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Nine Case Studies

Case Study 8: Kenex Knowledge Systems

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Kenex Knowledge Systems

Overview

Kenex Knowledge Systems Ltd (Kenex) is a geological consulting practice that utilises spatial modelling and Geographic Information Systems (GIS) to provide supporting information for the earth sciences and agricultural sectors in New Zealand. The firm brings together a unique blend of business development, mining expertise, research and development and spatial information technology skills to provide their services.

Whilst ICTs are important workhorses for the company, both its competitive advantage and its ability to add value to the New Zealand economy by attracting investment in the sectors in which it operates, rely upon the ability to access the data that supply its systems and the distinctive skills of its staff to analyse the data using GIS models.

The key issue facing Kenex relates to property rights of the data that feed into the GIS systems. Kenex management would like to see greater clarity about the rights of access to data collected by Crown-owned entities. This would enable knowledge-based firms like Kenex to convert much paper-based data into more easily usable digital form, undertake and stimulate other firms to undertake greater levels of research and development using that data, and thereby create both vibrant new knowledge-based industries and new investment opportunities for the New Zealand economy.

The Company

Kenex Knowledge Systems Ltd (Kenex) is a business development company specialising in modelling spatial information and its utilisation through Geographic Information Systems (GIS – see the appendix for a discussion of GIS technlogies). The firm's name is derived from the Gaelic word for knowledge; 'ken', with the organisation's focus on exploration and experimentation with knowledge contributing the 'ex'. The website states that the firm's "area of expertise is at the knowledge end of the 'Information Value Chain'"[i].

The company had its genesis when Rob Smillie, working at the Crown Mineral division of the Ministry of Economic Development (MED), identified the cumulative information value residing in routine reports filed for prospecting licence compliance. Simultaneously, Greg Partington, working in a project at the Crown Research Institute (CRI) Geological and Nuclear Sciences (GNS) was using GIS models and Bayesian statistical techniques to identify prospective areas for different minerals. Rob and Greg developed a prototype GIS showing gold prospectivity on New Zealand's West Coast in a joint venture between Crown Minerals and GNS in 2001, with a view that the two organisations would extend the project to cover other areas of New Zealand. When it became obvious that the government departments could not follow-up on the commercial potential of the GIS, and that it would lay idle under the joint venture, they, along with Michelle Stokes who has also worked at Crown Minerals, set up Kenex.

The firm is based in Eastbourne, near Wellington. As an information-based company, Kenex could theoretically be located wherever the partners chose. As all three partners had previously worked in Australia and Michelle is Australian, serious consideration was given to locating the business across the Tasman. The partners describe their location decision of a seaside town in New Zealand as one based on a combination of the "New Zealand government's stated commitment to developing a knowledge economy and offering support to small businesses to grow", and a "lifestyle choice made possible by the comparatively low price and ready availability of the broadband Internet information exchange infrastructures in New Zealand" that they would need to communicate with their clients and partners. As Michelle says, "you just couldn't operate the business in Dongara, WA where you have to go down the road to use the 56kbps connection at the Telecentre to avoid tying up your single phone line at home". The state of the infrastructure and price premia charged for broadband in other than metropolitan areas in Australia, even where infrastructure is available, were significant deterrents to the partners which made the decision to locate in New Zealand economically more sensible.

The Kenex partners see their business as bringing together "people, data and information … in a way that empowers organisations through increasing knowledge and intellectual capital"[ii]. By applying their unique skill mix of business development, mining industry experience, research and development experience, and spatial

information technology capabilities, the partners provide a range of services to customers in the earth science and agricultural sectors. These services include spatial data acquisition, compilation, management, analysis and modelling, along with geological and geographical information system consulting, training, and tenement management and monitoring. The wide range of the firm's activities is summarised in its motto "Creating Business Opportunities in the Spatial World".

