The Development Bureau of the Government of the Hong Kong Special Administrative Region

Consultancy Study on Development Strategy of a Common Spatial Data Infrastructure

Executive Summary (July 21, 2018)

Contents

Introduction

1. The Government of the Hong Kong Special Administrative Region, acting through the Development Bureau (DevB), has commissioned PricewaterhouseCoopers (PwC) to undertake the Consultancy Study on the Development Strategy of a Common Spatial Data Infrastructure (CSDI) (the Study). The Efficiency Office (EFFO) is involved in managing the Study on behalf of DevB.

2. The objective of the Study is to formulate an effective CSDI development strategy from a "joined-up government" and "spatially enabled society" perspective. The focus of the Study is on land and infrastructure planning, development and management in Hong Kong.

Context for CSDI Development

3. Spatial data is a strategic asset for Hong Kong, and its importance is duly recognised by a number of strategic plans formulated by the Government including the Policy Address 2017, the Hong Kong Smart City Blueprint and Hong Kong 2030+. Considering the experience of previous initiatives for improving spatial data management and sharing in the Government as well as emerging applications of spatial data, the proposed CSDI for Hong Kong should aim at:

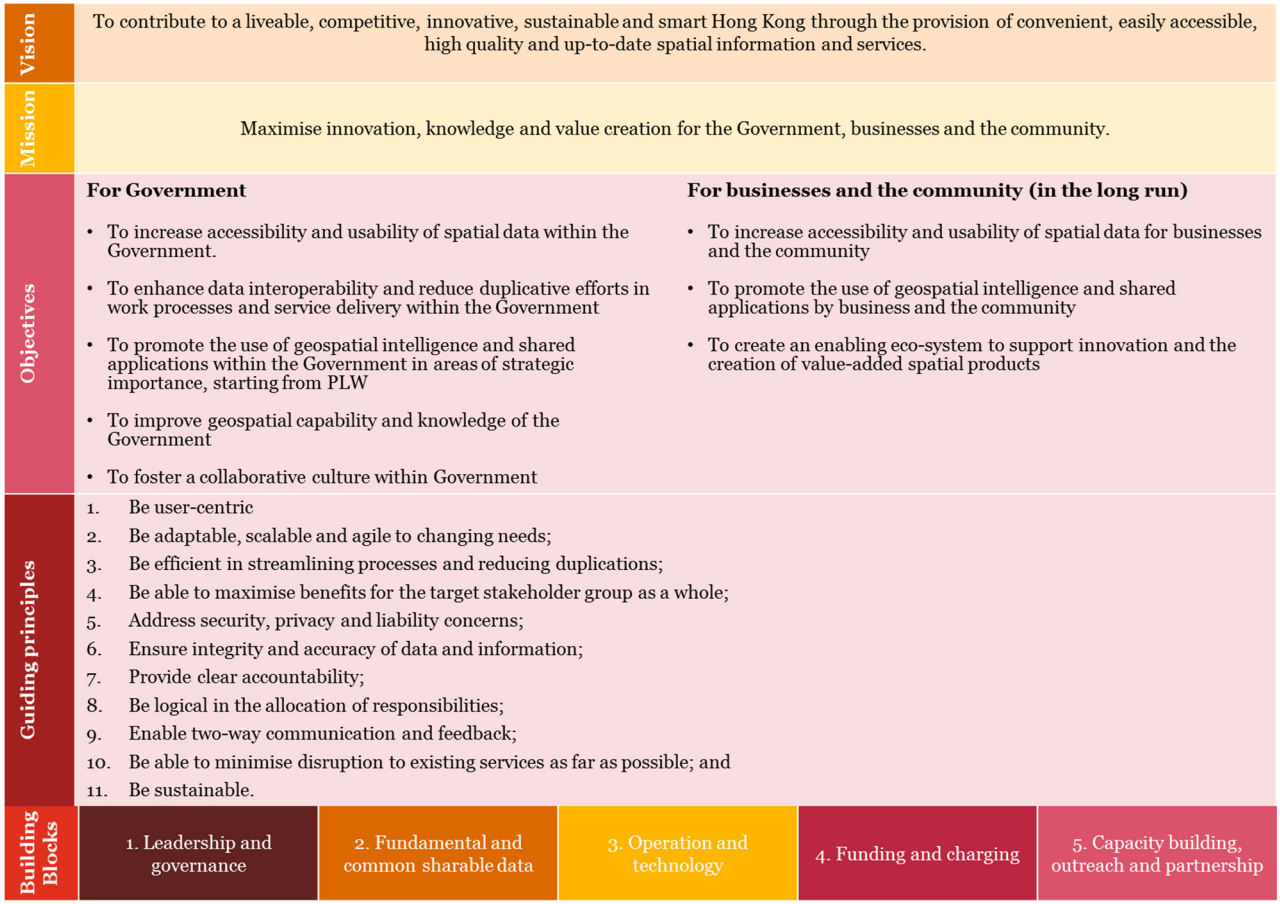
- Facilitating and supporting the development of a dynamic and flexible geospatial environment that provides standard interfaces for accessing and disseminating common spatial information;
- Facilitating sharing of spatial data across different B/Ds and eventually other stakeholders;
- Encouraging the adoption of common standards to ensure quality, compatibility and interoperability amongst different systems; and
- Making available a wide range of spatial data and analyses to enable potential applications.

