ACHIEVING & ENHANCING E-GOVERNMENT INTEGRATION: LESSONS FROM THE LAND DATA HUB PROJECT OF THE SINGAPORE LAND AUTHORITY

Teaching Cases

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Abstract

An integrated e-government is typically treated as the pinnacle of e-government development but there is currently little research on how e-government integration may be achieved. Moreover, the existing literature tends to treat e-government integration as a single, monolithic state, when integration can take on different forms and evolve over time. This teaching case, based on the developmental journey of a highly successful integrated e-government from a leading e-government nation, is designed to challenge students to think critically about the nature and process of e-Government integration. In particular, the teaching case can be used to (1) illustrate the multi-faceted and progressive nature of e-government integration, (2) highlight the challenges of e-government integration at various stages of progression and the potential strategies for overcoming them, and (3) shed light on how the extent of e-government integration creates increasing value for the participating agencies.

Keywords: E-government integration, Value creation, Inter-organizational systems, Teaching case

1 Please contact this author to obtain the teaching note
Introduction

E-government integration is typically treated as the pinnacle of e-government development (e.g. Layne and Lee 2001) and conceived as a single, monolithic state in the extant literature (For a review, see Siau and Long 2005). The account of the Land Data Hub project of the Singapore Land Authority (SLA) presented in this teaching case however, supports more recent suggestions that the process may be complex, dynamic and evolutionary in nature (Andersen and Henriksen 2006; Lee 2010). More specifically, integration is revealed as a process consisting of three progressive stages with distinct challenges that must be overcome in each stage. These challenges include:

- How do integrating agencies with no experience of working with each other overcome collective problems that arise with integration?
- What can involved agencies do when the e-government integration is stymied by resource constraints?
- How can involved agencies be motivated to participate and collaborate towards the derivation of synergistic outcomes?

This teaching case is thus useful as it hints at the potential strategies for overcoming these challenges. Given the high rate of implementation failure (estimated at 60-85%) in spite of the massive investments in e-government initiatives worldwide (Gunawong and Gao 2010; Heeks and Stanforth 2007), it is hoped that this teaching case can help e-government practitioners to evaluate their own projects, and channel their implementation efforts with the appropriate strategies more effectively.

Organizational Background

The Singapore Land Authority (SLA) was formed in 2001, as a statutory board under the Singapore Ministry of Law. Serving as the national land registration authority, one of the responsibilities of SLA is the management and maintenance of the national land information system, LandNet (refer to Figure 1). Today, there are 15 government agencies participating in LandNet to share and reference land data (refer to Table 1) in their daily operations. Some of these daily operations include land use planning and infrastructure development. These agencies include the Ministry of Law, the Housing & Development Board (HDB), the Urban Redevelopment Authority (URA), the Land Transport Authority (LTA), the National Parks Board (NParks) and SLA. With LandNet, land data is now shared online in real-time. This facilitates efficient and quick decision-making and strategic planning.

Figure 1: LandNet – The National Land Information System of Singapore
The practice of sharing land information among the government agencies goes all the way back to the 1980s. The Civil Service Computerisation Programme (CSCP) was launched at the end of 1981 to enhance the effectiveness and efficiency of public administration. In the Master Plan for the CSCP, the Data Administration Programme was officially launched in 1984 to better manage the vast data resources of the Civil Service by establishing rational national data policies, data standardization and data sharing across the Civil Service. Under the programme, three data hubs were identified: the People Hub, the Establishment Hub and the Land Hub. The People Management Committee, Establishment Management Committee and Land Data Management Committee (LDMC) were set up to oversee the implementation and steer data administration of the three data hubs. The LDMC was established to spearhead land data sharing in the Civil Service. LDMC was later re-constituted as the Land Systems Committee (LSC) in June 1985, chaired by Ministry of Law. Land Systems Support Unit (LSSU) was set up in September 1989 as the specialised technical support and co-ordination arm of LSC. The unit co-ordinates the on-going technical implementation and oversees the daily operation of the Land Hub.