The company provides services to a wide range of both public and private sector clients in New Zealand, Europe and North America[iii]. Clients are typically mineral exploration and mining companies who use Kenex's unique spatial modelling and prospectivity GIS outputs to gain increased information to decrease risk of prospecting failure when selecting areas in which to apply for prospecting permits. The Crown Minerals section of New Zealand's Ministry of Economic Development has also used Kenex to produce models to promote prospective areas of New Zealand to overseas exploration companies, in order to attract increased investment in the sector. In partnership with other technical specialists, Kenex has also successfully applied its GIS data and analysis techniques to horticultural projects. Kenex is the only company of its type in New Zealand, and one of only two commercial organisations in the world producing mineral prospecting models using GIS.

The business has provided full time employment for three people since its inception. When Rob Smillie left the partnership in December 2003, he was replaced with a full-time staff member. Greg is the managing partner, and a board comprised of Greg, Michelle and independent director, Sue Fitzmaurice, determines the strategic priorities of the company. Since its inception, the business has been extremely successful, with profits amounting to around 50% of revenue. Furthermore, joint ventures with clients have given Kenex equity and equity options in current and future projects. On the basis of current projects, if mineral prices stay at their current levels, Kenex work will attract a projected investment of up to $14 million in exploration in New Zealand over the next eighteen months to 3 years. This does not take into account the $100 millions worth of value to New Zealand if a mine is discovered.

Business Model

Kenex is a business that sits squarely in the field of 'knowledge working'. Kenex creates knowledge products by applying the specialist skills of the partners in combination with the capabilities of the GIS software to information provided by clients and the GIS data bases compiled by Kenex and its partner organisations[iv]. Thus, Kenex is a 'knowledge firm' that applies human capital (in the form of geological knowledge, business development and analysis skills, GIS development and analysis skills, etc.), information capital (in the form of its databases and software), and physical capital (computer hardware) to client information to create the desired 'knowledge outputs'. These outputs can take many forms, for example:

- Customised interactive GIS packages such as the samples displayed on the Kenex website http://www.kenex.co.nz showing prospectivity for specific minerals in specific locations and permit details for specific areas;
- GIS data documentation; and
- Geological consulting reports.

ICTs at Kenex

Kenex uses MapInfo and ArcView GIS software and current high-end desktop computers to convert data from its partners into GIS outputs. The firm distributes most of its GIS models to clients along with written reports on CDs using standard mail services. Reports and models are also distributed as attachments using email. This method ensures confidentiality of the reports and does not require the client to have the high-speed Internet access required for effective interactive web access. Also, it is a very cost-effective distribution method for both Kenex and the client, as the data and the model, once the project is finalised, do not change. As the client takes ownership of the model at this point, there are few justifications, either in terms of timeliness of data change or ease of access, for providing an on-line service hosted at Kenex for these products.

However, Kenex does maintain the capability for clients to access models interactively using a web interface. Access to these models is maintained using password protection. Use of the on-line models is typically greatest during the development and analysis stage, where collaboration between Kenex staff and clients is an important

part of the knowledge generation process. This feature is particularly valuable in development, as most project partners are based remotely. Hence, web access reduces the time taken to develop models. However, it does not eliminate all face-to-face or telephone contact.

Aside from its use in the development process, Kenex maintains examples of its models at their web site (http://www.kenex.co.nz) primarily as a marketing tool. The sample GIS models allow potential clients to gain an understanding of the tool, but the website also stresses the added value that Kenex staff provide over and above the modelling process. The web site offers no capability for selling or payment processing, as the nature of the business is such that the terms of the small number of very complex contracts must be negotiated individually.

Kenex's website is maintained on servers at the company's ISP, with periodic uploading of data, as the asymmetric nature ADSL and the slower upstream speed does not enable the site to be managed on the servers at Kenex. However, this does not present a problem, as the website data do not need to be changed in real time, whereas downstream speed is important for receiving data from partners. Most exchange of data from Kenex to clients is undertaken using attachments to emails.

