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## **Governing a Digital Business Ecosystem: Lessons from ONE.MOTORING Portal**

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### **Abstract**

While the IT innovation topic has gathered significant research interests, the existing discourse on IT innovation is centered on internal organizational processes such as IT capability development and organizational learning rather than IT innovation networks as the primary means for achieving superior enterprise performance. This is an important topic because a networked perspective of IT-enabled innovation is a critical dimension for the dynamics of collaborative innovation in today's networked economy. In particular, the development and implementation of a digital business ecosystem (DBE); a specific type of business ecosystem defined as an IT-enabled business network of entities with differing interests bound together in a collective whole, may hold the key to attaining superior enterprise performance in the context of organizations operating in complex business networks. Using a case study of ONE.MOTORING portal and adopting the theory of business ecosystems as an analytical lens, the objective of this study is to examine how are DBEs developed and governed? Our analysis identified three important lessons learnt that were instrumental in developing a DBE: institutionalizing ONE.MOTORING concept within business ecosystem; establishing connectivity and attaining network density and emphasizing value creation. We conclude with research and practice implications.

### **Introduction**

There is a growing trend for organizations to incorporate new technology into business practices to improve market competitiveness (Piotrowicz and Irani, 2010). Over the last decade, the potential of information technology (IT) in enhancing

enterprise performance has grown considerably (Sandhu and Ajmal, 2012). Such technological innovation is essential for the success of any organization in a competitive environment. A good example is how organizations such as Yahoo and Buy.com have leveraged IT to pursue strategies to seize emergent business opportunities (Hansen et al., 2000). In recent years, there are a number of studies that examined the topic of IT innovation. While the topic has gathered significant research interests, the existing discourse on IT innovation is centered on internal organizational processes such as IT capability development (Bharadwaj, 2000) and organizational learning (Sambamurthy et al. 2003) rather than IT innovation networks as the primary means for achieving superior enterprise performance. This is an important topic because a networked perspective of IT-enabled innovation is a critical dimension for the dynamics of collaborative innovation in today's networked economy. In particular, the development and implementation of a digital business ecosystem (DBE); a specific type of business ecosystem defined as an IT-enabled business network of entities with differing interests bound together in a collective whole (Iansiti and Levien 2004a), may hold the key to attaining superior enterprise performance in the context of organizations operating in complex business networks (Darking et al., 2008).

Using a case study of ONE.MOTORING portal, the objective of this study is to examine the process of developing and implementing a digital business ecosystem in a networked economy. Specifically, our research question is: how are DBEs developed? In this study, the theory of business ecosystems is used as an analytical lens as we believe the theory is well-suited for informing a networked perspective of IT innovation as it is replete with prescriptions for competing, strategizing and innovating in the networked economy (e.g., Iansiti and Levien 2004).

The reason for choosing ONE.MOTORING portal was because this organization has successfully developed and implemented a digital business network. It showcased how IT is leveraged to “wire” motoring regulators, vendors, service providers and other stakeholders as well as real-time information on traffic flows and public transports into a single platform to enrich the experiences of motorists, commuters and public. In other words, this important portal connects to every strata or “arteries” in the national transportation ecosystem to deliver real-time information for value-

added experience to motorists and commuters. To be sustainable, DBE portal must be relevant by continuously driving and adding values to its users. We believe its experience may provide valuable lessons on creating sustainable DBE for other public and private organizations. In the following sections, we review the theoretical foundations of IT innovation and Business ecosystem. We then describe our research approach. The case study of ONE.MOTORING portal is described, with particular emphasis on how the process of development and implementation was achieved. This is followed by a discussion on the major lessons learnt. We conclude by highlighting the implications for research and practice.

## **Literature Review**

### **IS Innovation**

An information systems (IS) innovation is defined as “innovation in the organizational application of digital computer and communications technologies, or information technology” (Swanson, 1994). The existing literature suggests IS innovation as mainly having two loci of performance impact (Swanson, 1994), namely (1) Internal business and (2) External business. For internal business, the innovation typically applies IS products and services to the internal business processes of the organization, so as to provide support to business administration. For external business, the innovation integrates IS products and services with business, thus directly augmenting the actual products and services offered by the organization, as well as its integration with other businesses.

So far majority of the studies have focused on the internal organizational processes of IS innovation. With the advent of the networked economy, however, there is a growing recognition that the traditional way of thinking about IS innovation is becoming limited in its ability to explain superior performance against the ubiquitous backdrop of amorphous, unbounded and fluid business networks (Iansiti and Levien 2004). To help address this knowledge gap, we will next review the literature on business ecosystems since the research stream is primarily concerned with mechanisms that promote business ecosystem that is externally focused and may influence firms’ superior performance when operating in complex business networks.

