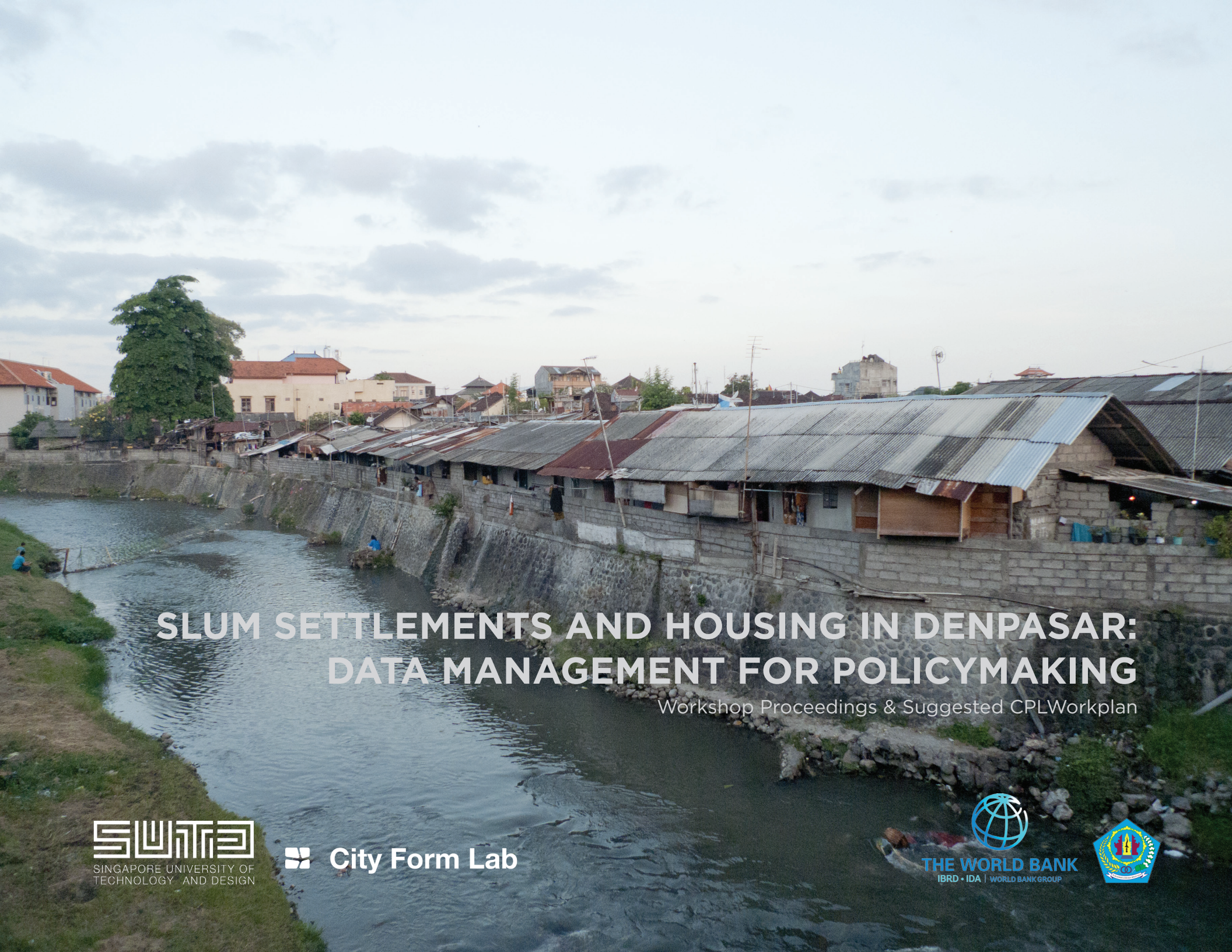

SLUM SETTLEMENTS AND HOUSING IN DENPASAR: DATA MANAGEMENT FOR POLICYMAKING

Workshop Proceedings & Suggested CPLWorkplan

SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

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1. SUMMARY

1.1 SUMMARY

Rapid urban population growth has increased the demand for adequate housing and basic services across Indonesia. The recent decentralization of the National Government's responsibilities regarding spatial planning and policymaking has put pressure on municipalities to quickly build capacity in order to develop solutions to housing challenges faced by their citizens. During this transitional period, slum settlements (or permukiman kumuh) have expanded in part due to the attractive economy of Denpasar as a growing metropolitan area. Consequentially, slum settlements have become an important focus of Kota Denpasar's planning and policy initiatives.

Slum settlement upgrading is a complex and multifaceted process requiring the support of a robust and comprehensive suite of data, analysis tools, and cross-departmental collaboration. Currently, data regarding slum dwellers and settlements in Denpasar is largely sourced from national surveys and is unfit to address the nuanced challenges surrounding slum settlements at the city-scale. In order to develop high-resolution policies that target the specific needs of slum dwellers in Denpasar, the City must maintain its own process for collecting, maintaining and analyzing information and establish its own context-specific solutions.

The City Planning Lab (CPL) aims to develop citywide geospatial data for Denpasar in support of the evolving initiatives of the City. By focusing preliminary data collection efforts on slum-settlements in Denpasar through a suite of "Pilot Projects", CPL expects to develop a resilient methodology for data collection, analysis and designing pilot upgrading schemes that will ultimately support Denpasar's vision of a city free of slum settlements.

CPL is envisioned as a permanent planning and urban analysis support facility within the municipal planning department. Access to leading technical assistance and advisory support in urban management, analytics and systems has been provided as part of the World Bank's National Urban Development Program (P3N) in Indonesia. Developing an evidence-based planning decision support system that relies on empirical and up-to-date data using powerful spatial analysis tools can make meaningful contributions towards turning the rapid urbanization of Indonesian cities into a vast opportunity for economic growth, equitable resource distribution and access to human development opportunities. Denpasar is one of the first Indonesian cities to pilot the City Planning Labs (CPL) concept.