Benefits of ICT: From Complement to Competitive Advantage from Human Capital

Whilst hardware and software are an integral part of Kenex's production chain (the GIS products are unable to be produced without ICTs), these capital factors are readily available in the relevant markets. The key to Kenex's ability to add value lies in its databases of GIS information and the human capital that creates the databases and analyses the information to create the relevant outputs (interactive systems, reports, etc.) and prospectivity models: in other words, knowledge. Most of the data used in the Kenex databases is either freely available publicly, or the rights to use the data can be purchased from the originating sources. Thus, in the ultimate, the key to Kenex's ability to use its assets to create a sustainable competitive advantage lies in the skills of its staff and the skills of the organisations that it partners with – that is, the human capital. As with any other business traditionally involved in the production of

information outputs using information inputs (eg medicine, law, accounting), in the absence of any exclusive rights over the hardware and software, it is the skills of the individuals that distinguish one business from another. The unique factor that characterises Kenex's human capital is the unusual combination of technical (geological and other scientific specialties and GIS) skills with an understanding of the ways in which information can be utilised to create value.

Problems with ICTs

The Kenex partners report no specific problems with the ICTs they use. The main problem that they, and other businesses working in the knowledge economy to create and operationalise new knowledge products, face is a lack of understanding amongst potential business partners of the different ways in which data, information, knowledge and processes contribute to the creation of value in a knowledge economy. Unless these business partners understand these processes, then unnecessary obstacles are placed in the way of companies such as Kenex which prevents them from increasing the stocks of knowledge processes from which the New Zealand economy can derive benefits into the future.

It is usually expensive to create a knowledge product, but cheap to reproduce it. Unless the costs of creation can be assured, there are few incentives to create new knowledge. Its creation is thus a risky business. Furthermore, its value does not typically decrease with time; rather its value may increase as new information is added to an existing base, making both the new and original information more valuable than either individually (that is, increasing returns and network effects). Moreover, its value is determined by its use. The same information product may have significantly different values in different uses. Finally, it is a 'consumption good'. Its value to the user cannot be determined until it has been 'consumed' (or observed). But having 'consumed' it, the value from consuming it cannot be returned or refunded if the product does not meet expectations.

Industries producing knowledge products thus face a dilemma in how to charge for their products. Unless they have a very clear understanding about how they and others use the products (and these may be many and various, due to the multiple

reusability and different uses for the same information), then the products may be priced inappropriately. The great danger is, as Arrow articulates, that knowledge products will be underutilised, and specifically that inefficiently low levels of new knowledge creation will occur. For a country striving to generate superior returns to its trading rivals in a knowledge economy, inefficient use of knowledge products places that country at a disadvantage.

Creating Value From information and Knowledge

Kenex charges clients a fee for consulting services performed. Growing revenue in this environment is predominantly a matter of getting more consulting contracts.

The consultancy's charging model relies upon the fact that it is the knowledge workers that are the 'scarce resource', not the information that they process. Clients paying consulting fees are paying for the knowledge worker to process information that may be 'owned' by any entity. The value comes not principally from the information input, but from the unique set of information processing skills that the knowledge worker applies to that information for which the client is willing to pay. Processing by the knowledge worker does not deprive the 'owner' from being able to use the information for any other purpose, as long as the information can be reproduced at low cost. The 'owner' of the information is only threatened if the processor who uses the data is competing with that owner using a process that is a substitute for the processes from which the owner derives value. Only then is it in the interests for the information owner to restrict its use in processes owned by others.

Property Rights to Information

Kenex's approach to charging for information and processes is illustrative. Kenex management draws a very clear distinction between property rights to data and property rights to the processes that manipulate and add value to that data. Moreover, the distinctions between Kenex processes (both human and software) and those processes for which rights of use have been purchased (eg the hardware and standard GIS software) are also recognised. Unless the agreement with the commissioning client specifically requires confidentiality of the output models, Kenex makes the GIS models it creates publicly available on its website.

Making GIS outputs available is not considered a threat to the ability of the firm to generate returns, as income is derived not from the sale of images or data, but from sale of the consulting reports and associated services that the firm provides as a result of constructing the GIS models. Whilst the models can be cheaply copied and distributed multiple times, the scarce resources from which returns are generated are the firm's human capital (i.e. report-writing and other specialist services) which is not reproducible and is a proprietary process, therefore not made freely available.