4. As demonstrated in findings from this Study, overseas jurisdictions have been able to benefit from the development of spatial data sharing platforms (and application of spatial data) mainly in areas – both strategically and operationally – beyond internal savings alone. This includes improved service delivery and decision making, which in turn lead to better policy outcomes and the realisation of wider societal and economic benefits (e.g., facilitating innovation and creativity as well as smart city initiatives). Whilst societal and economic benefits may take time to materialise, they have been found to be of high order of magnitude when compared with benefits arising from internal savings.

Strategic Framework and Building Blocks for CSDI

5. A high-level strategic framework has been developed to capture the vision, mission and objectives of CSDI, as well as five key building blocks of the development strategy, namely leadership and governance, fundamental and common sharable data, operation and technology, funding and charging as well as capacity building, and outreach and partnership. These building blocks are also generally in line with the considerations of overseas jurisdictions. Each building block entails a stream of work for the implementation of CSDI.

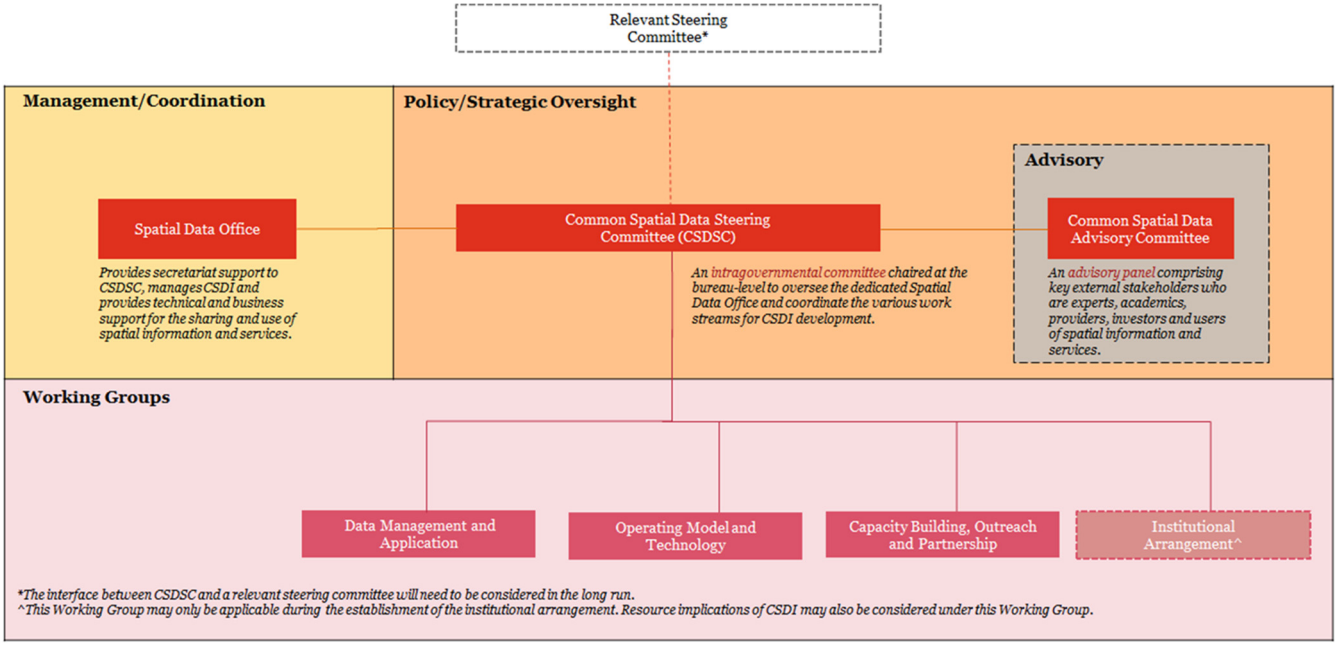
Figure ES1: High-level Strategic Framework for CSDI



6. Building Block 1 – Leadership and governance

The strategic objective is to establish an effective governance framework for the development, implementation and monitoring of CSDI, with alignment of the shared vision and the backing of a strong leadership. CSDI is expected to be governed by a three-tiered governance structure having four different functions, as shown in the figure (**Figure ES2**) below.