## **Business Ecosystems**

Business ecosystems are networks of organizations that are held together through formal contracting and mutual dependency (Pierce, 2009). The entities of a business ecosystem are structured around core organizations, whose centrality is established on the basis of control over the dominant technological architecture or brand that structures value in the ecosystem, or other factors such as product characteristics or geography (Teece, 2007). These entities include suppliers, producers and retailers that work in tandem to create value, as well as customers and producers of complementary products and services (Teece 2007). In general, the process of ecosystem development is heavily influenced by the role played by the core organization within the ecosystem (Iansiti and Levien 2004).

Specifically, the core organization can provide benefits to the rest of the ecosystem so as to improve its own chances of survival (Iansiti and Levien 2004). The core organization can play an important role through three distinct mechanisms. First, the ecosystem productivity may be improved by maintaining the population of the ecosystem within an optimum range, or connecting different nodes within the network, thereby decreasing the complexity of coordination and integration in value co-creation (Iansiti and Levien 2004). Second, the ecosystem robustness may be improved by introducing a continuous stream of innovations and providing a reliable point of reference for other entities within the ecosystem. This serves to buffer the ecosystem from environmental shocks and help ecosystem members adapt to new and uncertain conditions. Third, the diversity within the ecosystem may be increased by offering new capabilities to an array of third-party organizations that enable them to participate meaningfully in the ecosystem (Iansiti and Levien 2004). While the literature has discussed the mechanisms that support business ecosystem development, not much is known empirically about the development and implementation of digital business ecosystem. Therefore this study aims to apply this body of knowledge as a theoretical lens to analyze the case of ONE.MOTORING portal to inductively derived findings to address the research question set forth at the beginning of the paper.

## Research Methodology

The case study method is an appropriate means of empirical inquiry when the phenomenon to be studied is complex and not easily separated from its organizational context (Langley, 1999). From the site selection standpoint, ONE.MOTORING portal has proven to be an interesting and important case to study. It demonstrates how a DBE can be formed and nurtured and subsequently, leveraged it for the attainment of enterprise performance. Research access was negotiated and granted in June 2010, and interviews were conducted with the middle and top management of the Singapore Land Transport Authority (LTA) - altogether 8 interviewees. There were two additional rounds of interviews conducted by email with three of the interviewees. The face-to-face interviews, which took an average of 90 minutes, were digitally recorded and later transcribed for data analysis. To allay any fear of sharing and speaking, every interviewee was assured of the confidentiality and anonymity of the data provided, especially when potentially sensitive information is sought (Myers and Newman, 2007). The interview questions were exploratory in nature, open-ended and tailored to the role of the person interviewed. Data from the interviews was supplemented by newspaper articles, books, internal publications, and information from the corporate website. Notes from direct observation were also used to corroborate the data obtained. Historical reconstruction of event was subsequently performed by the field researchers. Inter-subject reliability was increased by using the narratives from one subject to confirm or contradict others in a social triangulation (Miles and Huberman, 1994). Data from various sources coalesced and built a specific narrative that explained the process outcomes (Langley, 1999).

Data analysis was performed in tandem with data collection to take advantage of the flexibility that the case research methodology affords (Myers and Newman, 1989). Based on our review of the literature on business ecosystems, we identified an initial set of themes that were pertinent to ecosystem development. This set of themes formed our theoretical lens, which served as a "*sensitizing device*" (Klein and Myers, 1999) to guide data collection. The data obtained from each interview was then organized and coded according to the set of themes. Each new finding was verified to ensure that it was supported by data and our theoretical lens was modified

incrementally whenever new findings that challenged the existing schema emerged. The entire data analysis process went through numerous iterations to formulate a coherent and consistent overview of the case organization (Klein and Myers, 1999).

### **The Case of ONE.MOTORING Portal Background**

Singapore Land Transport Authority (LTA) is a statutory board under the Ministry of Transport and its primary responsibility is to ensure 'a smooth and seamless journey for all' by delivering a land transport network that is integrated, efficient, cost-effective and sustainable to meet the needs of Singapore. From its early introduction of electronic road pricing to the subsequent adoption of intelligent transport systems, LTA is known to be an organization that leverages on IT to harness its land transport management. According to the Group Director for Innovation and Infocomm Technology (GDIIT): *"LTA has always exuded an innovative culture. It has a culture of being bold and first in introducing new solutions. An example is the electronic road pricing system. It was a case of even though no one has done it before, we still went ahead to do it as long as it made sense for us to do so"*.