When information workers develop, through their own research and development investments, new information processing techniques (eg Kenex's specific mineral prospectivity modules incorporated into the GIS systems), then it is protection of the knowledge creation process rather than protection of the outputs that entitles the creator to enjoy ongoing returns. Indeed, the processor is incentivised to widely circulate the outputs in order to ensure as many potential clients as possible become aware of the value that he is capable of adding to input data, overcoming some of the 'consumption good' problems of potential consumers being unable to 'see before they buy' thereby increasing the returns gained from multiple uses of human capital and proprietary processes.

Only if the process can be reverse-engineered and replicated perfectly from outputs alone would it be necessary for the outputs themselves to be protected (eg by copyright, patent or concealment) in order for Kenex to continue making returns from the development of the process. Electronic outputs, for example, may be presented in a format that does not incorporate the software that led to its creation. Information products are often formed using processes requiring a specific complementary, but scarce human resource input, which is never replicable, so even if the process can be discerned, the full extent of value creation cannot be replicated. Hence, the need for legal protection of the processes may not be so great as for the production processes for a tangible product (eg a design and construction methods used for a piece of furniture), which can be discerned from the item itself.

Access to Public Data for Process Research and Development

Whilst the Kenex partners can make a comfortable return from selling services associated with their existing processes, they see significant potential to expand their

existing GIS data and prospectivity modelling techniques into industries other than mining, for example horticulture and agriculture. A pilot project modelling likely planting locations for wine grapes has already been undertaken. Although Kenex can provide some data, geological knowledge and modelling skills, such projects require data and specialist knowledge from the other industries, and cross the boundaries between consulting services and research and development activities. The outcome of these projects is a new 'prospectivity' application from which new business activity can be developed.

Although possibilities for developing new processes exist, the risks of research and development not leading to the creation of viable commercialisable model each time are significant. Greg likens the risks of research and development to the risks faced by prospecting companies looking for commercial mineral deposits, which also have high probability of failure. In the mining industry, the risks of failure are managed by joint ventures between prospecting companies employing geologists who provide scientific input, mining companies who provide the technology to extract the minerals when located and financiers who provide the resources to carry out the exploration.

Kenex has successfully developed joint ventures with companies (eg mining, horticulture) willing to exploit a 'prospective' location (eg for gold, or grape growing) identified using GIS systems and models developed by Kenex and consultant partners from the other specialties (eg horticulturists) who have access to the specialist knowledge and the data required to create and perfect the models. In effect, the owners of the data provide a role similar to financiers in that the data are essential resources to the process of developing the model. The joint venture structure shares both the risks of failure and the gains from success across all participating parties, and ensures that the property rights to the resulting intellectual property developed are clearly vested in the joint venture, rather than any of the individual partners. All profits from successful applications are therefore shared amongst the partners, unless a commercial decision is made to dissolve the venture and sell the intellectual property (i.e. the model) developed. Without common ownership of the joint venture, no individual business partner would be able to bear the risks of undertaking the development, and the potential commercial benefits from a successful development are lost to the economy.

However, if the potential partners for such research and development projects are not clear about how they create value from their own information and/or processes, then the ability to negotiate either purchase of the requisite skills and data or the respective contributions to a joint venture is severely compromised. The Kenex partners have found that the attitudes towards both availability of data and the willingness of owners of information and skills, to enter into efficient commercial agreements to enable the development of new knowledge processes, are highly variable. Within the mining industry, there have been few obstacles, and it is from this industry that most of the Kenex joint ventures have emerged, resulting in the development of models for gold and granite gold prospectivity. However, where the requisite resources reside in state ownership, either in government departments or CRIs, the partners have come up against obstacles that have at times appeared to have arisen out of either a lack of understanding about how to value information and processes, or a fundamental lack of understanding about the use of equity partnerships as a means to manage the risk of research and development. Furthermore, the approaches have been inconsistent between various state entities.