Prior to the Data Administration Programme, agencies in Singapore that required land information had to search for and obtain them manually and individually from one another. To make matters worse, there were no Geographic Information Systems (GIS) at that point in time, and tracing papers were used and overlaid on top of each other. Mr. Chim Voon How, the present Chief Information Officer and former head of the Land Information Centre of the SLA brought up an interesting snippet of history:

“...because the more you stack (tracing paper), those at the bottom start to blur out because the tracing gets too thick”

However, with the CSCP in full swing, proprietary GIS systems were introduced into the individual land-related government agencies. At this point, the Singapore government noticed that with the newly acquired IT resources, agencies had started to migrate from tracing paper to digitized maps. Ms Kwong Yuk Wah, Manager of the LSSU at the time, elaborated:

“...when the civil service computerization program started in the early '80s, we realized that when we went through the computerization of all the Ministries, we have a lot of data resources. Hence, we must actually know how to use all the data resources”

However, due to the lack of integration, the disparate electronization efforts of the various land-related agencies did not eliminate the problems of the duplication of data maintenance effort, inaccurate and inconsistent land data, and land data redundancy across the Singapore public sector. Consequently, the
Singapore government realized that the functions of public administration could be greatly improved if data were treated as a corporate resource and shared across the Civil Service through a centralized data hub. This led to the conceptualization of LDH. The concept of the LDH at that time was fairly simple; instead of letting every agency that manages land-related data handle, process, and modify their individual sets of data, a centralized hub that facilitated the sharing of common data among the various government agencies could be implemented.

**Case Description**

The following subsections describe the process through which the integrated, inter-organizational e-government that was the LDH was implemented and developed over time. In particular, as we noticed that the LDH has gone through three distinct incarnations over the last 20 years, we will present our case study in three chronological phases. The following figure (refer to Figure 2) provides an overview of the major milestones in the evolutionary lifecycle of the LDH to date.

**Figure 2: The Evolution of the Land Data Hub**

**Phase 1: Land Data Hub (1987-1997)**

With the financial support of the Singapore government and the United Nations Development Program (UNDP), a pilot project for the LDH was initiated in 1987. The focus of the pilot project was non-technical, centered on the conceptualization of data sharing policies and data standards as opposed to the specific forms of Information Technology (IT) that would enable the implementation of the LDH. Ms Kwong Yuk Wah explained the purpose behind the pilot project:

“...the pilot was not so much on the computer system, the pilot is mainly (related to) the policy. So we decided on what is the data sharing policy, and what kind of data standard we should establish. It’s more of an institutional kind of setup rather than the computer system”

After the pilot project, the Ministry of Law was selected to oversee the implementation of the Land Data Hub. The decision was made as the government felt that it was more appropriate to place the project
under the purview of a ministry as they believed that it was easier for a ministry to gain the mandate to enact the activities and changes that were required for the implementation of the inter-organizational system. Mr. Ng Siau Yong, the Director of the Geospatial Division at the SLA, described the rationale of the government:

“I believe that a top-down approach starting from the policy level is the way to go... for most ministries, the functions are more policy-oriented whereas the stat boards are more operations-oriented... So I would say ministries, when they speak to other ministries in driving a certain government wide project, it would probably be more effective. At least they will decide at the ministry level first, at the policy level...”

Another reason why the Ministry of Law was chosen among the other ministries was that it was already responsible for 3 major land departments: the Survey Department, the Land Office, and the Registry of Title and Deeds. Each of these departments had a distinct set of responsibilities relating to land information. An additional department, the LSSU, was established under the Ministry of Law to manage the overall implementation of the Land Data Hub. A Land Systems Committee (LSC) was also established to discuss and oversee the policies and procedural changes required to facilitate land data administration and sharing.

The LSC in the initial setup was established for two purposes. First, its aim was to identify the agencies that could help in contributing land data to the LDH. During this period, agencies that used large amounts of land data were identified on the basis that they had the data required to form an integrated base map for Singapore’s overall land planning purposes. Among others, the agencies identified include the Urban Redevelopment Board (URA), which is the national land use planning authority; the Housing Development Board (HDB), which manages public residential housing, Singapore Telecoms, which had map layers of the communications infrastructure, and the Public Utilities Board (PUB), which had the data related to drainage and sewerage, as well as the Ministry of Defence, which was managing the use of land for military purposes. Collectively, these agencies provided the LSSU with enough information to create the overall base map within the LDH that all agencies could reference.