To date, Denpasar has built a City Planning Lab, hired staff, begun data collection and standardization, developed an online WebGIS for data sharing, and begun raising awareness about the benefits of spatial data and analytics in the context of urban planning issues faced by Kota Denpasar.

SUTD site visits to Jematang.

Solid waste management problems in Pemecutan Kaja.

The workshop "Slum Settlements and Housing in Denpasar" initiated by the City, addressed slum settlement issues in Denpasar from the perspective of evidenced-based planning and data management. Presentations familiarized city leaders, local experts, academics and community members with CPL activities, while facilitated exercises sought particpants' local knowledge regarding slum settlement issues. Facilitated by the WB and SUTD teams, participants identified four key concerns affecting slum settlements across Denpasar: Land Tenure & Migration, Sanitation, Access to Services and Local Economy. These concerns have shaped preliminary plans for data collection and analyses conducted by CPL at both site and city scales, as described throughout this report.

CPL will further explore, test, and refine its activities through Pilot Projects conducted at three preliminary sites of inquiry: Jematang, Ubung Kaja and Pemecutan Kaja. By refining a working information-systems process (including cross-departmental collaboration) at these sites, CPL may expand its data collection and analysis activities to multiple areas (10-15 sites) in the coming year. Developing a comprehensive understanding of slum settlement characteristics in Denpasar is critical for not only identifying opportunities for site-specific intervention, but also designing effective citywide policies for slum upgrading and prevention.

This report documents the process and outcomes of the participatory workshop in June 2014 and identifies priorities for data collection, analysis and pilot planning projects for improving slum conditions in Denpasar. These pilot activities are meant to support larger program implementations addressing slum settlements, which Denpasar may continue in the future. The lessons learnt and ideas generated, as part of the pilot programs should be used as a starting point for a comprehensive citywide slum improvement program. In the more immediate term, this report lays out recommendations for implementation of Pilot Projects, continued expansion of the WebGIS data sharing platform, CPL's organizational structure, professional aerial base map development, and cross-departmental collaborations with CPL.

2. SLUM SETTLEMENTS AND HOUSING IN DENPASAR: THE WORKSHOP

2.1 CONTEXT

Kota Denpasar has prospered economically due to an active tourist economy, which attracts migrants from various villages in Bali, Java, other islands and even foreign countries to part take in the City's labor market. Such popularity has led the city to a housing shortage while land values in Bali have increased to among the highest levels in Indonesia. Many migrants who join the city's labor pool cannot afford adequate housing and end up settling in slums. While a large share of Javanese migrants in Bali work on fields, often as seasonal workers, Denpasar's migrants are typically employed year-round in urban jobs varying from vending and street services, recycling, home-production of food and crafts, as well as basic tourist service jobs. The high value and scarcity of land prevent housing supply from matching demand. The city itself owns no land in Denpasar and cannot afford to acquire any at market rates. There is presently no city-run public housing development and migrants are housed under complex, multi-layered rental schemes by private landlords. Legal occupancy and development rights associated with each tenancy agreement complicate the potential upgrading options.

The zoning code in Denpasar currently does not allow multi-story, multi-family housing for spiritual reasons. According to a widely held belief, each Balinese household must have a shrine on the ground level of the house. It is not considered acceptable to have any other family's shrine above your shrine, making multi-story, multi-family housing impossible. This policy has produced serious consequences for the housing market – new units have to be low-rise and housing development is therefore very land intensive. Given the high price of land, the ban on multi-story housing effectively limits supply and incentivizes sprawl. Horizontal growth, in turn, puts further pressure on traffic congestion, municipal services, such as waste collection and utility systems, which need to cover longer distances.

Unlike other cities in Indonesia where slums typically emerge on government owned land (e.g. right-of-ways adjacent to railways, rivers and water bodies), Denpasar's slums are on private land with established landowners. With high occupancy densities, renting space in slum areas can generate relatively high rental income to landlords. Property taxes generally target building improvements on land, giving slum landlords little incentive to introduce permanent improvements that would increase their tax rate. Many of the structures in slum areas are thus developed by dwellers themselves and it is in the interest of the landlord to keep them as non-permanent so as to accommodate flexibility for future tenants' needs.

According to a survey commissioned by Bappeda, there are at least 35 slums with more than 10 adjacent slum-like buildings in Denpasar. These areas have been recognized by the

Initial remarks from City of Denpasar officials.


Members of SUTD, World Bank teams and Kota Denpasar.

Registration on Day I.

City as potential improvement sites. However, the present information on the definitions and locations of slum settlements is partial and would benefit from better documentation. The areas that were identified were pointed out in each Desa by the Desa heads. Not having a clear definition of what constitute slum settlements at the time of the survey consequently introduced variation into the data: homes considered problem cases in highly developed Desas may resemble middle-income households in a less developed Desa. The survey also did not have a clear definition of how far problematic houses could be from each other to still be considered part of the same slum settlement cluster: some clusters that were identified might thus be spread out at a distance with more consolidated housing between them, while other clusters that were not identified as slums might have pockets of less than ten adjacent slum-dwellings scattered through multiple nearby sites. Discussions with Bappeda have indicated that these definitional issues are indeed confounding the selection base for potential upgrading and should be addressed in future surveys.

Any slum upgrading strategies and policies introduced in Denpasar should desirably address both the on-ground particular issues of each site, as well as the broad citywide causes of slum settlement development simultaneously. This is a complex task that should be supported by a body of reliable data and evidence. CPL can inform Kota Denpasar of the current state of slum settlement areas, provide citywide spatial analyses that target slum settlement issues, identify opportunities for intervention and propose informed solutions and strategies for slum settlement upgrading in the city. In order to support each of these objectives, CPL must engage with different SKPDs to work jointly on slum settlement issues and coordinate efforts on data collection and analytic activities.