The idea behind ONE.MOTORING portal was first conceived by LTA in its e-Services Master Plan in 2000. In line with Singapore Public Service's vision of improving its customer service, the e-Services Master Plan recommended all public services and information to be made available online by end 2001. ONE.MOTORING portal was one of the several websites recommended to provide a comprehensive list of transport services and information.

ONE.MOTORING portal started as a one-stop portal that offers information services that include a series of procedures and e-forms in October 2000. For example, the portal provides a comprehensive guide on road tax renewal and incorporates easy-to-use e-forms required for various e-transactions such as Certificate of Entitlement (COE) renewal and license applications. Refer to Table 1 below for a summary of LTA's transport services and information.

**Table 1: A Summary of Vehicle-related Services and Guidelines**

<b>LTA e-Services</b>	<b>LTA Information &amp; Guidelines</b>	<b>On-the-Roads</b>
e-transactions Online Enquiries Mobile Services Login e-Services for Asset Owners	Latest Updates Ask LTA Pro-Enterprise Initiatives Buy A New Vehicle Maintain A Vehicle Buy & Sell A Used Vehicle De-register a Vehicle Facts & Figures Policies & Schemes Common Vehicle Modifications & Vehicle-Related Offences Vehicle Tax Structure Awards & Accolades Checklist Forms Download Transaction PIN & User Account Driving Into & Out of Singapore	ERP Rates Traffic Cameras Traffic News Interactive Map Travel Time Calculator Road Closure Traffic Management Road Safety Road Works Road Maintenance Road Facilities Road Projects Parking Street Directory Educational Materials e-News Alert

Between 2001 and 2010, ONE.MOTORING portal had introduced many motoring services and information online. Table 2 below presents a summary of ONE.MOTORING portal's milestones. One notably achievement in 2010 was the merger of ONE.MOTORING portal, Traffic.Smart and OnePay.Hub to form a newly integrated portal that provides a one-stop service gateway to all motoring and traffic information and services. In addition, ONE.MOTORING portal also offered Wireless Application Protocol (WAP) services to anyone with a General Packet Radio Services (GPRS) enabled mobile phone or Personal Digital Assistant (PDA) with a WAP browser that supported the WAP 2.0 specification.