Second, the LSC played a critical role in establishing and making decisions about the data policies, enabling IT systems, and standards for data formats that the LDH would require for the storage and exchange of land data. This ensured that there were concrete data policies and standards that provided guidelines for the other agencies, which in turn, would translate to the ease of data exchange when the LDH was eventually implemented. The decisions of the LSC with regards to system implementation and data standardization were enacted by the LSSU. Ms. Kwong Yuk Wah explained the roles of the LSC and the LSSU in the implementation of the LDH:

“...the LSC’s role is really to discuss all the policies, all the standards... (and) the (role of the) LSSU... is, after the setup of the policies, then (the LSSU would) go on to do the integration, implementation, setting of the standards, (and) basically do the integration”

After the decisions concerning the policies, data formats and enabling IT systems were made by the LSC, the LSSU commenced the implementation of the LDH. During this period of time, the main priority of the LSSU was to integrate the different forms of map data into a single map layer. This integration of data took almost five years and was divided into 3 forms of data: (1) mapping data, (2) graphing data, and (3) textual data. Ms Kwong Yuk Wah described the challenges of data integration:

“Textual data such as census data was a challenging prospect to integrate. We had to standardize the textual data formats based on what was decided by the LSC. However, the data that was gathered from other agencies were in many different formats as before the LSC set any standards, agencies were free to decide on what formats suited their particular needs.”

One of the reasons for this problem was the technical limitations of GIS technology at that time. There were no open standards for GIS information as software vendors were all trying to lock customers to their own existing proprietary systems and data formats. This made data integration from the agencies tedious and time consuming as apart from deciding on the data formats for the base map, the data that came in from the various agencies had to be re-converted back into the LDH’s data format. Mr. Anupam Mukheriee, the Manager of Application Services at the SLA, offered his views:
“...each agency had their own proprietary software. So that was the situation then: all of them were using different kinds (of software), some used ESRI, some used Intergraph, some used Autodesk... but we didn't have much choice then, as you know in GIS, there are products for specific applications. So the agencies were just using software that accomplished their own goals.”

To deal with this problem, some in-house data conversion tools were created to make the process of data integration with the various agencies less time-consuming and tedious. Although there were no off-the-shelf products that provided such capabilities, LSSU was able to implement their own customized solutions to tackle the problem. The objective for data integration was to allow LDH to be a centralized source of data where the relevant agencies could retrieve the latest and most up-to-date version of the common map layers that they required for their operational and planning purposes. Aside from data integration, the LSSU was also responsible for the distribution of the data. In the initial stage, data was distributed using magnetic tapes. This evolved to the use of CD-ROMs for data exchange when the use of CDs became widespread.

However, due to technological constraints, individual agencies still had to keep their own data. The LDH overcame this situation by implementing a control duplicate, which meant that although agencies had to keep their own base map that was sent from the LDH, agencies were not allowed to modify the map in any way without the expressed approval of the LSSU. All updates to the base map were made solely by the LSSU and stored into the LDH until the next scheduled release of the base map. Ms. Kwong Yuk Wah explained:

“At that time, we didn't have broadband internet services that we have now. So agencies still had to have their own individual databases to store the map layers... the vision was always to provide an online overlay of map information, but that was not possible...”

To get agencies onboard in contributing to and retrieving data from the LDH, the Ministry of Law decided at the time to sponsor the cost of running the LDH and provide the service of sharing the common map data for free to the participating agencies. Ms Kwong Yuk Wah described the rationale behind the decision:

“The decision was very clear that we didn't want funding (issues) to affect the progress of the project. So there was no discussion that the cost was to be shifted to the participating agencies.”