As a first step towards an inter-departmental approach to slum settlement improvement, a participatory workshop on “Slum Settlements and Housing in Denpasar,” was held from June 10-12th, 2014. The workshop aimed to broaden awareness of CPL capabilities and explore CPL engagements with slum settlement improvement challenges in Denpasar. It focused particularly on the housing and slum settlement challenges from the perspective of data management, emphasizing interdepartmental collaboration and technical tools. Because city-scale dynamics produce site-specific outcomes, three sites were selected as areas of study: Jematang, Ubung Kaja and Pemacutan Kaja. Workshop participants explored how these disadvantaged areas embody deeper housing and infrastructure problems common across Denpasar, identifying data required to understand and improve their conditions, and proposing possible planning and policy solutions.

The workshop was hosted by BAPPEDA

and the new CPL of Kota Denpasar, facilitated by the World Bank and Singapore University of Technology and Design's (SUTD) City Form Lab consultants and supported by experts from external agencies/ universities. Approximately seventy invited participants from across SKPDs and local universities participated in the workshop over the course of the three days. The workshop took place in a new municipal building, Graha Sewaka Dharma.

The objectives of this participatory workshop as set forth by Kota Denpasar and agreed upon by the World Bank and SUTD teams were to:

- Identify CPL priorities for additional data gathering and analytics necessary to understand slum settlement dynamics in Denpasar and inform policy-making.
- Engage different city government departments in a joint effort to investigate issues and opportunities around slum settlements in Denpasar.
- Introduce different local government agencies and stakeholders to CPL and initiate discussions regarding data sharing and management systems and practices.
- Raise awareness about the CPL initiative across the SKPDs in Kota Denpasar and invite participation through development of partnerships and future capacity building engagements.
- The WB and SUTD teams also introduced participants to important concepts of spatial data analysis and management in the context of slum settlement management in Denpasar including:
- Mapping & Analytical methods in ESRI's Geographic Information Systems (GIS). These standard procedures of mapping and analysis form the basis of CPL activities, and the core of GIS Management offices in many cities around the world.
- Best practices in data sharing using the new WebGIS Platform. Sharing data across departments is important for developing a streamlined data source that supports integrated policy-making across departments. Miscommunication across departments is one cause of delayed or unsuccessful responses to slum settlement challenges.
- Establishing Standard Operating Procedures (SOPs) for data management. Taking other city government structures into account, Kota Denpasar was introduced to existing models of data management, providing examples for city leaders.

Several outcomes were achieved by this workshop including:

1. Identification of priority concerns surrounding slum settlements to be addressed by future CPL activities.

2. Identification of types of data recommended for designing policy/ solutions to slum settlement issues in Denpasar.

3. Identification of potential data sources within and beyond Kota Denpasar.

Site visits with attendees.

Presentation by CPL staff.

Presentations by SUTD.

1. Increased cross-departmental awareness and participation regarding the CPL initiative.

2. Increased awareness regarding data sharing needs and opportunities.

3. Demonstration of the new WebGIS system developed June 2-6 with Agrisoft/ CPL.

Outcomes 1-3 informed the development of a Pilot Project as well as a citywide suite of analyses presented in Section 3.3 of this report. A catalog of group work output reflecting items 1-3 is available in Section 1 of the Appendix. Ongoing discussions between the World Bank, SUTD and CPL team members are reflected in budgetary and timeline requirements for key CPL activities moving forward in Section 4.

2.2 WORKSHOP PROCEDURES

The workshop commenced with opening remarks from Denpasar city leadership and the World Bank, followed by presentations from BAPPEDA introducing the workshop and the CPL initiative. Workshop participants included invitees from across SKPDs including the four Camat (District) heads of Kota Denpasar, and Kepala Desa (Village Heads) of the three case study sites. These participants were able to bring in-depth local knowledge to discussions throughout the workshop. (See Section 4 of the Appendix for a listing of invitees.)

Each day began with a registration period, followed by presentations and group work. Presentations from the SUTD team and other experts invited by the World Bank demonstrated the benefits and importance of evidence based planning, techniques and tools for data analysis, best practices for data sharing & management, and provided example case studies for mapping housing and neighborhoods areas.

Six themes identified by the World Bank and consultants team together with Kota Denpasar for investigating specific site issues were:

- Housing & Tenure
- Urban Infrastructure & Mobility
- Local Economy
- Social Inclusion
- Hazard Risk & Vulnerability
- Environment & Sustainability

Workshop participants were formed into teams based on their background and expertise and each team was allocated one of the six themes as a lens for investigating slum challenges in Denpasar. In each team a lead facilitator was identified with previous work experience regarding the corresponding theme. In between work sessions, each group presented their ideas with all workshop participants in a "pin-up" format using maps, diagrams and drawings. Two professional translators were hired so information could be

conveyed in English and Bahasa Indonesian throughout the workshop.

2.2.1 Day 1

Day I began with presentations from BAPPEDA framing the current state of housing and related policies being pursued by Kota Denpasar, and introducing the City Planning Lab initiative to cross-departmental participants.

2.2.2 Presentations

Ibu Rini, BAPPEDA Head of Infrastructure Division and CPL lead, introduced the new City Planning Lab (CPL) initiative and described local and regional conditions contributing to housing problems in Denpasar, existing programs related to slum settlements set forward by the Mayor, and objectives and challenges for the CPL. Rapid population growth, changes in neighborhood function, exploitation of natural resources and outdated infrastructure are key challenges faced by Kota Denpasar. Additionally the City struggles to support the "Bali Clean and Green" environmental policy, representing a commitment to maintain 35% of Denpasar's public land as open space. Bappeda's presentation outlined two important objectives for the workshop:

- To assess slum settlement problems in Denpasar for the coordination of government offices in support of related policy-making and planning.
- To introduce and develop CPL concepts including spatial data management and data sharing through discussions with related parties.

