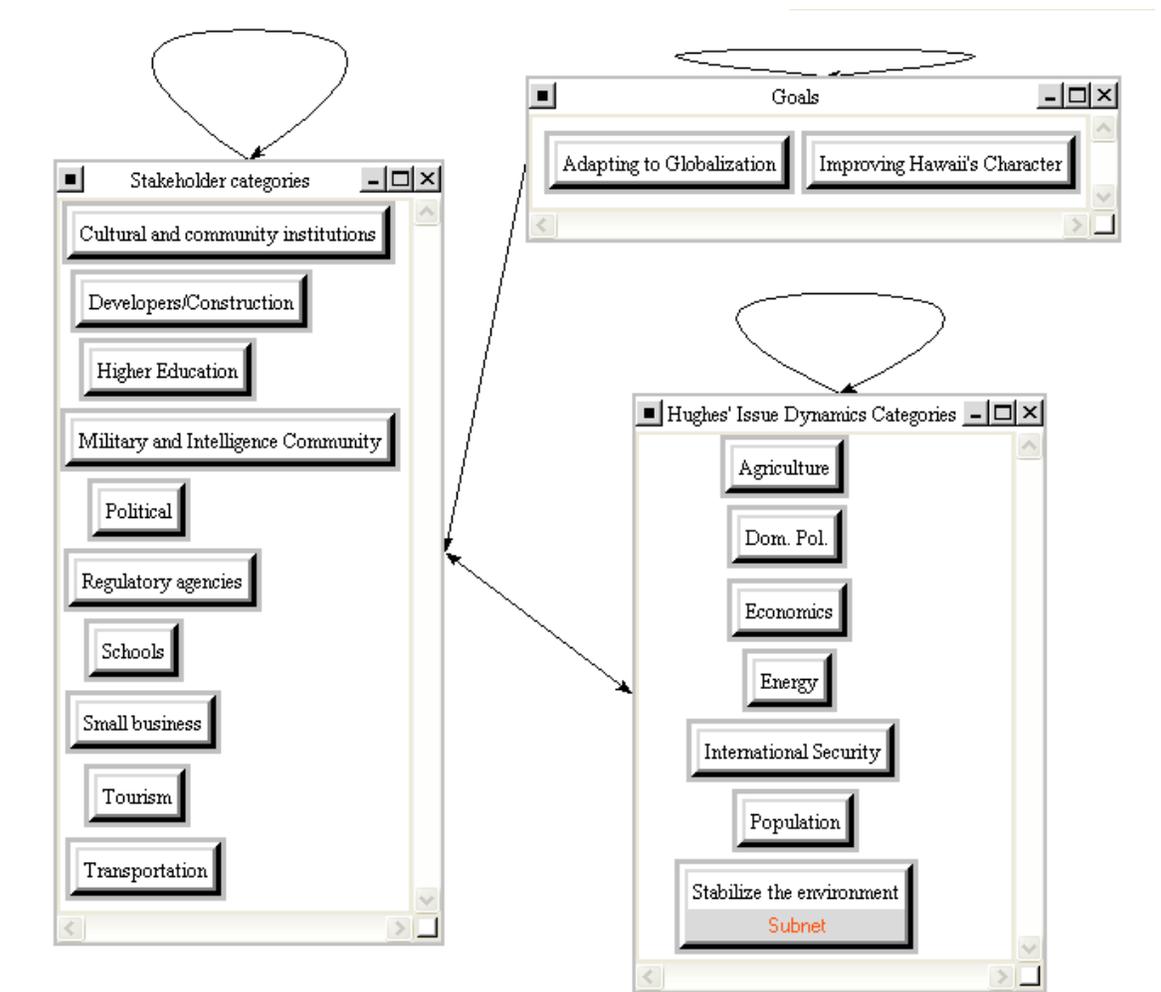
Not shown in the above graph are the relative weights given by each stakeholder to each of the issue categories (Hughes' sectors), for instance, how much more important is population change compared to agricultural issues for regulatory agencies of state and local governments? Similarly, stakeholders comparatively evaluate their importance or relative influence on each other; for instance, how much more influential are cultural and community institutions to politicians than the military and intelligence community? Is that relative importance conditioned on particular issues, such as international security vs. energy policy?[18]

Choices

What, if anything, should Hawaii's decision makers (business, government, and other institutions) do in response to anticipating such a change in demographics? Here are some obvious possibilities:

- Do nothing. Wait until what is anticipated materializes (if it ever does) in sufficient quantity to increase demand in some services and decrease it in others (e.g., more golf courses, less education), and take action appropriate to the then current economic and demographic conditions.
- Prepare for the change. Discuss increases in investment in facilities favored by an increase in numbers of older people, prepare infrastructure accordingly, at a rate consistent with anticipated changes in demand. Investigate implications for the size of financial institutions and real estate markets (housing, especially elder care facilities), HMOs, and Federal aid.
- Resist the change. Attempt to reconfigure Hawaii's economy to slow the demographic transition to an older population. For instance, use permit acquisition processes for construction to tighten further the housing market. Increase taxes to discourage immigration. Use the power of condemnation to decrease available space for further development.