Price Discrimination for Government-Owned Information

For example, Crown Minerals data collected as a by-product of the permit management process is freely available, albeit with a transaction charge for reproduction. However, data from Landcare is charged for according to a schedule that appears to bear little resemblance to the costs of reproduction. For a particular set of data that Kenex sought to get on behalf of a client, a charge of $1800 was quoted for public sector entities or publicly-funded research, a price could be negotiated with 'approved companies', or if the client was a consultant, a fee based upon a number of data points was quoted that equated to $41,000[v]. As Kenex was deemed to be a consultant, the highest charge would apply. Approaches to negotiate as an 'approved company' failed to reach any satisfactory conclusion, as Kenex was unwilling to pay a substantial sum until it could be ascertained if the available data could in fact be used for the required purpose. Landcare, on the other hand, would not let Kenex see the data to assess its usefulness without paying the fee first.

Such discriminatory pricing based upon organisational ownership alone takes no cognisance of the use to which the data is put. When the use is research and development, the effect is to 'crowd out' such activities undertaken by private sector enterprises in favour of publicly funded research. Kenex could put a proposal to FoRST for exactly the same project that it might offer to a private sector funder, but if the state funds the research, the price for the data is less, even though the applications developed will be used by the same industry sector in the same country. If the price for access to data is prohibitively high, then private sector funding will not arise; if FoRST does not fund the research then it will not occur either. Thus, FoRST 'sets the agenda' for research using CRI data, yet in the current environment, FoRST-funded projects probably have the most "inelastic" demand. The net result is less research and development undertaken in total. And just as with minerals prospecting, valuable information is lost. When a well is dry or a core sample fails to reveal evidence of the sought-after mineral, even this information is valuable, as it will prevent future prospectors from going over the same ground. In the research environment, the potentially profitable development will not be created, and even if the research is undertaken and the results are not able to be commercialised, there is still value, as the failure by this venture will prevent future ventures from pursuing what has already turned out to be a failure.

Furthermore, the only reason for discriminatory pricing in the private sector is the transfer of all surplus (or as much surplus as possible) to the seller. CRIs are charged with generating a return on their assets to their owner, the government. However, in respect of information for research and development, the 'cost' of the profit is a reduction in the quantity of research undertaken. Thus the government's role as an owner of the CRI expecting the return of dividends is at conflict with its role as custodian of a New Zealand knowledge economy that stimulates the creation of knowledge and knowledge products. The current pricing schedule favours the interests of ownership over the public good. This does not appear consistent with a 'Knowledge Economy' strategy.

Strategic Obstacles

This begs the question of whether there is any strategic reason why CRIs would want to crowd out private sector research using 'their' data. It is feasible that CRIs view

organisations such as Kenex as rivals for private sector research funds. This may be reasonable if the CRI is undertaking research in the same area as Kenex. Yet Kenex is the only enterprise either public or private in New Zealand using the combination of GIS and Bayesian modelling to develop prospectivity models. So even here the rationale is flawed. The only other feasible strategic reason may be that the CRIs see Kenex as competitors for state-funded research. Yet even this appears to be barely plausible, because if Kenex did apply and receive FoRST funding in competitive processes, the CRI would be bound to supply data at the lowest price under the state-funded research clause. Only if the discriminatory pricing actually forces Kenex from the market would this benefit the CRI. Yet this is only an academic question. Kenex has never applied for FoRST funding, as it has access to funding from the private sector.

The only possible outcome of the discriminatory pricing is to increase the cost of identical research undertaken in the private sector so that it is many times higher than the same research in the public sector. If the private sector funder pays the high prices, then less research is undertaken for the same combined budgets than if the lower price was charged. Thus, the research that is undertaken is inefficiently expensive. The only loser is the New Zealand economy that could have got more research for its dollar.

Joint Ventures as a Solution

The problem of pricing of information could be overcome, however, by the custodians of the data assessing the price and availability of the information by the use to which it is put rather than a crude proxy of ownership form of the accessing organisation. Ownership of the information need not change; access could be offered on a licence basis, limiting the ways in which the data was used without threatening the other uses to which it might be put. If fear that the resulting process will be used for profitable purposes from which the information owner might be excluded if the CRI is merely a supplier, then the logical contractual approach would be to take an equity stake in a joint venture company to undertake the research. That is, the government could become a part owner in the research by providing the information as a 'share'. Similar approaches could be taken if the intellectual capital of government- or CRI-employed

personnel was important to the research process (for example, acgricultural scientists for developing agriculture sector models).