Pak Putu Perdana Kusuma Wiguna, CPL team coordinator, explained during his presentation what CPL has done since inception. He demonstrated the newly launched Kota Denpasar WebGIS for data sharing through the Internet, gave an overview of existing geospatial data that has been collected by CPL and its many challenges, discussed needs for evidence- based planning and geospatial analysis, and introduced potential developments for CPL and Denpasar. These discussions clarified that CPL needs support from across SKPDs in the form of streamlined data-sharing and improved data quality.

Pak Nyoman Kami Artana presented his data and experience of mapping slum areas in Denpasar.

2.2.3 Site Visits

After forming teams and allocating themes, all participants jointly visited the study areas by bus, spending around 45 minutes at each of the four sites. All team members received four A3-sized aerial and line drawing maps for each site and the City of Denpasar. Led by a WB or SUTD facilitator, team members were encouraged to record their observations through note taking, mapping and photography. Groups also conducted onsite interviews.

Day II group work.

These findings were used during group work sessions to spatially identify key problems related to housing. District heads of sites were previously informed and participated in the visits, brining an important local perspective of the sites' challenges to the teams.

The day ended with a short debriefing exercise lead by team facilitators, in which participants gathered to share their findings with other team members and develop analysis maps for the following work.

2.2.4 Day II

The second day of the workshop introduced data management and analysis techniques and focused on group work. Following a similar format to Day I, presentations from WB and SUTD teams occurred in the morning with group exercises and presentations in the afternoon.

2.2.5 Presentations

Presentations from SUTD consultants provided case studies that demonstrated the functionality of analysis-based policymaking and planning via case studies and examples. Open source databases like NYC's Open Data platform showcased the potential of CPL's WebGIS platform to connect and coordinate data-sharing across Kota Denpasar and the public. SUTD introduced data analysis techniques such as "cluster detection" in GIS, thereby demonstrating how

Group presentations

BAPPEDA could objectively identify slum settlements to target focal points for intervention.

Other techniques introduced in this presentation catered to Denpasar's analytical needs and existing data sets.

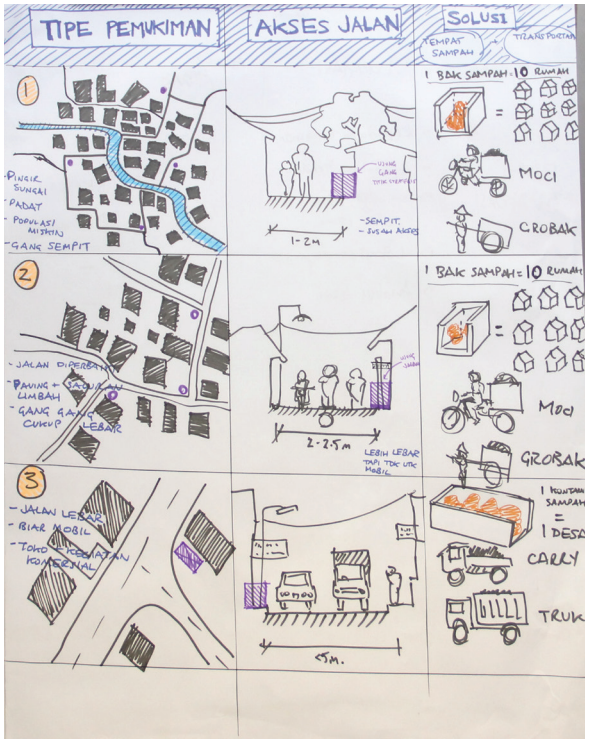
2.2.6 Group Work

For the remainder of the day, groups brainstormed and mapped key challenges and opportunities for housing across the three sites in Denpasar, focused on their designated theme. Groups were equipped with A0-size aerial maps (1:500 scale) for each site, as well as a city-scale (1:10,000) map of Denpasar. Rulers, drawing materials and stand-alone writing pads were made available. Groups were encouraged to prioritize the challenges identified within their themes and interpret those challenges as processes that could be visually communicated. Facilitators helped groups translate their ideas into maps and diagrams, enhancing each group's ability to connect complex challenges to spatial analysis and visual thinking. Groups presented the results of their work at two intervals; comments and questions from other teams were encouraged and mediated in Bahasa and English.

2.2.7 Day III

Significant schedule changes affected the third day of the workshop. Due to religious observances of Purnama (a Balinese full moon ceremony), Day III of

Facilitators lead group work.



Group work output (for complete inventory see Appendix: "Workshop Output").

the workshop was compressed from a full day into a shorter session. Morning presentations proceeded as scheduled, and group work ended in the early afternoon. Day III presentations focused on best practices and standard operating procedures for data-sharing and database management. Group work developed spatial planning and policy ideas that addressed the problems identified on the previous day.

2.2.8 Presentations

SUTD consultants discussed best practices for data management, standards for data collection, and importance of data sharing. This presentation focused on the new Kota Denpasar WebGIS as a standards-based system, which could be used for data sharing across SKPDs. Open data and open government practices in Indonesia (Open Government Indonesia, OGI) and elsewhere demonstrated how data accessibility can improve public awareness and participation in planning processes. It was recommended that Denpasar draft and distribute SOPs covering data collection, sharing and management. Next steps for Kota Denpasar may include establishing a working group between CPL and related Dinas, assessing the current inventory of data within each department and drafting the above mentioned SOP. A consultant shared Kota Kita's (a Solo based NGO) experiences doing participatory mapping and creation of neighborhood atlases to support data driven community discussions and decision making in Solo.