As the costs of implementing and running the LDH was borne by the Ministry of Law, it lowered the barriers of participation and allowed many agencies to participate and contribute data to the LDH as most agencies saw the advantage of a centralized source of data. Moreover, with established mechanisms for data exchange and the availability of more accurate and timely map information, it was not difficult to convince the various agencies of the importance of the uniform data standards and policies of the LDH. However, getting agencies to commit to the new data standards had its challenges as each government agency had to modify their systems to comply with the data standards that had been set by the LSC. Fortunately, most agencies understood that the benefits far outweighed the costs. Ms. Kwong Yuk Wah explained:

“...the demand for the data drives the supply. This means if agencies needed to exchange data from the LDH, they would have to follow the standards that had been set by the LSC... If the agencies did not follow the standards, they had to do their own data conversions when retrieving data from the LDH...”

This provided the motivation for agencies to move towards the standards and data formats established by the LSC and accelerated the pace at which data integration and centralization of map data was done across the Singapore public sector.


With the convenience afforded by having a centralized source of common map data, the participating agencies began to expect more from the LDH. For instance, there was a general drive towards greater efficiency across the Singapore public sector at the time, and government agencies had to find the means
of improving the efficiency and effectiveness of their planning and operational activities. With the need for shorter planning cycles, the demand for more timely data by the various public agencies grew. Apart from having more timely data, agencies also wanted more flexibility when it came to retrieving data from the LDH. A number of them were requesting the rights to retrieve map data as and when it was required, without having to make any specific request to the LSSU. Mr. Chim Voon How described the situation at the time:

“... as the planning cycles of the agencies got ramped up, there was a need for more timely information... (Moreover,) agencies said that... every time they needed data from us, there's a service level of 3-5 days. So they asked if we can reduce (the time required). If (they) wanted the data now, can it be within a day or can (they) get the data and deal with the data (themselves)?”

At around the same time, a high-speed, secured government intranet came into the picture, which inspired the notion to share land data electronically. The emergence of the enabling technology, coupled with the growing demands of the participating agencies provided the impetus for the second incarnation of the LDH as the SLA soon realized that the current operational model was no longer adequate in fulfilling the needs of the various public agencies. This led to the launch of a pilot project that was named “LandNet Pilot”

LandNet Pilot began in 1998 and involved 3 government agencies; the Ministry of Law, the URA and the LTA. These agencies were selected on the basis that they were the primary contributors and users of land data. Although the LandNet Pilot project was still helmed by LSSU, both the URA and the LTA played critical roles in enhancing the features and streamlining the requirements of the system. Mr Tan Chia-Li, a Senior Planner at the URA, elaborated on the roles of the collaborating agencies:

“... we gave inputs to the LSSU team on things such as setup, implementation of the system and its features, and setting up some of the standards... Usually it's a two-way thing. Because the LSSU proposes something, we test and give our feedback along the way...”

Despite the limited scale of the LandNet Pilot project, there were several challenges in implementation. First, the staff at LDH lacked the required knowledge and technical expertise to implement the LandNet concept, which was considered the first of its kind at the time. For instance, they struggled with building custom data conversion utilities and batch programs to automate the sharing of data electronically. To deal with this issue, LDH staff trained under a number of GIS vendors and shared the knowledge gained extensively among themselves. Second, even with the high-speed government intranet, there were data transmission problems such as the bulk of data choking the network and firewalls blocking the data. Moreover, implementing the LandNet Pilot required substantial investments in infrastructure at the different agencies.

Faced with these challenges, the LDH team collectively brainstormed on the ways to solve the problems, which provided invaluable insights for their future attempts at implementation. In addition, the three participating agencies actively tested new functions to provide insights for improvements. Most importantly, the LandNet Pilot project provided a glimpse of the benefits from the electronic sharing of data. First, the reduction in manual processes led to manpower and time savings. The three agencies no longer need to export land data to CD-ROMs and send people down to deliver or collect CD-ROMs. Second, the conversion of the data became much more efficient. Each of the three agencies could download the land data, which was automatically converted on the fly into the required format. Third, data became timelier as custom batch programs downloaded any changes every night. Finally, URA and LTA were able to gain the advantage of having the flexibility of contributing and retrieving data at their own convenience through the Singapore Government Network. Mr Goh Chye Kiang, a Senior Systems Analyst with the URA provided the following anecdote:

“I think one of the main benefits of LandNet is the conversion of the data was done on the fly. When we download the data, when compared to the past whereby we get the data from a CD, and we had to do offline data conversion, it was a lot more straightforward.”