Figure ES2: Governance structure



- **Policy / strategic oversight:** At the policy and strategic level, a **Common Spatial Data Steering Committee (CSDSC)** will serve as the key body for providing policy/strategic oversight. This is envisioned to be an intragovernmental committee chaired at the bureau-level to provide strategic directions for CSDI development, enforce the objectives and guiding principles of CSDI, oversee the work of the dedicated Spatial Data Office (SDO), coordinate the various work streams that are undertaken by the working groups, approve and review progress of activities against a set of key performance indicators (KPIs) as well as resolve conflicting views and prevent overlapping and duplicating work amongst Government agencies;

- **Advisory:** A **Common Spatial Data Advisory Committee (CSDAC)** will provide advice on the development, management and use of spatial data, and will share leading industry practices, know-how and trends. Members can be drawn from various sectors beyond the Government including businesses, professional bodies, academics and statutory organisations that are spearheading innovation and technology and the use of spatial data in improving city operations;

- **Management / coordination:** A dedicated **SDO** will be the office responsible for managing the CSDI platform that will enable the discovery, updating, retrieval and archiving of spatial data. It will also facilitate application development of individual Government agencies and provide high-level coordination of common application that could be leveraged by multiple agencies as agreed at steering committee-level or working group-level meetings, The functions of the office will include data and application advisory services, platform development and application facilitation, capacity building and outreach as well as policy research. Specifically, SDO will focus on raising awareness of agencies on CSDI implementation and facilitating the change management process as different degrees of process re-engineering may be required for adopting CSDI; and

- **Working Groups:** Four working groups will be set up with the involvement of key Government agencies to undertake different work streams for planning, implementing and reviewing the key components of CSDI. A regular reporting channel should be established between CSDSC and the working groups, with SDO assuming a secretariat role for CSDSC. The working groups include:

- **Data Management and Application** – key tasks are to identify and prioritise common sharable data; to draw up guidelines, data definitions, data standards and technical specifications to facilitate data interoperability; to monitor the current uses and applications of spatial data across agencies for development of user requirements; as well as to advise, facilitate and provide high level coordination of collaborative opportunities across agencies for the potential development of common applications that are relevant to multiple agencies.

- **Operation and Technology** – key tasks are to design the operating model of the CSDI platform; and to develop measures to facilitate interfacing between existing platforms and the operating model.

- **Capacity Building, Outreach and Partnership** – key task is to develop a capacity building, outreach and partnership plan with communications, activities and programmes to be considered for Government agencies, academics, professionals, businesses and the community.

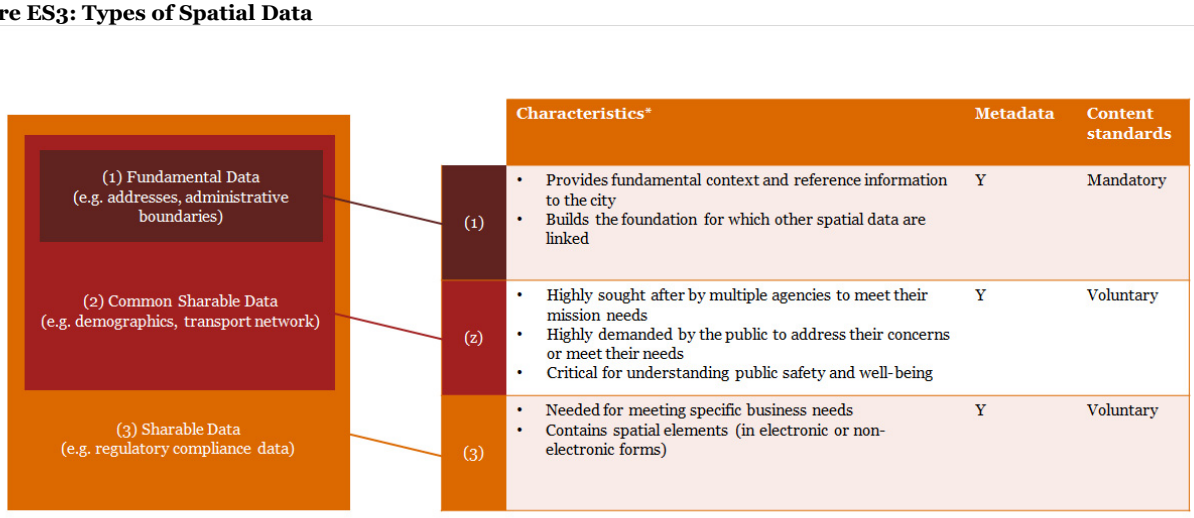
- **Institutional Arrangement Working Group** – key tasks are to further develop the governance framework for CSDI including detailed design for the proposed bodies/working groups, interfaces with other steering committees; and to consider the funding model in the longer term. This working group will eventually be terminated once the institutional setup has been firmly established.

7. Building Block 2 – Fundamental and common sharable data

The strategic objective is to enhance the discovery, accessibility, interoperability, quality and uses of spatial data, particularly for fundamental data and common sharable data of priority interest through consideration of possible use cases and applications with the adoption of a user-centric approach.