**Table 2: A Summary of ONE.MOTORING Portal's Milestones<sup>1</sup>**

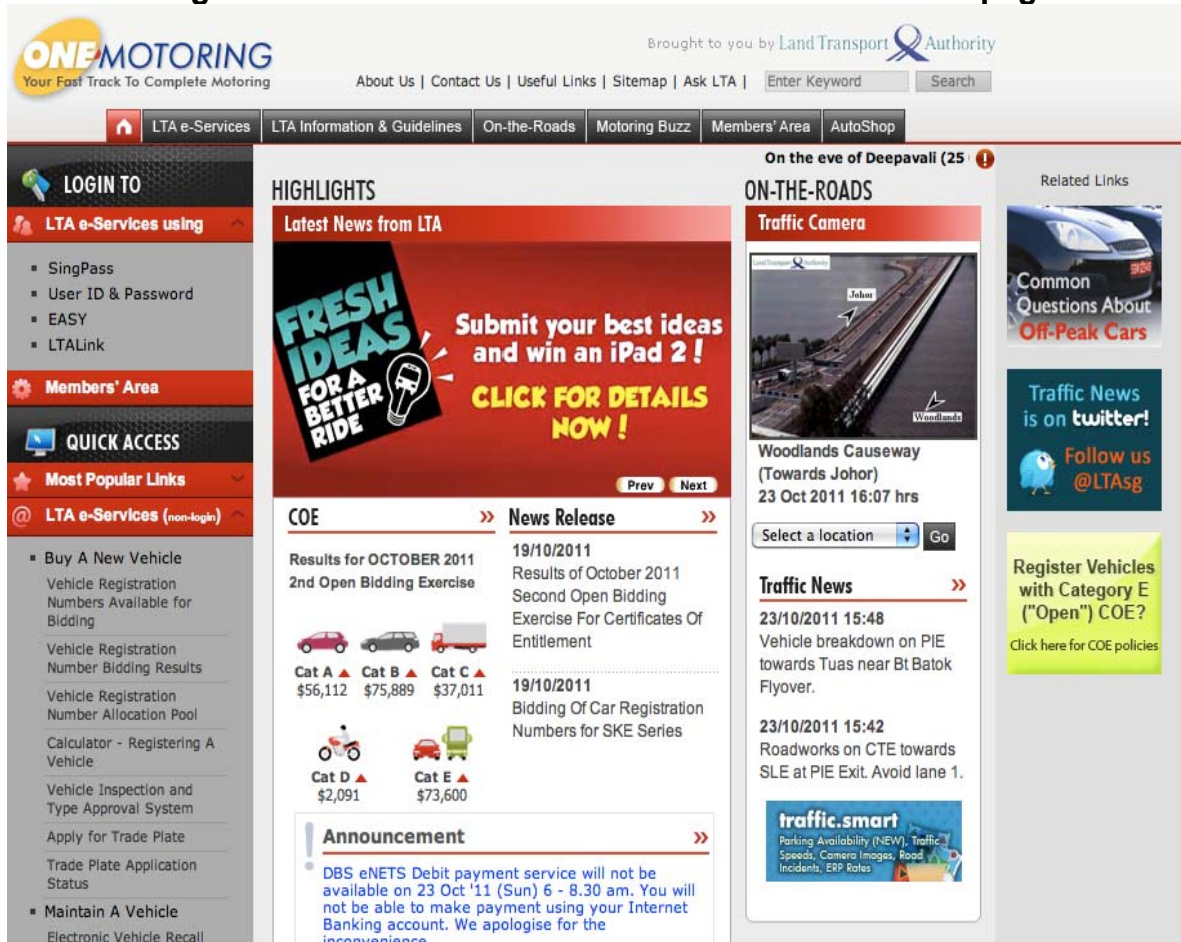
<b>Year</b>	<b>Key Milestone</b>
October 2000	Launched ONE.MOTORING portal
2001	ONE.MOTORING offered enquiry e-services that include road tax payable and vehicle rebates
2002	ONE.MOTORING offered online transactions that include renew road tax and online COE bidding
2003	ONE.MOTORING offered online payment that include credit card, cash card and direct debit
May 2004	ONE.MOTORING merged with Traffic.Smart and OnePay.Hub to operate as the newly integrated ONE.MOTORING portal under a public-private partnership model, providing a one-stop service gateway to all motoring and traffic information and services that include regulatory information and services, lifestyle hub and forum
September 2004	ONE.MOTORING Mobile Services (through WAP)
June 2005	Launched ONE.MOTORING Interactive Map
February 2006	e-Services@ONE.MOTORING offered a full suite of e-services to enable most of the vehicle services to be carried out online. Services include online registration, transfer and de-registration
September 2006	ONE.MOTORING portal's overall customer satisfaction level crossed 90% level
April 2007	Vehicle Recall System made available via ONE.MOTORING portal
July 2007	Introduced ONE.MOTORING EzCode
March 2008	ONE.MOTORING crossed 10 million pageviews per month
April 2008	Introduced AskLTA, an intelligent online FAQ search system
September 2009	ONE.MOTORING crossed 600,000 unique visitors per month
March 2010	Introduced MyTransport.SG's mobile platform for smartphones
June 2010	ONE.MOTORING portal awarded Web Excellence (Outstanding Award)

Since its inception, the popularity of ONE.MOTORING portal has grown steadily. Its monthly page views has grown by five-fold from 2.4 million in 2004 to 13 million in 2010 while the average monthly visits to the portal has grown by nearly 19 times from 40,000 to over 762,000 in the same period. Currently, the portal processes an average of 60,000 transactions daily with more than 20 per cent of the online transactions completed after the office hours, Overall, ONE.MOTORING portal has helped to streamline the operational processes and achieve a 40 percent reduction of its operational costs. To date, the ONE.MOTORING Portal has already won a number of awards since it was first launched in October 2000. These included winning the Minister Innovation Award twice in 2002 and 2004 from the Ministry of Transport and the CIO Award in 2003. In 2006, it achieved a semi-finalist standing in the Commonwealth Association for Public Administration and Management Awards and the merit award for the National Infocomm Award in the category of Most

<sup>1</sup> Adapted from <http://10years.onemotoring.com.sg/One.Motoring-Key-Milestones.html>

Innovative Use of Infocomm Technology (Public Sector). It was voted one of the top five government projects in Singapore that exemplifies the achievements and dedications of the public service. Figure 1 below presents the screenshot of ONE.MOTORING Portal Homepage<sup>2</sup>.