The pilot project passed the User Acceptance Test of the three participating agencies and the available infrastructure that was created during the LandNet Pilot Project was carried over in the implementation of the escalated pilot project, known as LandNet Plus. However, the LDH team began to encounter a
number of challenges during the implementation of LandNet Plus. One of the challenges that the LDH team had to face was a change in ownership. In 2001, the Ministry of Law decided that there was a need for cost accounting to ensure that taxpayer money was prudently spent and accounted for. As a result, the decision was made to transfer the ownership of the LDH from the Ministry to a new statutory board, known as the SLA, which would be formed by merging the Survey Department, Land Office, Registry of Title and Deeds, and the LSSU.

A second challenge was that the high costs of establishing the requisite IT infrastructure. Mr Anupam Mukherjee from the SLA elaborated:

“...we found that the cost was too high, because at every agency you had to setup a server, install additional software and hardware. Furthermore, every agency had different GIS systems, which meant that a different GIS convertor was required.”

The high costs meant that only a limited number of agencies could tap into this new online system for electronic data exchange (i.e. in particular, the two agencies – the URA and the LTA – that were recognized as the most significant contributors and users of land data). Although there was no means of tackling this problem directly, the SLA made extensive efforts in improving the exchange of data for all the agencies, regardless of whether they were connected to the new online system (LandNet Plus) or still using CD-ROM mode of data exchange through the LDH. For instance, for the users of LandNet Plus, a version control system was created to tackle the problem of huge amounts of data choking up the network when agencies downloaded or uploaded data from LDH. Before the version control was implemented, agencies had to re-download all the map layers from scratch in order to get the latest version of the data, which was a long and time consuming process. After the version control system was implemented, only the changes to the map were downloaded and updated on the agencies’ systems. This provided the agencies with a more efficient way of retrieving and contributing data to the LDH. Mr. Anupam Mukherjee explained:

“...we build automatic programs to export the data from the agencies, take for example the LTA system, we would export the data in a nightly manner, and put the whole set of data into this LandNet agency server at LTA. Now in LTA agency server, another process will start, which will compare this dataset. Both sides will be compared and the system will automatically find out what has been deleted from the data, what has been changed, any road changes, whatever changes have been made and update accordingly.”

This implementation dramatically improved the performance of online data exchange as data could be retrieved and contributed more consistently without persistent network failures. For agencies that were not connected to the network, the CD-ROM exchange was also improved by allowing agencies to contribute in any format they had. Mr. Anupam Mukherjee provided this example:

“LandNet started doing things automatically. When agencies come in with the CD, the operators will just load in the data, and LandNet will automatically convert it into Oracle Spatial Format.”

This provided the agencies that were still on the CD-ROM mode of data exchange with more incentives to contribute data to the LDH, and provided every participating agency with rich and relevant datasets that helped in their own land-related operations. Aside from improving the technical aspects of data exchange, a monthly agency administrator meeting was also established to allow for better communication between the agencies. Mr. Tan Chin Peng, a manager in the Landscaping/Aboriculture branch of NParks, explained:

“all the members of LandNet will send their agency administrator to this meeting and through this meeting, we are aware of what is the current needs or data use of all the agencies. Furthermore, we are also able to find out data that is available, or what other new layers that are going to be shared out.”

The monthly agency administrator meetings provided members with a clear picture of what forms of data were available for use in the LDH, and the means to make requests for any additional map data that they might require for their operations. Agency members could also voice their opinions on places where they felt improvements could be made to the LDH. SLA would then improve or develop the functionality based on the feedback from these administrator meetings. Overall, this phase provided members with better and
more efficient means of data exchange, which was done to encourage agencies to contribute more data to the LDH.