For spatial data to be effectively managed to achieve the objective, it is necessary to first determine different types of spatial data (refer to **Figure ES3**), each of which may be assigned a different priority in terms of interoperability and quality.

Figure ES3: Types of Spatial Data



	Characteristics*	Metadata	Content standards
(1)	• Provides fundamental context and reference information to the city • Builds the foundation for which other spatial data are linked	Y	Mandatory
(2)	• Highly sought after by multiple agencies to meet their mission needs • Highly demanded by the public to address their concerns or meet their needs • Critical for understanding public safety and well-being	Y	Voluntary
(3)	• Needed for meeting specific business needs • Contains spatial elements (in electronic or non-electronic forms)	Y	Voluntary

**While data in the lower tier do not exhibit the characteristics of the higher tier, data in the higher tier will also exhibit the characteristics of the lower tier. For instance fundamental data , which are denoted as (1), will also have the characteristics of (2) and (3).*

Whilst common standards on structure and format as well as metadata specifications should be mandated for all shareable spatial data for enhanced discovery and interoperability, a user-centric framework should be used to develop content-specific standards for the identified sets of fundamental and prioritised common sharable data.

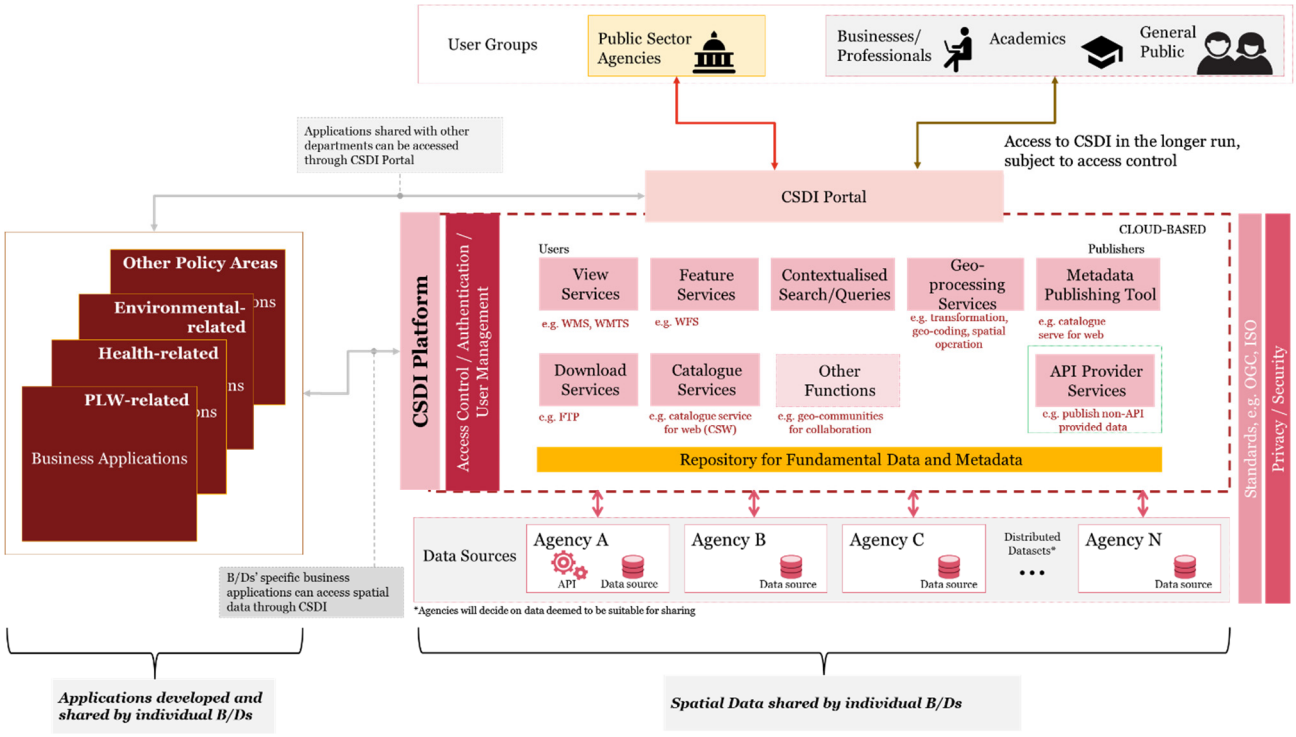
This is underpinned by a federated data governance approach where roles and responsibilities are clearly allocated for the Working Group, SDO, Data Owners and Data Users; and clear guidelines/polices for the scope of data sharing/archiving.

CSDI is to establish an enabling environment for supporting agencies to develop business applications that are purpose-driven. These applications can be linked to the CSDI portal for further dissemination.