Working with these or similar basic choices and their implications may continue and results reported at a later date, contingent on interests that develop for this approach.

Opportunities for Future Modeling with IFs for Hawaii, and Beyond

This effort to date has yielded a number of observations about how IFs data and model structures might be modified to better support Hawaii decision makers' needs in business, government, education and social institutions. One would expect similar adaptations would be required to apply IFs usefully to other local environments.

- Change in the size of the labor market in Hawaii is inconsistent with the cohort analysis done so far. See trends in the IFs "LAB" variable. This may be due primarily to inconsistency in the population cohorts assumed to be in the labor market. I took the 25-69 year olds as labor, IFs takes 15-65 year olds.

- Foreign born and migrant data is absent. IFs has a beginning migration model that should be taken advantage of.
- Tourism, the main engine of the Hawaiian economy, is imprecisely specified as exports in general. Specific data on tourism by number of persons, duration of stay, and amount spent per tourist have been collected by one of my former students working for the Japan Tourism Bureau, but funding for further work to embed the data into the IFs model has not yet been sought. The Hawaii export and import data above, compared with Hawaii's GDP, make the need for this obvious.
- Numbers of foreigners in Hawaii (excluding tourists) and migration data are available but not yet embedded in the model, although that coding (unlike tourism) already exists.
- There is inadequate modeling related to indigenous peoples in general and Hawaiians in particular. This is particularly important for a crucial population in Hawaii, the population of Hawaiian ancestry, for social, economic and political reasons. Hawaii's cultural traditions have been much influenced by many cultures, but chief among them are the Hawaiian culture and language, not to mention the diverse and large ethic immigrant groups. For instance, this specific culture is one of the "great attractors" for tourists. Cultural "preservation" is an inadequate term, but it points to the need for Hawaii to support and encourage Hawaiians and Hawaiian culture, and not only for tourism but in connection with the care of natural flora and fauna, knowledge of medical herbs and traditions for tropical living, and general understanding of certain facets of human nature and potentiality.
- Another opportunity for modeling lies in the impact of multiculturalism on education, educational institutions, and globalization phenomena. Hawaii's university system as well as primary and secondary educational systems, is by far the most diverse in the USA, and perhaps in all of Pacific-Asian countries. How this influences political stability and security, economic growth and development, and quality of life, has yet to me adequately conceptualized and modeled. The value of doing this may well be as an exemplar for similar efforts (some existing in IFs) in representing such dynamics as ethnic minorities' relations in other countries (China, India, Indonesia and so on).
- Embed existing knowledge of housing market dynamics and FDI in the model, as well as tourism and settlement dynamics.

Conclusion

Adapting IFs to glocal analysis isn't straightforward, but then neither is local adaptation to globalization dynamics. Contrary to what might at first appear to be adding layers of complexity to already complex issues and problems, the use of global models for analyzing local trends and leverage to make valuable changes in policies seems highly promising. The problems that are emerging from this ongoing exploration are tractable and researchable. Similarly, Saaty's ANP enables a level of capturing complexity every bit as relevant as global modeling is for capturing global dynamics, trends, and opportunities for guiding change. Problems with the adaptation of both global modeling and the ANP decision process to actual decision makers' needs, is less a problem of technical expertise and funding as it is a reorientation of decision making processes to the task of seriously integrating long term trends and possibilities into

thinking about more immediate problems in the usual, habitual, crisis management mode. L.F. Richardson made a similar observation in his posthumously published book in 1960. The context was arms races and advice to kings.

> Critic: Can you predict the date at which the next war will break out?
> Author: No, of course not. The equations are merely a description of
> what people would do if they did not stop to think. ...they follow their
> traditions, ...and their instincts…because they have not yet made a
> sufficiently strenuous intellectual and moral effort to control the situation.
> The process described by the ensuing equations is not to be thought of
> as inevitable. It is what would occur if instinct and tradition were
> allowed to act uncontrolled.

I'd like to conclude with noting that there is no professional association of global modelers analogous to Saaty's ISAHP (International Symposium on Analytic Hierarchy Processes), not to mention the ISA's many professional sections. There should be such a professional association, a refereed journal, developed guidelines for centers for global modeling—perhaps even degree granting programs—and so on. The process of global modeling took a leap forward with the Club of Rome's corporate funding. The "shock and awe"—to borrow the title of a well-known book—with which major powers viewed the implications of global trends produced by the Club of Rome's first two efforts, changed the way we thought about the planet—at least in some circles—as much as the first photos of earth from space. While the value of such modeling for national security affairs cannot be denied (indeed, it is one of the reasons why the current IFs model exists), it is also vital that this technology be applied and developed in local institutional contexts worldwide. So far as I can see, aside from the emerging protocols of futurists and remote viewers, it is the only other technology capable of bringing together data and theory on global dynamics for local decision-making. and Saaty's ANP is by far the most promising approach I have found for structuring decision situations in a global modeling context.