2.2.9 Group Work

Group work for the remainder of the day focused on facilitating teams to think about planning policy ideas around one or two priority issues within their designated theme. Groups produced plans and drawings (including sections and diagrams in some cases) of their proposed solutions. In addition to producing visual artifacts, teams were asked to identify data sets needed to achieve their goals and to identify what agency would be responsible for collecting and maintaining the data. In some cases, teams also identified data collection methods and speculated on analytical methods that could better frame their problem or improve an existing policy.

2.3 OUTCOMES

2.3.1 Group Work

Group work focused on the production of site plans and diagrams, identification of key concerns, priority data types and potential data sources in order to inform CPL activities. These findings are catalogued in the chart below. Documentation of Group Work results can also be found in Section 1 of the Appendix.

2.3.2 Key Concerns

While workshop groups tackled a variety of challenges relating to slum settlements, four common themes

GROUP WORK OUTPUT				
GROUP	OUTPUT	KEY CONCERNS	PRIORITY DATA TYPES	SOURCES
Environment & Sustainability	3 Site Area Maps, City-wide challenges, priority data layers, data analysis types	Sanitation (Reduce Pollution), Trash Management, Clean Energy Sources	DSDP Network, parcel land use, demographics, Population density, growth expectations, location of public facilities, public health, electricity usage, air quality, trash collection points, trash bank capacity and location, wastewater network, location of dams	DSDP, Kepala Desa, BLH, PLN, DKP, PU, Dinas
Housing & Tenure	4 Diagrams, 2 Data charts	Land Use patterns not optimized or enforced and poor Housing conditions.	Land use: RDTR, RTRK, permits (PPM, IMB, LIKL UPL, SITU, SIUP TDP, TDG, ITR), land & building taxes, land parcels, open space. Housing Conditions: infrastructure database, demographics (population, household size)	Bappeda, DTRP, BPN, DKP, DISPENDA
Local Economy	Spatial plan (Ubung Kaja), two diagrams	Zoning & land use that supports small businesses	Inventory of small businesses, location of markets	PU, PDAM, DKP, Dusun & Desa
Risk & Vulnerability	3 Typologies, 2 Site Plans (Pemecutan Kaja)	Sanitation, Trash Management, Drainage	Street Centerlines, topography, bodies of water, number of households, parcels, building foot prints, existing routes	PU, DKP, Kepala Desa
Social Inclusion	2 site plans, Proposed analyses, Recommendations, Data needs & existing challenges	Ethnic tensions, conflict, environmental pollution, economic security	Demographics, topography, Incidents, Disease, Income, home locations, migrant status	
Urban Infrastructure & Mobility	Design typologies, two site plans, Data sources list	Sanitation, Trash Management, Drainage	Topography, trash collection routes, existing drainage infrastructure, household locations & size, population density	BPN, DISPENDA, PU, DKP, PDAM

Table 1. Group Work Output Inventory.

Group work output: Evironmental Sustainability.

emerged from their work. Land Tenure & Migration, Sanitation, Access to Services and Local Economy materialized as major issues affecting the greater part of slum settlements in Denpasar. These concerns represent future areas for data collection and analysis initiatives recommended for the City. These concerns can be used as guides to define survey metrics that describe ground conditions in slum settlement areas, as well as the priorities of analyses conducted by CPL in service of both Pilot Projects and citywide analyses.

1. Land Tenure & Migration

Access to secure, affordable land is key to housing development, and is of particular concern for slum settlements in Denpasar. Land rights in Indonesia have evolved under complex historic circumstances rooted in legal structures introduced by Dutch colonization, which transitioned into a modern land system in the late 20th century. This recent transition at the national level contributes to a general uncertainty regarding land rights and tenure systems.

In Indonesia there are several types of rights that may operate simultaneously on a site. Freehold right (Hak Milik) can only be inherited by Indonesian citizens, while cultivation rights (Hak Guna Usaha) may be distributed to citizens and/ or corporations. Building rights (Hak Guna Bangunan) are often not allocated to the owners themselves, but rather to the individual operating the site. Usage rights are directly controlled by individual communities or the state. Most urban slum settlement dwellers experience uncertain land use rights as a consequence of inconsistent enforcement of these overlapping definitions.

In the case of Jematang for example, 3-4 private owners must be negotiated with in order to implement any planned site changes. In Ubung Kaja, land ownership by a private company impedes top- down improvements, resulting in community- sourced funding for basic infrastructural renovations such as road paving or streetscape improvements. These unofficial and unregulated renovations are of poor quality due to a lack of standards and inconsistent maintenance. Because city interventions in slum settlement areas are limited due these complexities, having an inventory of existing ownership, use and value at the parcel level would help identify areas where the City can more easily implement proposed upgrading projects or acquire land.

2. Sanitation

Slum settlement areas in Denpasar suffer from severe sanitation problems. All three case-study sites exhibited poor sanitation conditions resulting in part from failing or inefficient infrastructure and/or ineffective waste management practices. Decentralization of National Government planning services has made it difficult to develop integrated infrastructure systems across a

municipality.

As a consequence, residents in slum settlement areas develop their own solutions to waste and water management. Many of the sites visited do not participate in citywide trash collection but have instead developed community-driven solutions for solid waste management. In some cases, the sites themselves are sources for trash dumping. Residents of Ubung Kaja for example receive trash onsite and sort it according to re-sellable or recyclable materials.

Sanitation problems observed by the groups in all three sites were exacerbated by a lack of infrastructure. With limited access to City provided infrastructure, residents of dense, urban core sites like Jematang drill their own water wells and maintain communal toilets. Mismanaged wastewater leads to unsanitary environmental conditions. Topographic characteristics and site proximity to bodies of water make these sites especially susceptible to flooding.