8. Building Block 3 – Operation and technology

The strategic objective is to provide a scalable, technically feasible and secured sharing portal for the exchange of quality and up-to-date spatial information, services and applications in a readily accessible manner. It is envisaged that a sharing platform is available to facilitate effective exchange of quality and up-to-date spatial information and provision of services (e.g., API provider services, geo-processing services[1]) for Government agencies as well as businesses/professionals, academics and the wider community in the long run. **Figure ES4** presents the conceptual operating model for the CSDI platform.

Figure ES4: High-level Technical Architecture for CSDI



Whilst individual agencies continue to be the "owner" of their spatial data stored in their individual systems, fundamental data as defined in point 7 above and the metadata for all available spatial data are expected to maintain a copy or store in the CSDI platform centrally to enable quicker access and easier discovery.

In addition, applications developed by individual government agencies could be linked to the CSDI Portal. It is envisioned that priority would be given to applications regarded as "common applications" as determined by the governance body of CSDI. These common applications should have the following key features:

- Involve more than one agency and enhance cross-agency collaboration in specific policy area/issue;
- Be developed with consideration on the user requirements of more than one agency;
- Enhance business processes and business decision of more than one agency; and
- Enable benefits from the visualisation, combination and analysis of spatial data to be shared across two or more agencies.

9. Building Block 4 – Funding and charging

[1] Geo-processing services execute according to pre-defined logic and algorithms. Examples include geo-enablement, data transformation/aggregation or format conversion.

The strategic objective is to secure sufficient funding for ensuring momentum and long term financial sustainability of CSDI, with recognition of the wider value of spatial information and services. To this end, it is suggested that a pool of funding covering both capital expenditure and operating expenditure be established to ensure financial sustainability of CSDI for more than five years and potentially up to ten years (assuming that over this period CSDI is managed by a Government entity).

In addition, a dedicated funding is suggested to be established for incentivising agencies to undertake CSDI-related initiatives that are incremental in nature (e.g. harmonising spatial data in accordance with standards, geo-enabling data for linking to CSDI). A set of criteria may be used to determine funding priorities, for instance, whether the concerned request promotes collaboration across Government agencies, reduces duplication of efforts and creates sustainable value for public service delivery.

When consider the charging regime in the future, spatial data (particularly common sharable ones) should ideally be considered as public assets and therefore made available free of charge. This is in line with the recommendations made in the Smart City Study in which spatial-related data has been proposed to be included in the list of priority public sector data to be opened to the public.

10. Building Block 5 – Capacity building, outreach and partnership

The strategic objective is to create an enabling environment for Government, businesses, the academia and the wider community to participate and collaborate in the sharing and use of spatial information and services. In order to sustain momentum of the development of CSDI over time, different types of engagement are required to incentivise participation within the Government and seek collaboration with external parties including businesses, academia and the wider community. **Figure ES5** shows an overview of the types of engagement to be considered for different stakeholder groups.

Figure ES5: Engagement for Capacity Building, Outreach and Partnership

	Government	Businesses	Academia	Wider Community
Aware and Understand	• Briefing sessions on CSDI • Regular electronic updates • Workshops on geospatial uses and analytics • Change champion in individual agencies • Overseas visits • Geospatial forum with cross-sector involvement	• Briefing sessions on CSDI • Events for matching developers/providers and users	• Workshops on geospatial uses and analytics • Scholarship and internship opportunities • Geospatial programme for students	• Social media campaign • Workshops on geospatial uses and analytics
Co-create and Own	• CSDI award • Funding priorities for geospatial initiatives • Think tank for geospatial uses	• Funding for geospatial technology and application development • Collaboration in the provision of training, services and R&D • Partnership with key data owners in the private sector	• Funding for geospatial technology and application development • Collaboration in the provision of training, services and R&D • Geospatial challenge and hackathons	• Geospatial challenge and hackathons

Implementation Plan

11. In the light of the strategic objectives, considerations and envisioned state of each building block, it is proposed that a phased approach, starting from within the Government, be adopted to advance the five work streams (WS), each corresponding to a building block. In alignment with the proposed time frame for CSDI development in the *Hong Kong Smart City Blueprint*, CSDI should ideally be fully operational by 2023. Prior to this, there should also be interim releases of functions, services and quick wins. A summary of the envisioned state of the overall CSDI and the five WS upon completion of each phase is presented are illustrated in **Table ES1** below.