Figure 1: Screenshot of ONE.MOTORING Portal Homepage



## Creation of Digital Business Ecosystem

The initial idea for ONE.MOTORING portal came about in 1999 when LTA was having challenges handling approximately 900,000 telephone enquiries, 500,000 letters and 500,000 walk-in visits a year. Initially, LTA considered hiring many more staff to cater to the increasing customer needs and rising expectation to provide better public service<sup>3</sup>. However, this would result in escalating manpower costs. Besides, LTA had limited office space and therefore could not increase its number of

<sup>2</sup> Source: [www.onemotoring.com.sg](http://www.onemotoring.com.sg)

<sup>3</sup> PS21 (Public Service for the 21<sup>st</sup> Century) Movement

service counters by several folds. At that time, one of the customer service managers contacted the IT group within LTA to explore the feasibility of deploying the internet as a vehicle to inform the public about land transport information. After hearing the customer service manager's enquiry, the Director from GDIIT envisioned it could have a large portal that would allow the public to receive static informational content as well as to submit online transactions. By 2000, ONE.MOTORING portal concept was formalized and the proposal was submitted to LTA's senior management and subsequently to its Board of Directors and the Ministry of Transport for approval. After the approvals were obtained, National Computer Systems (NCS), a leading IT and communications engineering service provider, was engaged to design and manage ONE.MOTORING portal. The portal aimed to serve as a flagship one-stop motoring platform to provide the public a range of comprehensive information and services that include buying, owning, and driving a vehicle in Singapore.

The development of ONE.MOTORING portal involved three phases. Phase 1 focused on developing information content. Phase 2 of the development involved creating the enquiry functions and in phase 3, the focus was developing a series of complex online services. The project manager recounted his experience during phase 1: *"It was very hands-on for us - from the day we were awarded the contract to the public launch of the online portal. In addition, we had to prepare the content, the design, the IT aspect, and the infrastructure issues before rolling out"*.

During the development process, LTA maintained its influence over how ONE.MOTORING was developed and managed. For example, LTA was playing the role of an 'architect', while NCS was the 'developer'. A joint development team consisted of both LTA and NCS staff developed the work plan, established the key performance indicators and conducted the quarterly reviews for building the portal. While there had been instances of difference between LTA and NCS during the development process, it was openness and transparency that played a key role in bridging these differences.

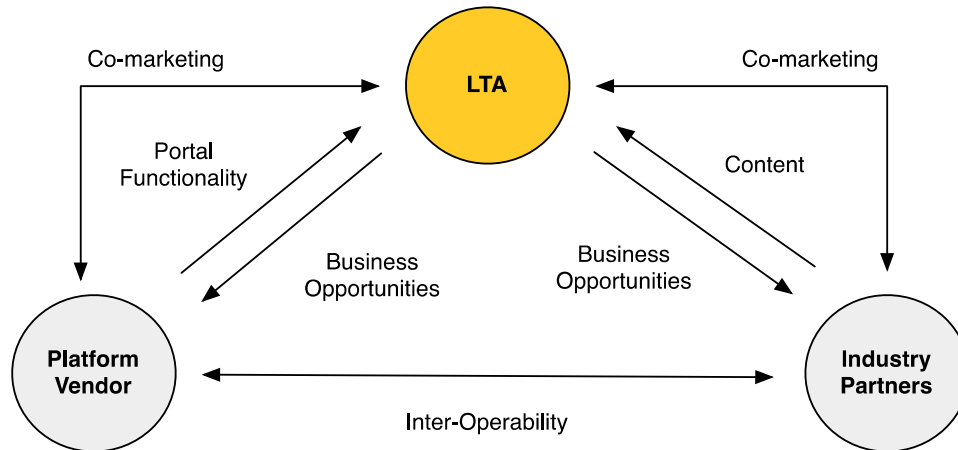
During the initial stage of development phase 1, only regulatory content and services were uploaded onto the portal. Information related to private sector service providers was included in the later part of the phase. Private sector service providers such as

motor dealers, motor finance and insurance companies provided hyperlinks that would allow ONE.MOTORING users to visit their websites. In phase 2, portal users grew accustomed to visiting the web portal that several of them requested the inclusion of more sophisticated services. These requests included allowing the portal to be accessed through mobile devices and more “*lifestyle element*” contents, such as advice on vehicle maintenance and driving tips.