2. Access to Services

Slum settlement areas in Denpasar suffer from poor access to public services, amenities or utilities. Public services including hospitals, educational facilities, police headquarters, and fire fighting facilities are not easily accessible in some sites. Workshop participants noted that public amenities including open space or parks are virtually non-existent, resulting in few or potentially hazardous public gathering areas. Access to city services such as utilities (electricity and water), sewage or trash collection systems, requires a connection fee or "tariff." Many residents of slum settlement areas avoid these fees by finding alternative solutions. Often these alternative solutions are unsustainable, untenable or environmentally hazardous. Limited access to public services and amenities is a significant detractor to quality of life.

4. Local Economy

All sites visited feature robust small-business ecosystems. Small businesses provide jobs for residents and support for local families. Past field interviews suggest that accessible business environments attract slum dwellers to slum settlement areas. Cheap rents and accessible customer base encourage storefront development, while proximity to local markets incites onsite home-manufacturing. Different slum settlement areas attract varying small business typologies according to their unique attributes; Ubung Kaja hosts small-scale manufacturing operations, while Pemecutan Kaja and Jematang communities participate in retail and service-industry oriented business often conducted outside the home. Workshop participants identified and discussed opportunities to enhance or support local economies in these areas. A profitable and resilient local business environment was seen as a key endogenous catalyst for improving income levels and upward social mobility for slum dwellers.

Final Group work for Housing & Tenure.

2.4 LESSONS

Future workshops would benefit from several key lessons learned from this experience. Below are recommendations for improvements to future workshops conducted with related stakeholders, and may be particularly useful for public community engagements surrounding future Pilot Project initiatives.

1. Attendance & Recognition

Attendance was quite strong on Day I and dwindled on subsequent days. One possible solution to this problem would be to have City officials, such as the Mayor, attend group presentations on the final day of the workshop. In addition to maintaining numbers, this would provide workshop participants with important recognition for the hard work completed over the course of the three days.

2. Communication

Language posed a significant barrier during the workshop, and the need for several professional translators was evident. Translators were required at three key stages in workshop procedures: presentations, group work and group presentations. Additionally, awareness of cultural and professional codes is key for successful communication between facilitators and participants. Ideally, facilitators are familiar with what to expect in terms of participants' level of experience with the workshop format, and existing attitudes towards participatory planning processes. Introductory meetings between facilitators, City Leaders, and translators prior to the workshop could prepare facilitators for these types of nuances. Notably, several workshop participants arrived on Day I wearing shoes inappropriate for planned site visits. It is important for the invitations to convey appropriate attire when site visits are planned.

3. Acknowledge Existing Plans

It was challenging to communicate general principles of data collection and analysis to a broadly skilled audience, while honoring the complexities of site-specific conditions addressed by existing policies in Denpasar. In order to respect the experience of department heads, it may be helpful to communicate the workshop's position on this matter at the start of a workshop procedures to avoid confusion further down the road.

4. Reliable Digital Infrastructure

Reliable Internet connectivity is a necessity for workshop procedures. Having consistent access to information significantly enhances discussions and the accessibility of related material to aid workshop deliberations. The lack of reliable Internet made it impossible to use the new Kota Denpsar WebGIS during the workshop.

High attendance on Day I with the presence of important city leaders.

3. DATA AND ANALYSES

3.1 INTRODUCTION

The absence of reliable data on slum settlements is common to many developing countries. Typically slum settlement data is available at the national level, however this data is often incomplete, or too large in scope to inform context-specific policy development on the ground. Denpasar faces challenges in filling the void left by the dissolution of socioeconomic planning responsibilities from the national government to local municipalities. The City must develop not only solutions to current challenges faced by its citizens, but reliable and replicable processes by which to arrive at these solutions. Such a process requires data collection and analytical methods that integrate departments to achieve collaborative objectives.

Two national ministries (Ministry of Public Works and Ministry of Housing) evaluate the progress of slum alleviation in Indonesia using different criteria for what constitutes a slum settlement. The Statistical Central Board (BPS) currently provides slum settlement data to municipalities through the National Economic Survey or "Susenas."These data contain two features: the number of households that are "non-liveable" (RTLH) and the number of "poor households". There is some uncertainty that the criteria used to characterize these households are appropriate for the specific context of Denpasar. Dealing with inconsistent, abstract data collected at the national level is an incentive for Kota Denpasar to maintain a degree of autonomy regarding data collection and analysis.

CPL provides an opportunity for Kota Denpasar to develop its own methodology for data collection and evaluation in a cross-departmental manner. CPL addresses the data needs of Denpasar in two parts: through supporting Pilot Projects and developing citywide geospatial information.

Pilot Projects are site-specific interventions, such as a land consolidation plan, that address a current objective of the City and are supported by data collection and geospatial analysis. As proposed in stakeholder conversations following the Workshop, CPL Pilot Projects should focus on slum settlements in Denpasar, starting with Jematang, Ubung Kaja and Pemecutan Kaja. Section 3.2 describes the Pilot Project concept in greater detail.

Pilot projects are an opportunity to develop best practices for planning and executing data collection and analysis in service of a stated objective. Because the small-scale nature of a Pilot Project makes data collection at a fine resolution more manageable and affordable than at the city scale, Pilot Projects are an opportunity to enhance the quality and methods of data collection for later scaling to the city at large. A successful Pilot Project carried out at the site, or Desa/Kelurahan level would showcase a methodology for transforming project goals into tangible results through cross-departmental collaboration. Ideally, the methodology that emerges as an outcome of this process would be replicable across Desas/ Kelurahan in Denpasar.

An ongoing initiative of CPL is the development of a citywide geospatial base map (see Section 3.3). An up-to-date, accurate, detailed, streamlined base map will be the source of official maps for Kota Denpasar and ensures a reliable and consistent information resource that can support initiatives across SKPDs. Several common geospatial analyses are possible with proper investment in a professionally created base map, and the generation of key data layers such as parcels, building footprints, topography, administrative boundaries, land use and zoning. This information (in accurate form) is the foundation of a comprehensive understanding about the City's current state. Analyses performed using this information ensure appropriate investment in evidenced-based spatial planning strategies.