Yet even with this approach, Kenex has encountered resistance. Repeated attempts to form joint ventures with GNS and discussions with Landcare and have failed, as according to Greg, the management of these CRIs cannot "get their heads around the model" as a way of progressing the research. Negotiations of this form with GNS were pursued for over twelve months before Kenex gave up trying to establish a project along these lines. Not only does Kenex lose out on the potential research opportunity, but negotiating with these entities is a time-consuming process. Michelle estimates that negotiating with government departments, one way and another, has taken approximately one man-year in the eighteen months that Kenex has been operating, for negligible productive outcome. It is with a touch of irony that Greg identifies Kenex's origins as a joint venture between a government department and a CRI. If these arrangements can be acceptable when both partners are government-owned, he asks, why are they problematic when one is privately owned?

Government Support for Knowledge Companies

Greg, Michelle and Sue all express disappointment with the levels of support promised, but not provided, by the government agencies charged with assisting businesses to establish themselves in the New Zealand 'knowledge economy'. As a new small business with a knowledge product, Kenex would appear to be an ideal candidate for support from these agencies. However, the reality has been sobering. The partners have approached Trade and Enterprise New Zealand, BizInfo and the Wellington Regional Development Agency to see if they could qualify for assistance to grow the business by moving into other areas such as agriculture.

Whilst ostensibly assistance is available, the nature of the Kenex 'product' does not fit neatly into any of the categories for which 'knowledge economy' money is available. Their product is none of a true product, service nor software. Sue likens the process of applying to 'passing a test by ticking the boxes'. If you can tick the right boxes, then you may be eligible for assistance. Even though Kenex's product is a pure knowledge one exported to all corners of the globe, it didn't fit the profile of exportable "high technology products" (electronic equipment) or "high technology software", so didn't

qualify for assistance. Furthermore, the partners had great difficulty in convincing the assessors that the real benefits of their products extended far beyond the contract value of the sale of analysis based upon the models into flow-on investment in the mining, horticulture and agriculture sectors in New Zealand.

Furthermore, the partners found that the officials with whom they dealt had no real concept of knowledge as a commodity, but rather could comprehend only tangible products that they could count or measure. This explains the focus on electronic equipment and software as the sectors to have benefited most from "knowledge economy" business support policies. Yet these products are only the tip of the iceberg of the potential knowledge products that could be developed. As Howell (2003)[vi] notes, by focusing on the technologies, it is easy to overlook the fact that the real value in an information economy is generated not by the technologies, but the information they process. It makes little sense to talk of the information economy and then measure it by counting the machines that process and transmit information rather than the value that is created from the information itself. This is about as sensible as measuring the value added to the economy by electricity solely by counting the generators that create it and the wires that transmit it, whilst ignoring the value added by industries that use it. Yet government support to businesses, by the Kenex partners' experience, is skewed towards the information equivalent of makers of generators and wires rather than the companies that make and sell things using electricity.

Summary

Kenex has flourished, despite all of the obstacles faced to date. The company's success has been as much despite government co-operation as because of it. Other companies may not be so fortunate. The Kenex partners have a very clear understanding of their product and have been able to establish a sustainable business case to pursue their work and product development without New Zealand government support or assistance. Ironically, the New Zealand economy may be the loser. Core geological data in most Australian states is available free (except for reproduction costs). When a client has a choice, it will cost less to develop new models for the Australian environment, which will attract new mining investment to that country in

preference to New Zealand. Although Kenex may remain a New Zealand company, paying taxes on profits in New Zealand, the much greater benefits from mining industry investment as a result of the company's activities could accrue across the Tasman. Unless the New Zealand government addresses the issue of the cost of access to information and the value of knowledge products, then real economic differences between the two countries could be exacerbated.