Despite the attractive potential benefits of an online mode of data exchange, the LandNet Plus project was not carried to fruition in the end as the costs of government-wide implementation was excessive. When a tender was called in 2001, the proposals received exceeded the budget by far, suggesting an estimated cost of $10 million to implement the system on a government-wide scale. Moreover, costly satellite servers had to be set up and maintained across many agency sites. And the problem was that many agencies had different GIS systems with custom built components. Consequently, plans to implement LandNet across the agencies were shelved. While the tender results did not sound a death knell for LandNet, further developments stagnated and rollout across multiple agencies was deemed infeasible. The return on investment was hard to quantify and not everyone was sold on the idea of spending on IT infrastructure, especially when the implementation was projected in the region of $10 million. Fortunately, a new technology was about to emerge to breathe new life into LandNet.


In 2004, Jack Welsh, the Senior Vice President of Oracle’s International Technology Group approached SLA with a newly developed technology not yet seen in the world. He wanted to conduct a proof of concept (POC) for the technology in the LandNet context. The technology was Enterprise Grid Technology. Enterprise Grid Technology effectively addressed the biggest concern which halted the progress of LandNet - the cost of implementation, by allowing LandNet to scale incrementally and affordably. For example, a new database server could be seamlessly added to the architecture when additional capacity was needed. To other parts of the system, all these database servers function as though it is one unified server. Furthermore, the POC sparked off further developments as the Infocomm Development Authority of Singapore (IDA), Oracle, Autodesk, Sun, and SLA pooled their resources. In doing so, they created a small piece of software called the “LandNet agency agent” to handle and coordinate updating of data to and from LandNet, replacing the need for participating agencies to make big ticket infrastructure investments such as satellite servers which can cost up to $150,000. The total cost to link up a new agency dropped to less than $10,000, lowering the barrier for any interested agency, thus paving the way for the government-wide launch of LandNet. Mr. Anupam Mukherjee of the SLA explained the fundamental impact of the introduction of Enterprise Grid Technology:

> “Enterprise Grid Technology helped the LandNet type of concept in a big way. We were able to increase the capacity by simply adding a new server into the architecture, giving us scalability to grow in an incremental manner. An agency agent was deployed on the members’ side that allows for online data exchange between SLA and each agency at a low cost of just $10,000 per agency. This allowed more agencies to migrate from CD-ROM to online data exchange.”

After the LandNet POC, it was determined that Enterprise Grid Technology was sufficient in meeting the objectives of improving data integration and sharing through an online mode of data exchange. Consequently, by 2007, the new, fully operational LandNet was launched with new web-based functionality that enabled participating agencies to overlay map information through their browsers without having to setup their own GIS systems. This provided agencies that have not participated in the LDH project previously with the means to test the capabilities of the new LandNet at a low cost, and encourage the adoption and use of geospatial information.

Yet, although the cost of implementing LandNet is substantially lowered with Enterprise Grid Technology, SLA was confronted with a fresh financial challenge as a result of a new directive from the Singapore Ministry of Finance (MOF). The new directive sought to ensure greater accountability in the use of public funds. Consequently, the SLA made plans to introduce a pay-for-use model and actively gathered the support from participating agencies to share the costs of implementing and sustaining the LandNet project in lieu of public funding.

The policy change created a number of challenges to overcome. First, it meant that existing and potential participating agencies had to relook their bottom line and source for funding to participate in LandNet. Second, the pay-for-use model adds on to the ongoing challenge of securing the participation of different agencies. Previously, some agencies were already reluctant to share “sensitive” information. With the pay-for-use model, many of the agencies wondered why they were sharing their land data freely but yet had to
pay to access the land data. As a result, SLA had to overcome resistance to the pay-for-use model by convincing the different agencies that cost-sharing was the way forward. Mr Asokan, the Senior Manager of Estates Geospatial Information (EGI) at the DSTA explained:

“I would say that, because essentially with that policy, they (MOF) are only looking from one point of view. They don't look at it from the buyer's point of view. So the buyers now are required to find their own source of funding and justify for it. The communication plan from SLA about describing LandNet is that the data is free, just that you are paying the cost for operating the system. That makes communications on our side a bit tough because people will say “Then I don't need to use the system. Do you need to use the system? Without using the system, can't you just use the data?”