Table ES1: Summary of Anticipated Outcomes

Overall/ WS	Short Term (1-2 years) ("Plan and develop")	Medium Term (3-4 years) ("Implement")	Long Term (5 years and beyond) ("Review and update")
Overall	• A "joined up Government" with the increased ease of discovering, accessing and using spatial data, particularly in the area of planning, lands and works (PLW). Operations of relevant Government agencies become more efficient. • There are also incentives for Government agencies to collaborate on CSDI-related matters as the value of spatial data and application is being demonstrated.	• A "joined up Government" with the increased ease of discovering, accessing and using spatial data for a wider range of policy domains. More Government agencies participate, and the public begin to have wider access to spatial data, services and application. • There is a greater drive to collaborate across agencies and with external parties to generate greater value from the use of spatial data.	• "A spatially enabled society" where Government, businesses and the community seek for opportunities to use spatial data for meeting their needs. There is open access to a wide range of spatial data, services, applications and parties beyond the Government are willing to contribute to the pool of data and knowledge created. • There is a collaborative culture within Government and beyond where partnerships/engagement with external parties are actively sought.
WS1: Leadership and governance	• A policy mandate has been provided, with CSDSC and the four working groups being established to drive the planning and development of the detailed strategies/action plans/initiatives. • The initial governance structure of SDO has also been set up to assist Government agencies in transiting to CSDI.	• Connection between CSDSC and other relevant steering committees have been established, with a greater focus on collaboration opportunities within and beyond the Government. • SDO is fully functional. Strategies, action plans and initiatives are being implemented under the supervision of CSDSC and working groups.	• Strategic value of CSDI for pushing the policy agenda continues to be recognised. • The Working Group on Institutional Arrangement is phased out over time. • SDO's role changes from service provider to facilitator. Staff strength and the skill requirements are reviewed and updated.
WS2: Fundamental and common sharable data	• Spatial data particularly in the area of PLW is made discoverable through the provision of metadata.	• Spatial data beyond the area of PLW are gradually made discoverable through the provision of metadata.	• Spatial data in a range of policy domains are made discoverable. • Accessibility, interoperability and quality of spatial data are improved.

Overall/ WS	Short Term (1-2 years) ("Plan and develop")	Medium Term (3-4 years) ("Implement")	Long Term (5 years and beyond) ("Review and update")
	• Fundamental data are identified and provided in compliance with common standards and content-specific standards. • Other relevant Government agencies share their spatial data in the "as is" state, which will be made interoperable in the short term by SDO. • Spatial data policies, technical guidelines and templates are developed and communicated to relevant Government agencies. • Applications of spatial data, particularly in relation to PLW, are developed to demonstrate the value of CSDI. • Consideration on the selected sets of spatial data i.e. fundamental data, and potential applications which may be made available to the public via the Public Sector Information (PSI) initiative.	• Governance of fundamental data are reviewed/updated, with the inclusion of a wider range of common sharable data. • Content-specific standards are developed for these data (agencies will be encouraged to comply). • More Government agencies follow the requirements for common standards during system upgrade. • Wider applications of spatial data beyond PLW are developed to demonstrate the value of CSDI in addressing issues of public interest. • There is greater contribution of spatial data to the PSI initiative, and the implication of the development of open data on spatial data sharing is considered.	• Almost all Government agencies participating in CSDI should have adopted common standards over time (and hence a reduced need for data conversion services). • A greater degree of involvement of the Government, business and community helps drive more spatially-enabled applications. • There is an increasing number of spatial datasets available for internal and public access. Some spatial data may be made available to the public through a wider open data initiative.
WS3: Operating model and technology	• The CSDI portal is launched with access to Government agencies. • Key components of a CSDI platform including the metadata catalogue and basic services such as an initial set of processing services are available. A repository is also available to house fundamental data and metadata. • Relevant Government agencies link their data sources to CSDI depending on their level of readiness.	• The CSDI portal provides access to Government agencies and to selected external parties over time. • Metadata catalogue and all available services are enhanced. The number of processing services are increased and contextualised searches/queries are better tailored to address concerns of a wider range of policy domains. • More Government agencies (beyond PLW) link their data sources to CSDI. • Business applications developed for a wider range of policy domains are linked to the CSDI portal for sharing.	• The CSDI portal provides access to both Government agencies and the public over time with appropriate access controls. • Metadata catalogue and all services are enhanced and updated. Other functions such as the setting up of virtual GeoCommunities can be explored. • External parties such as academia or businesses may seek to link their data sources to CSDI. • Business applications developed by Government agencies and external parties can be linked to the CSDI portal for sharing.

Overall/ WS	Short Term (1-2 years) ("Plan and develop")	Medium Term (3-4 years) ("Implement")	Long Term (5 years and beyond) ("Review and update")
	• Business applications, particularly in relation to PLW, can be linked to the CSDI portal where available.		
WS4: Funding and charging	• A pool of funding for covering both capital expenditure and operating expenditure of CSDI on a multi-year basis is secured. • A dedicated pool of funding is available to incentivise Government agencies to undertake CSDI-related initiatives that are incremental in nature. SDO is responsible for managing applications over time.	• Expenditure on CSDI and disbursement of funds for CSDI-related initiatives is monitored regularly to ensure the intended outcomes are achieved. • Cost recovery model is reviewed in the light of the Government's policy towards the opening of PSI.	• Alternative commercial and funding models are considered, such as transferring the operations to an arms-length organisation, an academic institution or a private sector operator through a PPP. • More spatial data are accessible to the public for free. Value-added services on spatial data can be considered as a channel of revenue stream.
WS5: Capacity building, outreach and partnership	• A Capacity Building Plan (within the Government) with change champions identified and an External Stakeholder Engagement Plan are developed. • CSDAC comprising external stakeholders are formed and consulted in the development of detailed strategies, action plans and initiatives. • There is a prioritised focus in engaging Government agencies through various means. Ideally, external stakeholders (e.g., utilities) are also involved in delivering demonstrative projects.	• CSDAC are consulted on a regular basis in relation to the current state of development and data sharing and collaboration opportunities. • In addition to engaging Government agencies through various means, an increasing emphasis is placed on outreaching to businesses, academics and the wider community as well as developing targeted collaborations/ partnerships with businesses and the academia.	• The composition and function of CSDAC is reviewed in view of changing trends. • Engagement with Government agencies, businesses, academia and the wider community are sustained, with a greater emphasis on co-creation of spatial innovation.