3.2 PILOT PROJECTS: DATA COLLECTION & SURVEY

3.2.1 Concept

Slum settlement upgrading is a priority for Denpasar, however past initiatives have been stymied by a complex land tenure system and demographic issues surrounding residents. Social programs such as "bedah rumah"

Infrastructure challenges in Pemecutan Kaja.

have been implemented to improve quality of substandard housing and provide much needed infrastructure in slum settlement areas, with limited success. Denpasar seeks to improve the approach to slum settlement housing, particularly in light of CPL activities. Pilot Projects at three sites in Denpasar provide an opportunity to collect data about slum settlements and use this information to design site-specific solutions to critical problems.

Jematang, Ubung Kaja and Pemecutan Kaja have been named by Bappeda as appropriate locations to test-run a slum-settlement upgrading strategy supported by geospatial analyses conducted by the CPL. These sites were selected as Pilot Project sites because they represent typical slum conditions in Denpasar. Problems in these three sites touch on all of the key themes discussed during the workshop: severe sanitation and drainage problems, limited access to services, a complex land tenure system, unsupported migrant residential population and promising but fragile small business communities. The sites are located nearby constraining topographic features such as steep slopes or bodies of water, posing hazard/ risk and environmental concerns.

The Pilot Projects aim to address these concerns chiefly through land consolidation and slum upgrading. Land consolidation strategies vary globally, but all fundamentally consist of the realignment of parcels with consent of communities in order to improve living conditions, provide services and upgrade infrastructure. Denpasar has a strong history of land consolidation and these practices may be improved through technical assistance provided by CPL, as well as exposure to global best practices by the World Bank.

The chief objective of the Pilot Projects is to improve the quality of life for residents in these areas while also addressing broader city planning objectives. The resulting slum settlement upgrading strategies would therefore keep inhabitants on site while supporting small-businesses. To improve affordable housing availability, the area should be densified vertically, widening streets and consolidating development as necessary. Several key objectives must be met by the land consolidation scheme that seeks to improve quality of life for its residents:

1. **Land consolidation scheme should involve the realignment of parcels, especially with consent of owners.** Crowded, unsanitary conditions, construction over a designated watershed area and complex land tenure agreements necessitate the collectively approved readjustment of land parcels and development of supportive zoning policy. Low-rise housing (with a maximum of 3 stories, less than 15m in height), is an example of a suitable strategy for Denpasar.

2. **Readjustment of land parcels will require improvements to the existing street network.** Widening and beautifying streets, as well

as developing a coherent street network that connects seamlessly to the surrounding fabric will improve accessibility for emergency services, businesses and households alike.
A significant opportunity exists for supporting walking and non-motorized transport as the primary modes of circulation in slum settlement areas, but these need to be enforced with good access to public transit in the improved sites.

3. **Consolidation projects should retain and improve the existing socio-economic structure of a site.** Slum areas in Denpasar have thriving entrepreneurial communities – several families operate storefronts from their dwellings, many households have manufacturing operations on site. Manufactured goods are sold to various markets around the city. Several small storefronts also cater directly to local residents. These important small business anchors form the spine of the community and should be supported and further enhanced in consolidation plans.

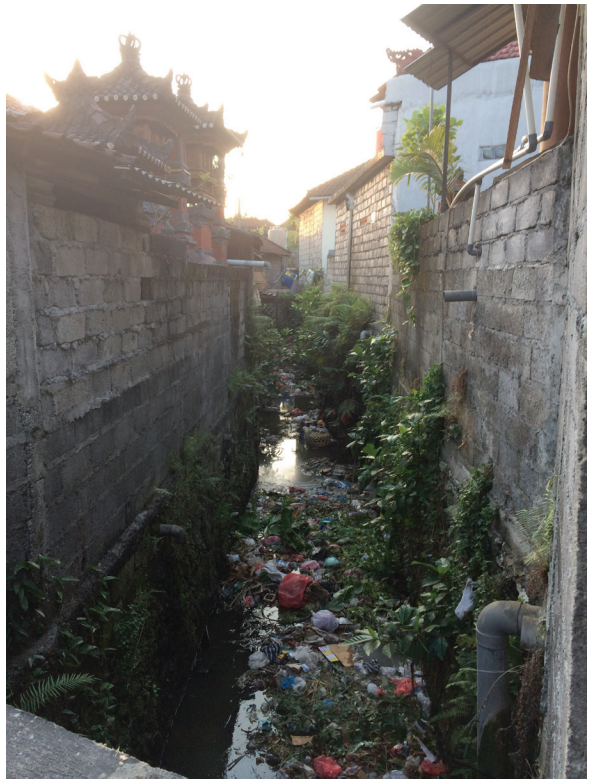
4. **Finally, the pilot project proposals should consider provisions for maintaining affordability on improved sites.** As land consolidation often results in increased land prices, it is important that community residents are able to afford rental units after project implementation. This may require Kota Denpasar to purchase land from an owner for the development of an onsite public housing project, or the development of a Housing Authority within Kota Denpasar. The details of this process will depend on the specifics that emerge through a comprehensive design process.

Slum settlement upgrading is a complex undertaking that requires coordination across departments and agencies, iterative community engagement, and professional consultation on planning, urban design and data management. CPL is in a position to support the City's efforts in this undertaking with data, spatial analysis and related planning proposals. The World Bank and consultants are presently already supporting this initiative. However, data collection will need to be performed internally or by an approved third-party such as a local university (UnHi Planning School may be a suitable candidate) with strategic advice from consultants. CPL staff should also participate in carrying out appropriate analyses in support of the Pilot Project objectives together with consultants.