However, SLA invested substantial effort in persuading the agencies that the cost-sharing approach was the only way to keep the LandNet project sustainable. In particular, SLA had numerous dialogues with not only top management, but with middle management of the participating agencies as well, to explain that the average cost would be lower if every agency chipped in. The SLA also understood that participating agencies had to seek the budget to pay for LandNet and was very accommodating in that it agreed to continue supplying the agencies with the data they needed until their budgets were approved. Consequently, even though there was some resistance to the cost-sharing model in the beginning, many of the participating agencies began to see that the value of participation indeed outweighed the cost of sharing the running costs of the LandNet. Mr Tan Chia Li of the URA explained:

“...right from the start we were aware that there's this charging coming, and we also have interest in (being involved in) the operations of LandNet. Otherwise, we will have to go and incur more resources to get information from the various agencies ourselves. So right from the start we were actually (already committed), not much selling was needed (to convince us) that we need to be involved in the project.”

The way the cost-sharing model was implemented was also a critical factor in securing the continuing commitment of the various government agencies. Mr Ng Siau Yong explained:

“We thought ok, based on past behavior, we approximated that when it was free, the usage was like of a certain amount. Now that agencies needed to pay, we thought the usage would be cut by about half. But it turned out to be less than half. And that is no good. So then we slowly adjusted, now is more on (a) subscription (basis) so (the emphasis) is not so much on pay-per-use anymore.”

In response, the SLA quickly modified the cost-sharing model to be more equitable Heavy users of the data had to pay higher fees while lighter users paid less. This modification provided greater incentives for agencies to use and contribute data to the LDH/LandNet and ensured that agencies continued to have access to the most up-to-date data.

Besides playing an important role in motivating agencies to migrate towards the online mode of data exchange, technology also gave rise to improved data quality as it enabled SLA to provide member agencies with a higher level of service quality with data now available on a real-time basis. However, in order to encourage an even greater extent of data sharing and to get new agencies onboard, it was believed that the simple, operational use of geospatial data would not suffice. Mr. Ng Siau Yong of the SLA explained:

“... my view is that the usefulness of data depends on how people use it. If people don't use it effectively then your data is useless. We started promoting the use of spatial data, because when you start getting people interested in different uses of spatial data, it can be more effectively used to produce economic benefits.”

Hence, during the POC, SLA launched several initiatives to change the conventional perception of the LDH as being “just a data repository” to an invaluable inter-organizational information system that enabled value-adding collaboration. One of these initiatives was the launch of the quarterly Geospatial Information and Technology Exchange (GITEX) forums. The objective of this forum was to allow various government agencies to interact and present how they have successfully used geospatial information to improve their planning and operational effectiveness. Aside from how agencies use information, they may
also present on the various geospatial tools that may be used to improve their analysis of the data retrieved from the LDH. Mr. Asokan from the DSTA provided an interesting example:

“Our presentation was about the use of open source geospatial tools. With the availability of data due to the rollout of LandNet, agencies had the opportunity to exploit this data for their own internal needs apart from just using LandNet. They can also download the data and use open source tools to do their own internal analysis and so on. So our presentation touches on the various open source tools that we ourselves are using internally.”

Moreover, private sector organizations were also invited to these forums to showcase what new GIS technology was available, which kept SLA and its members informed about the latest technological developments in the GIS landscape. Overall, the GITEX forums served to increase the communication between the SLA, the participating government agencies and the private sector, and provided a conducive environment for the various agencies to collectively innovate on the various ways in which the geospatial information can be used.

Apart from the GITEX forums, SLA was also aggressively targeting traditionally non-land related agencies to participate in LandNet. These agencies stem from different clusters such as healthcare and education. SLA encouraged participation by creating pilot projects or providing a conceptual showcase of what LandNet could provide. Mr. Lim Ming Khai, the Head of Geospatial Operations & Development at the SLA gave an example of a pilot project done with the Ministry of Health (MOH):

“We approached MOH and said that we could place all their survey information on digital map and let them see graphically the density of the patients and the locations of the hospitals, GPs and clinics in relation to each other. It is very interesting, as looking at the map, you have the distance perspective, the geographical perspective, which gives new insights as compared to traditional tables and graphs.”