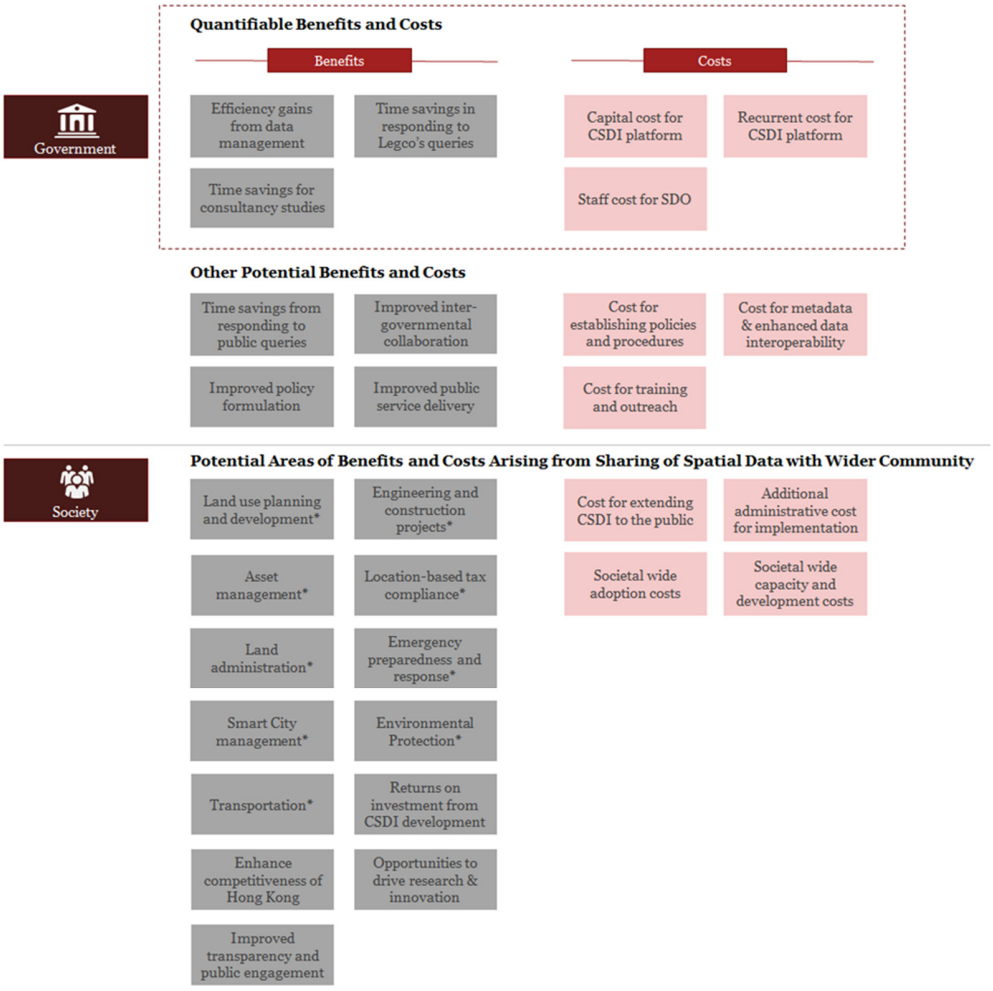
12. To demonstrate the value of CSDI early on, it will be key to identify quick wins and/or demonstrative projects as a matter of priority. An initial list of potential quick wins which include new projects or existing projects with expanded scope are set out below:

- Metadata catalogue
- District-based spatial information dashboard
- Address Data Infrastructure
- Map API
- Geo-tagging tool
- Visualisation of tree and slope management responsibility boundary
- Short Term Tenancy (STT) information
- Demographic data
- Batches of cadastral data

High-level Business Case

13. Drawing upon overseas experiences, technical experts' opinions, findings from the stakeholders' engagements and quantitative inputs from selected Government agencies, a high-level business case has been developed to illustrate the potential costs and benefits that could arise from the development and use of CSDI. **Figure ES6** shows the key components and scope of coverage of the business case.