Policy Issues Arising from the Kenex Case Study

The Kenex case study illustrates a real need for the Government to address its role as a holder of the property rights to considerable quantities of information, the value of this information in the processes for which the Government collects the information and the potential value that this information may have in stimulating the creation of greater stocks of knowledge and information products that will add value to the New Zealand economy. Whilst it is acknowledged that information relating to individuals may need to be treated differently to other information, there is potential for the Government to both directly contribute to growth of these industries and act as a role model to other holders of property rights to information stores. This requires the government to address the question of whether the profit objective of CRIs is at odds with the role of government as a promoter of research for the public good. If making a profit from the information is still an imperative, then the use of joint ventures with the private sector must be more seriously considered. The current model appears to inefficiently bias the quantity of research undertaken downward and the cost upward.

Secondly, the Kenex case illustrates the role of Government as a seeding ground and joint venture partner for sustainable businesses based around information products. The genesis of Kenex came from within a government department and a CRI. The individuals concerned were aware of both the availability of the relevant information and the opportunities that it offered, and the initial pilot project resulted from a joint venture between two crown-owned entities. In this sense, the relevant crown-owned entities have 'accidentally' acted as an incubator for the creation of viable information-based business that emerged, in a manner similar to a classic innovation incubator. If the information that stimulates the creation of such ventures is in government ownership, then partnership with government in the initial research and development

stages of these businesses may well be apposite. However, Government must also be aware of the role it can play as a partner in research with the private sector in addition to controlling the agenda either overtly through direct funding or covertly by discriminating against private research using public data.

Both of these policy implications, however, require government to recognise the information it owns as an asset, and the research and development of processes utilising the information as a way of generating a return on that asset. This is in direct contrast to treating information and its collation, maintenance and storage as a cost to be minimised, and publicly owned data a commodity from which profits can be extracted using discriminatory pricing. It also challenges government to make decisions about whether it wishes to be in any of the businesses of managing the databases (that is, 'owning the data'), managing the research processes (that is, controlling the research agenda either directly by commission or indirectly as a research partner), or operating the new businesses (that is, 'owning the processes' following creation) in the long term. The Kenex business could have been continued within the government joint venture ownership, but it is debatable whether the incentives or opportunities would have existed to develop the horticultural applications if the focus had remained solely on minerals prospectivity. Only by understanding the underlying contributions of each component to the value chain can such decisions be made in each individual case.

Furthermore, if Government is to provide advice and financial support to businesses operating in the knowledge creation business under the aegis of its 'knowledge economy' strategy from entities such as BizInfo and Trade and Enterprise New Zealand, then those setting the policies and criteria and those dispensing advice must be fully cognisant of the distinctly different economic characteristics of information products to ensure that the advice given is sound, and that the potentially most valuable businesses are prioritised for receiving support from limited budgets. From the Kenex case, it must be questioned whether, at the current point in time, there may be some doubt about the ability of the current processes and individuals to achieve this effectively.

Government has a responsibility to address these questions in relation to all of its roles as owner of information, regulator and policy-maker.

Appendix: GIS – Geographic Information Systems

What is GIS?

GIS stands for geographic information system. "GIS stores information about objects that have geographic locations. These objects may be points (eg survey pegs), lines (eg fence lines) or areas (eg a farm)."[vii] A geographic information system provides the user with layers of information about a particular place. Examples of the different layers of information a GIS can store and display are streets, roads, buildings, lakes, water pipelines, population, boundaries of properties, and the list goes on. The user defines which layers of information they want to see, depending what they want to find out about a place, and can turn the different layers of information on and off as they desire. For example, a user could bring up information about the size and location of the population, buildings, roads, and lakes within a given geographical area, and if they then decide that the size and location of beaches is useful to them, they can add this information to what is being displayed on the screen.

Components of GIS

A GIS is not merely a software package, but is a system made up of hardware, software, data, and personnel.

Hardware

The hardware required can include a computer, web server, GPS data logger (to collect data), and a digitiser (to convert data from one form to another).

Software

Software is used to create, edit and analyse data. Additional software may be used to extend editing capabilities or to transfer information over the Internet.

Data

The data on a GIS can come from different sources and in different forms. Capturing the data on the system requires identifying objects and their locations, as well as their spatial relationships to other objects. These spatial relationships are central to analysis of information on a GIS.

Personnel

People play a variety of roles in GIS, from computerising information, analysing and interpreting the information on the system, to displaying the data in a suitable way.