This form of collective innovation through novel ways of using the available data was something that was not achieved in the previous incarnations of the LDH, and has led to the development of similar pilot projects with a number of other non-land related agencies. With each successful showcase, agencies begin to see further possibilities of applying geospatial data in their operations, and through dialogue with the SLA, agencies are able to explore how they can collaborate with the SLA to co-produce additional relevant information or applications to support their areas of need.

**Epilogue: Moving Forward with SG-SPACE (2007-Present)**

From 2007, the story of LandNet continues to unfold. As LandNet possesses immense, untapped potential for the participating agencies in the innovative leverage of geospatial data, SLA is currently exploring ways to link up with the data exchanges or “hubs” of other non-land related agencies to form a more powerful entity: SG-SPACE (refer to Figure 3). SG-SPACE is a type of National Spatial Data Infrastructure (NSDI) that has been implemented in a number of developed nations, such as the United States and Australia. Mr. Ng Siau Yong explained:

“...We noticed that many countries are moving towards NSDI. So we assessed ourselves and said ‘yes!’... (Actually,) we already started many years ago. Land Data Hub is a small version of a NSDI. We already have the clearinghouse, we have the service, LandNet. What we perhaps lack is a comprehensive (set of) policies, standards, (as well as) the capabilities. The LDH consisted of mainly land-related agencies. The new agencies that were not part of LDH did not have a means of comprehensively sharing their data...”

Through SG-SPACE, the LDH will be linked to other data hubs such as the People Hub managed by the Ministry of Home Affairs (MHA) and the Business Hub managed by the Accounting and Corporate Regulatory Authority (ACRA). The ultimate aim is to provide richer and more useful information in the geospatial format, and help the local agencies develop their capabilities in exploiting geo-spatial data. Clearly, the SLA can expect new challenges on top of the perennial challenges of inter-agency collaboration: these include technical, data management and communication challenges.
In particular, technical challenges may stem from the hybrid model of data management adopted by SG-Space, which utilizes both centralized and decentralized models. Moreover, as SG-SPACE will enable the sharing of live data, it means that the underlying technology has to be able to support this. With regards to data management, SGSpace will face increasing complexity in data classification and ensuring data confidentiality as more agencies become involved as each agency will possess data of differing sensitivities and classifications. For example, the information that a participating agency obtains from third parties is not shared, and there is also a need to establish proper classification rules to determine what pieces of fundamental and critical data have to remain available at all times.

With the integration of the different data hubs, effective communications between agencies become even more crucial. However, communication challenges may arise as data access policies across the different hubs need to be unified and the details of data exchange have to be worked out. Yet, despite the challenges, there is ground for optimism. Inter-agency committees at various levels have been established. A high-level steering committee was assembled to provide the guiding principles as well as resolving inter-agency issues related to data sharing and harmonizing of data policies. A coordinating committee that reports directly to the steering committee was also set up to handle the operational level issues. Further down, there are also technical committees that handle implementation issues such as the creation of data standards. A committee was also created to promote and create awareness of spatial information. With the committees performing specialized functions at the various levels, cross-agency communications can help to identify and cater to the needs of every stakeholder group to obtain participant buy-in. SLA itself has also taken pains to safeguard the confidentiality and privacy of data. For example, with SG-SPACE, only aggregate data concerning people are displayed. This demonstrates that SLA recognises the concerns of the participating agencies, and by addressing these concerns, the SLA is able to gain buy-in from the participating agencies. The increasing commitment and buy-in from the agencies can be seen from the way they are stepping forward to take up responsibility and ownership over certain layers of information. NParks and BCA for instance, have taken the lead in contributing and managing the data from diverse sources for the tree layer and building data layers of SG-SPACE respectively. In this, the SG-SPACE initiative will provide more value sharing opportunities between agencies and will allow government agencies to become more effective in their leverage of geospatial technology.
References