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Endnotes

[1] The first draft of this essay was written for presentation and critical review at the first Global International Studies Conference of the International Studies Association and World International Studies Committee, held in Istanbul at Bilgi University, August 24-27, 2005. I want to thank Barry Hughes in particular for his forbearance with my frailties as the research moved through several stages of development over the last few years, and the kindness with which he made the many modifications to his IFs model and database essential to this work, as well as for the opportunity he provided by organizing the global modeling panels in Istanbul. This second draft was prepared at my friend and colleague's persuasive insistence, Jim Dator. I hope to complete a third and final draft soon—although it may become a sequel essay to this one as it stands—embedding more of Tom Saaty's ANP graphs and tables; but in the meantime I will make it available for comment and constructive criticism by my colleagues and students, on my website at www.hawaii.edu/intlrel/, until it is finally revised and frozen in time by a publisher's website. Your comments and suggestions would be most welcome.

[2] Barry Hughes is the designer of the International Futures (IFs) simulation of global systems dynamics.

[3] The texts referenced here are only a small and unrepresentative sample of books in print on such subjects. Amazon.com, for instance, lists over 900 books specifically dealing with the local-global interface.

[4] For a recent overview of global issues and trends, see the National Intelligence Council webpages at http://www.dni.gov/nic/NIC_2020_project.html, especially the *2020 Project* report.

[5] See Chadwick (2000) for a recent history of global modeling.

[6] IFs, for instance, has been in use at the UNDP, and current at UNEP and the NIC, but never for local policy analysis. For more information see the IFs website at www.ifs.du.edu.

[7] The ISAHP (International Symposium on Analytic Hierarchy Processes) met at the East-West Center July 8-10, 2005 in Honolulu. Information on its proceedings with downloadable papers can be found at http://www.superdecisions.com/~saaty/ISAHP2005/.

[8] The version of IFs (4.30) used here was specifically modified by Barry Hughes at my request to embed Hawaii in the model in 2003, as if it were another nation-state. Mark Ridgley, the Chair of our Geography Department, collaborated with the data organization and provided me with constant encouragement in applying Saaty's ANP to this type of data and decision problem. We intend to continue the collaboration in a future stage of this work.

[9] In Kuhn's terms, a "paradigmatic exemplar" would be a doubling of meaning, a redundancy. See his usage in his postscript to the second edition (Kuhn, 1969).

[11] This characteristic of global modeling is significant and highly underrated. Global models were initially criticized severely as regards their data, theory, and policy significance (cf. Cole et al. (1973). However, in principle at least if not always in practice, global models act as repositories of accepted theory and data, and integrate them in a way that makes a more useful product for policy purposes than libraries or concept search engines such as Google. A global civilization requires some way to translate its complexities and existence in terms understandable to its human participants and even creators, some way of making relevant the longer term, indirect implications of decisions in the shorter term and smaller scale.

[12] Paul Brubaker (2005), Chief Economist for the Bank of Hawaii, independently arrived at these same general trends in the economy. It's comforting when mutually consistent results are produced by different methodologies and data bases.

[13] Hughes notes that the PQLI has been replaced by the HDI (human development index) in the UN, and he has experimented with several variations on it to correct for upper bound problems. I graphed his "HDI21stFix" variation and noted very little difference. The relative ranking of the countries over time remains the same but at the upper end of the scale the trends in the indicators appear somewhat closer together, something that could be an artifact of the upper bound issue.

[14] Despite the favorable outlook in this version of IFs, China has some well-known and formidable problems looming on its immediate horizon. The bird flu epidemic has spread over much of central and western areas and into Siberia. I understand that compounding the problem is that antibiotics intended for human use have been used on fowl to curb the epidemic and that strains have resulted that are no longer susceptible to them; should these strains jump to humans, an epidemic could go uncontrolled. China's water supply to Beijing and other cities is vulnerable. Its financial system is strained, some believe nearly to the breaking point. Increasing energy demand has already made obsolete the IFs forecasts in this edition, which produces price levels of only half their current value; some of this price increase is due to projected increases in Chinese demand and is unlikely to be sustainable.

[15] Technically, parameters are factors or variables whose values are manipulated by the user. It is assumed that such settings are related to the implementation of a policy and an impact of a policy or policy change; but a parameter could also be some feature of the model that is open to conjecture so that a variety of values may be set given varying assumptions, for the purpose of sensitivity analyses.

[16] While there are no explicit decision models in IFs, it could be argued that there are many implicit ones, mostly for statistical groups but a few also for governments. Economic models generally make assumptions about how the average consumer will behave as a statistical group, the average investor, the average migrant, and so on. Also embedded in IFs are Richardson-like processes regulating decisions on military expenditures based on empirical theories about threat perceptions. Many parameters exist that can override these built-in assumptions, however. The choices made by Hughes, as with any global model designer, as to what degree to embed decision processes in IFs, would seem to be governed by available, reliable theory and the uses to which the model is expected to be put.

[17] The reader should refer to the NIC 2020 Project for details, at http://www.dni.gov/nic/NIC_2020_project.html .

[18] William Coplin (1972) and his associates formulated precisely such questions more than three decades ago. His models for actors' self ratings on influence, issue position and issue salience, are easily programmed into spreadsheets for situationally specific assessments of likely decision outcomes.