Benefits of GIS

A GIS can improve organisational integration through better management of resources, can improve decision-making ability through the availability of better information, and can be used to make maps – from road maps through to maps of the human body.[viii] The use of GIS can also allow better analysis of data, and can be used in design, planning and management of the environment and resources.

Uses of GIS

The geographical locations provided by a GIS can be used in a variety of ways, from planning the best location for a new mall, to finding out what school zone a specific property is in. GISs can also be used "to explore relationships between features distributed unevenly over space, seeking patterns that may not be apparent without using advanced techniques of query, selection, analysis, and display."[ix] In this way, GIS technology has modelling uses ranging from predicting good mining areas through to planning a good location for crops.

Several district councils in the country now have websites with GIS technology providing information to Internet users about flood zones, water and wastewater services, sewer services, locations of buildings, property boundaries, fence lines, and much more. Other areas where GIS technology is used include:

Business

Agriculture

Banking

Insurance

Retail

Telecommunications

Transportation: infrastructure management, fleet and logistics management, transit management

Land and property

Infrastructural databases (eg, to avoid cables where excavation is being carried out)

Landscaping

Real estate: locations of properties, data about the location of roads and other relevant objects such as bus routes, train stations, businesses, beaches, and so on.

Surveying

Environment

Forestry

Marine, coast and oceans

Water and wastewater

Pipelining

Petroleum

Mining and earth sciences

Natural resources

Conservation and sustainable development

Research and Education

Archaeology

Environmental studies

Libraries and museums

Media

Universities and schools

Government

Government and government agencies

Defence

District and city councils

Emergency services

Health

The Future of GIS

According to Peng Aik Lim of the Eagle Technology Group, "GIS is becoming the central information system in many government and central government organisations in New Zealand. It is becoming part of the mainstream IT and IS such as accounting and OA systems."[x] This is demonstrated by the number of city and district councils who have set up GIS links on their websites. The development of the GIS market not only in New Zealand, but worldwide, has lowered the costs of, and seen continual improvements to, GIS hardware, software, and data.[xi] This will promote and extend current uses of GIS technology, and most likely result in innovative applications of the technology in new areas.

Sources of Information:

http://erg.usgs.gov/isb/pubs/gis_poster

http://www.esri.com/industries/k-12/basicgis.html

http://www.esri.com/news/arcnews/winter0001articles/wellingtoncity.html

http://www.gis.com/whatisgis/geographymatters.pdf

http://www.gis.com/whatisgis/whyusegis.html

http://www.gislounge.com/library/introgis.shtml

http://www.offsys.co.nz/GIS.htm

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[i] http://www.kenex.co.nz/services.htm

[ii] http://www.kenex.co.nz/bus_focus.htm (the Kenex home page is http://www.kenex.co.nz)

[iii] See http://www.kenex.co.nz/clients.htm for a list of past and current clients.

[iv] Kenex has built up its core GIS databases from a combination of geological information collected by Crown Minerals as a by-product of its minerals permit management process[iv], research databases owned by the Crown Research Enterprise Geological and Nuclear Sciences (GNS) and land information data sources such as Terralink and Land Information New Zealand. Much of the initial data for the Kenex databases comes from publicly available data held by New Zealand crown-owned bodies.

[v] *"the work was publicly funded but there is IP in Landcare Research. 3 levels of charge- public ($1800), companies (can negotiate a price), and use by consultant etc. The latter is $ 50* sqroot of area in km2 + $15,000. For NZ at say 27M Ha (270,000 KM2) this is $ 41,000."* Email from a consultant provided to Kenex in relation to a quotation for joint work.

[vi] Howell, B. *Measuring the Benefits of the Brave New World*. Editorial In Competition and Regulation Times (9) Nov 2002.

[vii] SOS Consulting: http://www.offsys.co.nz/GIS.htm

[viii] http://www.gis.com/whatisgis/whyusegis.html

[ix] http://www.esri.com/industries/k-12/basicgis.html

[x] Cited in: http://www.esri.com/news/arcnews/winter0001articles/wellingtoncity.html

[xi] http://erg.usgs.gov/isb/pubs/gis_poster