Figure 3 below presents ONE.MOTORING portal’s business ecosystem. Through various alliances, LTA has positioned itself in the core of a dynamic organization network that spanned across a variety of industries. It plays a coordination role, where it oversees and makes the final decisions regarding the portal. The developers and content providers would benefit from increased business opportunities, where brand reputation is built upon the success of the ONE.MOTORING Portal. Thus, through the effective establishment of this network, LTA is able to create a “win-win” situation for itself and its strategic partners. In a sense, LTA and its partners co-evolved capabilities around ONE.MOTORING portal, where they worked cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate newer innovations. This business ecosystem enhances continual innovative improvements to the services and content provided, which are critical in LTA’s mission to provide Singaporeans with a world-class transport system.

One of the main factors that contributed to ONE.MOTORING portal's success is the creation of a business ecosystem approach. The close collaboration with software developers and content providers to co-develop wireless content, technology and services brought about significant improvements in service information and provision, which are vital components in a world-class transport system. Throughout the entire development process, LTA adopted a highly consultative stance and was accommodative in adjusting some of their pre-requisites in response to feedback from private vendors. For instance, LTA was willing to modify the contractual term from three to five years in response to private vendors’ feedback that three years would be too short for them to recoup their investment. During the partnering process, one of the important considerations was who would own the intellectual property of the portal content. It was later proposed by LTA and agreed by others

that the intellectual property rights would be retained by respective parties in the ecosystem. For foreground intellectual property rights, they would be retained by LTA.



**Figure 3 – ONE.MOTORING Portal’s Business Ecosystem**

A major challenge for LTA was how to convince stakeholders ONE.MOTORING portal was indeed a partner and not a competitor. LTA had to assure its stakeholders that ONE.MOTORING portal was not intended to compete with their services, but would provide a gateway to their offerings. Some stakeholders also voiced the concern of additional costs for linking up with LTA. To address this concern, LTA aggregated the demand for high-speed leased lines with the telecom companies through a LTA-initiated tender, which offered a special group discount scheme to business partners connecting with LTA, while providing a trusted environment where fast and secure e-transactions could be performed.

### **The Development of ONE.MOTORING Portal**

Believing this challenge could be surmounted, the GDIIT spurred the ONE.MOTORING portal project team in their search for solution. She persuaded them to be more “business minded” and to “put away the old mind set” in their pursuit. After several brainstorming sessions, it was decided LTA would rope in a private operator for the ONE.MOTORING portal. LTA believed that being “*bottom-line driven*”, the private sector would propose innovative ways to meet public demands while keeping a low cost. LTA started to look for a business partner to help manage the portal, instead of just having an IT vendor to develop and maintain the

portal. A project manager elaborated on the selection criteria: *“we were looking for a business partner who was not only competent in managing both the hardware infrastructure and security, but also aware of what customers need and how to meet those needs”*. A Request for Proposal (RFP) was subsequently called. To encourage creativity, the specifications in the RFP were kept to a minimum. A project manager clarified: *“we provided a lot of leeway for vendors to come up with creative ideas”*. A manager involved in the evaluation of the submitted proposal commented: *“We were looking for a vendor who would take initiative and bring the project forward without us giving detailed instructions for every little step.”* After many rounds of evaluation, Green Dot Internet Services Private Ltd (GDIS) was selected as the outsourcing partner on January 2003.

To expedite the development of the ONE.MOTORING Portal, two development teams were formed in LTA to handle the project: IT project management team and business team. The role of the IT project management team was to ensure the smooth development and operation of the portal, and the exploration of new enhancements. The business team focused on the commercial aspect of the portal, such as examining the interest and predicting the market demand to decide on the implementation of new features. At the same time, GDIS also took on the lead in developing the commercial aspect of the portal. For instance, when there were requests for new features from the public, LTA would consult GDIS regarding the relevance and appropriateness before approving the requests. Depending on the type of request, sometimes GDIS would have to carry out a more detailed exploration by evaluating the technical feasibility and conducting market research. The partnership between LTA and GDIS strengthened over time. This was mainly due to the numerous meetings and discussions organized to iron out differences among the two parties.

Throughout the entire development process, GDIS was given a lot of flexibility in its planning and operational aspects of the portal. For example while LTA had a set of strict guidelines on the kind of services and information that could be hosted on the portal, GDIS was allowed to make recommendations on how they would intend to provide additional channels for accessing the services and information (e.g., through mobile services). To expedite the decision making process, both parties established

a set of guidelines for developing the commercial content of the portal. As long as the guiding principles were applied, GDIS could decide how they wanted to proceed. On this matter, GDIS also ensured that LTA was kept in the loop of how and what decisions were made.