Figure ES6: Key components and scope of coverage of the business case



*Refer to the estimated economic or productivity impacts arising from the use of spatial data in the stated areas as computed in ACIL Allen's report on *Economic value of spatial information in New South Wales.*

a) Quantifiable Costs

14. It is estimated that the total CAPEX for the CSDI Platform would be approximately **HK$100 million** to be expended over three years. The platform is assumed to be newly built with an initial internal user population of 10,000, among which 20% are concurrent users. The annualised recurrent cost is assumed to be 13% of the CAPEX or approximately **HK$13 million per annum**.

15. The proposed SDO will be headed by one Directorate Grade D2 officer and supported by three staff pitched at D1-level and 19 staff pitched at technical to senior professional level from a wide range of professional / general management grades. It is expected that when fully staffed (end of Year 5), the annual staff cost (excluding benefits) would be **HK$25.6 million per annum**. The actual staff cost would be subject to the actual staff ranks.

b) Quantifiable Benefits

16. In terms of efficiency gains (or internal savings), three potential areas of savings[2] in relation to the use of PLW data are identified, namely time savings in data management processes, time savings in responding to LegCo's questions and time savings in consultancy studies. **Table ES1** shows the indicative estimates of internal savings for the three areas.

Table ES2: Indicative estimates of internal savings

S/N	Potential Benefits	Indicative Estimate of Internal Savings within the Government (HK$)
1	Efficiency gains / time saving throughout the data management process	$5,723,000[3]
2	Time savings in responding to LegCo's queries	$ 153,900 – $ 513,000
3	Savings in consultancy studies	$ 1,442,000 – $ 4,327,000
	Total	**$ 7,319,000 – $ 10,563,000**

17. A summary of the year-on-year quantifiable benefits and costs for CSDI development is illustrated in Table ES2. It suggests that internal benefits to the Government alone would unlikely be sufficient to justify the costs for developing CSDI. **However, overseas experience tends to suggest a similar situation and overseas research has demonstrated that substantial benefits could be obtained as a result of sharing of spatial data with the wider community**.

Table ES3: Summary of quantifiable benefits and costs

[2] It is observed that there are wide variations in potential savings in relation to the use of PLW data. Therefore, a range of saving figures (lower bound and upper bound) instead of a single figure are used in the business case: (i) for efficiency gain in data management, the range reflects the varying degrees of cost avoidance; (ii) for savings in consultancy studies, the range relates to the extent of efforts that could be avoided in collecting baseline data; and (iii) for time savings in responding to LegCo queries, the range relates to the various levels of manpower expended for addressing questions from the LegCo.
[3] This is the estimated figure of the total efficiency gain of LandsD and PlanD. The information collected, however, are unable to support the derivation of a range of possible quantifiable savings.

				Cost and Benefit of CSDI by Year				
				Year 1	Year 2	Year 3	Year 4	Year 5
Costs	Total Cost		$	65,556,120	58,530,480	55,956,840	38,626,440	38,626,440
Benefits	Total Benefit	(Lower)	$	-	1,463,917	3,659,792	5,855,667	7,319,583
		(Upper)	$	-	2,112,675	5,281,689	8,450,702	10,563,377
Net	Net Balance	(Lower)	$	(65,556,120)	(57,066,563)	(52,297,048)	(32,770,773)	(31,306,857)
		(Upper)	$	(65,556,120)	(56,417,805)	(50,675,151)	(30,175,738)	(28,063,063)

c) Qualitative benefits and costs

18. Cost and benefit items that are discussed qualitatively in the business case include:

Government	Wider Community
Costs	
• Cost for establishing policies and procedures • Cost for metadata and enhanced data interoperability • Cost for training and outreach	• Cost for extending CSDI to the public • Additional administrative cost for implementation; • Societal wide adoption costs • Societal wide capacity development costs
Benefits	
• Time savings from responding to public queries • Improved inter-governmental collaboration • Improved policy formulation • Improved public service delivery	• Better land use planning and development • More efficient engineering and construction projects • Improved asset management • Enhanced location-based tax compliance • Improved land administration

Concluding Remark

19. The development of CSDI is a timely and strategically important initiative as Hong Kong embarks on its journey to become a liveable, competitive, innovative, sustainable and smart city. This initiative will have the ability to support the long term vision of Hong Kong through the provision of a critical information infrastructure that maximises innovation, knowledge and value creation for different segments of the populace starting from within the Government.

20. To enable Hong Kong to realise the full benefits of CSDI in the long term, it will be key for the Government to ensure that the following key success factors are addressed:

- High level support and policy mandate to sustain the momentum of development;
- An enabling institutional arrangement that steers development and review progress;
- A sustainable source of funding that enables CSDI to reach a state where it could demonstrate benefits and incentivises participation and collaboration; and
- A supportive eco-system whereby the Government, businesses, academic and the wider community are spatially knowledgeable in tapping on the potential of CSDI.