On 25<sup>th</sup> August 2004, after six months into partnership with GDIS, ONE.MOTORING Portal was launched. The event was attended by the CEOs of both LTA and GDIS. In his speech made during the event, the CEO of LTA noted: *“By collaborating with a private sector partner, we hope to deliver a more vibrant and content rich portal to our motorists and the motoring industry as a whole. Whilst LTA would continue to provide the regulatory content and services for the portal, we needed a partner who would drive the commercial related initiatives such as marketing and collaboration with other interested parties and service providers.”*

The business ecosystem relied heavily on the partnership with industry partners to deliver information and services electronically via e-Services@ONE.MOTORING. The e-Services@ONE.MOTORING was developed and supported by industry partners representing the public and motor trade industry like Automobile Association of Singapore, the Motor Traders' Association, Singapore Vehicle Traders' Association, Singapore Motorcycle Trade Association, Automobile Import and Export Association, Finance Houses Association and General Insurance Association of Singapore. LTA also worked closely with authorized inspection centres and other government agencies such as the Singapore Customs to ensure relevant up-to-date information on all vehicles' Open Market Value; the Housing Development Board and the Urban Redevelopment Authority to establish database interfaces needed for Vehicle Parking Certificate for heavy vehicles; and the Accounting & Corporate Regulatory Authority for updates on change of company addresses. Another key partner was the Hire Purchase, Financing & Leasing Association of Singapore, where an immediate check of the financing status of vehicles can be done when a transfer of vehicle ownership or de-registration of vehicle is initiated. The new services available on e-Services@ONE.MOTORING enable the public to check on the scrap value of their vehicle, apply to de-register their vehicle, and even update their vehicles' colours. Motor dealers appointed by LTA as Electronic Service Agents (ESAs) can carry out a variety of transactions,

such as registration of vehicles and transfer of vehicle ownership, and even retain vehicle registration numbers for their customers, in a shorter time without having to visit LTA.

Overall, to sustain the partnerships, LTA maintained a close relationship with its stakeholders through regular dialogue sessions and meetings with the motor industry. These regular dialogue sessions and meetings generated ideas for service and process improvements.

### **Lessons Learnt**

Our analysis identified three important lessons learnt that were instrumental in developing a DBE: institutionalizing ONE.MOTORING concept within business ecosystem; establishing connectivity and attaining network density and emphasizing value creation.

### **Institutionalizing ONE.MOTORING Concept within Business Ecosystem**

A key challenge for most organizations with any transformational change is taking actions to institutionalize change (Malhotra, 2004). The challenge is similar in a business ecosystem. To institutionalize strategy, the central organization may have to ensure that such strategy remains open to critique, adaptation and replacement (Nadler and Shaw 1995) among its partners. The constant need for innovation imposes upon the central organization to rely on creative synthesis resulting from a dialectical confrontation of opposing interpretations (Malhotra, 2004). For institutionalization to occur, effective management of collaborative relationships through close communication between central organization and its partners may allow a high level of coordination and integration (Day, 1994). In the case of ONE.MOTORING portal, establishing and maintaining strategic partnerships with various stakeholders were essential to LTA in delivering the portal. To make the partnership happen, LTA strived to better integrate stakeholders' trust and commitment which could enhance the institutionalization process (Prahalad and Hamel, 1990).



ONE.MOTORING portal was able to establish its identity as the de facto B2B platform for motoring opportunities in Singapore, and structure ecosystem value creation around its vision of connecting motorists to a vast supplier network of motoring services. By taking on the leading role of a central organization and involving itself directly in collating the necessary information published on various electronic discussion forums, publishing the relevant information on its web portal, facilitating access to the information by organizing the information and providing navigational tools, and promoting the information on other websites, LTA enabled many Small-and-medium enterprises in the motoring industry to participate in the digital business ecosystem, and subsequently, benefit from the global exposure afforded by the Internet. In addition, collaborative partnerships also provided a critical source of innovation, knowledge and resources that could enhance existing capabilities or even develop new capabilities (Wheeler, 2002). One important critical success factor in the institutionalization process is the availability of LTA's resources and capabilities to support the creation of the DBE and the alignment between the strategic actions of LTA and its resources and capabilities.

### **Establishing Connectivity and Attaining Network Density**

Rowley (1998) argues connectedness is an organization's position within a network relative to other organizations in the same network. Centrality enables the organization to effectively influence the development of the DBE and subsequently, leverage the DBE for the attainment of superior enterprise performance (Pierce 2009). Social network research distinguishes networks according to the type of ties comprising the network (Bell and Zaheer, 2007). Existing ties imply a well-established, trust based relationship (Krovi et al., 2003). The strength of the ties depends on several factors such as the amount of time spent together, the emotional intensity, the intimacy, the reciprocal services associated with the relationship (Granovetter, 1973), the sense of belonging and the perception of the actor's role importance (Hahn et al., 2008). The level of connectivity is influenced by network ties. The degree of connectivity depends on whether the ties are strong or weak. Generally in an organizational setting, it is important to establish strong ties among actors in order to enhance team performances and promote innovation. In the case of ONE.MOTORING portal, by relinquishing direct control over its ecosystem

members, interactivity within the ecosystem was further enhanced as frequent, rich and autonomous interactions between ecosystem entities were made possible.

Besides connectivity, it is important the central organization “shares value” (Iansiti and Levien 2004) with the entire ecosystem by providing direct services that lower the barriers of ecosystem membership, which in turn, enables a larger pool of entities to participate in the ecosystem to attain self-sustaining critical mass. Critical mass is particularly important in DBE development as it (1) is the key enabler of effective collective action (Hargrave and van de Ven 2006), and (2) facilitates the attraction and retention of ecosystem members (Moore 1996), which is important because in networked competition, network entities tend to be highly mobile (Pierce 2009). In the case of ONE.MOTORING portal, the DBE witnessed a steady increase of its number of partners over the years. It started with industry partners to deliver information and services electronically via [e-Services@ONE.MOTORING](mailto:e-Services@ONE.MOTORING) and later followed by industry partners representing the public and motor trade industry and authorized inspection centres and other government agencies.

### **Emphasizing Value Creation**

It is important to increase mutual interdependence between the central organization and the other partners, which enhances ecosystem value creation (Holm et al. 1999) and serves as the foundation for stability and creativity in the ecosystem (Iansiti and Levien 2004). Also by channeling the resources and actions of disparate ecosystem entities towards the collective good that enhanced the overall competitiveness of the digital business ecosystem, it may provide the motivation for stability and collective action (Adler and Kwon 2002) priming the ecosystem for innovation and continuous change, and enhancing the strategic focus of its ecosystem members, “co-evolving, self-reinforcing system of strategic contributions” (Moore 1996, p.53). Also, as the entire ecosystem functions as a single entity, utilizing communal resources and capabilities towards the shared objectives of the ecosystem, individual ecosystem entities may lead to co-production of innovations (Lengnick-Hall 1996). In our case, LTA's strategies of ecosystem development were centered on the development of capabilities for business expansion, online marketing and online advertising revenue generation for its ecosystem members. The strategic intent underlying

ONE.MOTORING's strategies and its new ecosystem role was to strengthen its members and enable them to contribute more to network value creation.

## **Conclusion and Implications**

The purpose of our paper has been to address our research question of how are DBEs developed? In this study, we have used business ecosystem theory as our analytical lens. We have drawn on LTA's ONE.MOTORING development experience by interviewing relevant project stakeholders and reviewing secondary data extensively. Our analysis identified three important lessons learnt that were instrumental in developing a DBE: institutionalizing ONE.MOTORING concept within business ecosystem; establishing connectivity and attaining network density and emphasizing value creation.

From research point of view, our paper has made two major theoretical contributions. First, by examining how DBE is developed, this study contributes to a networked perspective of IT innovation and provides important indications for firms operating in the pervasive context of complex business networks. In doing so, this study complements the existing perspectives that emphasize internal organizational processes such as the development of IT capabilities and organizational learning as the means of achieving superior enterprise performance. Second, most of the earlier studies that discuss the importance of innovation in external processes have not been empirically validated. By explaining how specific combinations of organizational strategies and ecosystem roles contribute to the development of ONE.MOTORING portal, this article has contributed to the literature with empirical evidence that are grounded in the empirical reality of a real world organization. From managerial point of view, by tracing the antecedents, nature and implications of DBE development from its initial formation to maturity, this study should be useful for practitioners managing DBEs in varying stages of development. In particular, it is hoped that practitioners who face difficulty in advancing the development of their ecosystems or leveraging their ecosystems for tangible gains can use the ONE.MOTORING experience as a roadmap to identify the appropriate actions, so that they can make the most of the efforts and resources invested in managing their DBEs, and exploit their fullest potential. Future research is clearly needed to apply our findings in other

DBE development contexts so as to fine-tune or expand the list of important lessons for developing DBEs.

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