3.2.2 Preparation

Time: September to October 2014

Preparations must be made in advance of data collection to plan and design surveys, obtain appropriate surveying equipment, debrief personnel, and agree on survey structures and output formats. It is recommended that students from a local university guided by CPL are responsible for collecting data and surveys on site as part of existing coursework or related



Problems with solid waste management in Pemecutan Kaja.

academic programs. There is also a potential opportunity to have the local university partner with a foreign university (e.g. Singapore) in carrying out these surveys. Technological equipment such as iPads and Smart Phones make the survey collection process far more manageable by increasing efficiency and accuracy with GPS and user-friendly interfaces, than former pen and paper methods. Necessary survey equipment for data collection should be acquired in advance. Typical applications used for digital map-based survey administration include Fulcrum, and iOS or Android based portable tablets. These tools do not require wireless signals and can operate via GPS in low-connectivity areas. Use of digital map-based and GPS enabled surveying devices would help eliminate potentially significant digitization errors involved with paper-based surveys.

While most of the suggested data can be observed in person or gained though first-hand interviews on site, legal parcel boundaries and necessary attributes will need to be supplied by the city department legally responsible for this data – DISPENDA. Official on site surveying by professionals with legal equipment is likely necessary. Legally recognized administrative boundaries, land use, and zoning will also need to be provided by the city department legally responsible for this data.

CPL staff will be responsible for understanding how to lead and repeat the data collection process so they can support this work through a future citywide expansion, and so CPL clearly understands the data collected and its appropriate uses in analysis.

3.2.3 Data Collection

Time: October 2014 to January 2015

Data collection may be performed internally or by third parties. With a team of students or trained individuals, it is expected that onsite data can be collected for a single Pilot Project site in about two to three weeks. This estimate may be revised pending available resources. Below is an example list of data layers needed for Pilot Project development. These data reflect important issues of slum settlement upgrading, including demographics, ownership, land value and physical attributes of the site in question.

Data Types:

1. Built Form
   - Building footprints and heights (structurally independent buildings should be represented as separate entities)
   - Vehicular circulation paths (centerlines and polygons)
   - Pedestrian circulation paths (centerlines and polygons)
   - Building materials (as attributes associated with each building)
   - Publicly accessible green spaces (shown as polygons)
   - Private green spaces (shown as polygons)
   - Open spaces used for street activities and play (e.g. dish washing, seating, vending etc.)
   - Shared community facilities (e.g. wc, shower, wells etc.)
   - Publicness of ground floor spaces (categorized as public, occupiable, private. Occupiable spaces are typically privately owned but publicly accessible, such as shops, eateries etc. Shown as polygons)

2. Demographic Indicators (unit of analysis: household)
   - X, Y coordinates of the main entrance to the household (HH).
   - Age of Household (HH) members
   - Ethnicity of HH members
   - Number of owners or renters, subrenters (include name of owner)
   - HH Income
   - HH occupancy duration in current premises (e.g. years)
   - Length of HH stay in Denpasar
   - HH place of origin before moving to Denpasar (if applicable)
   - Number of HH members
   - Occupations of working HH members
   - Distances traveled daily to work or schools by HH members
   - Access to utilities in HH (water, electricity, sewage, drainage, gas, trash collection).

3. Land ownership (unit of analysis: parcel)

- Geometric boundaries
- Owner's name and contact
- Assessed value
- Current occupant name
- Tenancy or sublet structure if applicable

4. Local business environment (unit of analysis: establishment)

- GPS coordinates business establishment
- Name of business
- Type of business (retail, service, manufacturing by 4-digit SIC category)
- Monthly fixed costs of running the business (rent, salaries and utilities)
- Owner's name and contact
- Business floor area in m^2
- Fixed or mobile location
- Owner, renter, sub-renter (include name of owner)
- Number of employees including owner
- Number of staff not related to owner
- Number of staff living in store
- Volume of waste produced per week

It is recommended that such data collection be first piloted on the three study sites in a sequential order. This will allow the pros and cons of the data collection methods to be re-assessed after the first case, making the second and third cases easier and more effective to survey. After iterative improvements, the survey data and methodology will desirably be ready for citywide slum area mapping.

3.2.4 Data Analysis

Time: January to May 2015

Data analyses will be conducted primarily by CPL in collaboration with consultants and are listed below. These analyses intend to describe indicators of "quality of life" among pilot area residents both before and after an upgrading project is implemented. By thoughtfully collecting a robust data set on preliminary conditions prior to redevelopment, Kota Denpasar is empowered to both critically evaluate and defend the success of the adopted slum-settlement upgrading strategy later. This is critical for Kota Denpasar moving forward, so that it may make informed decisions and iteratively improve consolidation or upgrading processes in the future.

The following analyses are suggested as ways in which to measure the "liveability" characteristics of housing environments before and after consolidation. The outcomes measured on present conditions can also be used as guides for any upgrading or consolidation design.

Shared Community Facilities

Slum settlements have a few positive characteristics that should be preserved, one of which is access to shared community facilities. Community-sourced amenities such as small parks, gyms, tools, pools and gardens reduce conflict and improve health conditions. Upgrading strategies

Children play on a homemade bench press & outdoor gym.

Table 2. Pilot Project suggested Analytics including analysis types and possible metrics.

ANALYTICS: PILOT PROJECT		
CATEGORY	**TYPE**	**METRICS**
Shared Community Facilities	• Before & after: comparisons or simluations conducted from GIS database.	• Number and types of shared community facilities • Geolocation of each type of facility in GIS
Open & Green Space	• Before & after	• m2 of open space for street activities and play per resident • m2 of green space or landscaped space per resident • Quantum and distribution of public, private and occupiable space
Local Economy & Diversity of Uses	• Before & after	• Number of business per local resident • m2of business per resident • Mean, Min. and Max. sizes (m2) of businesses • A tally of existing businesses, showing X,Y coordinate, business type, name and staff size • Number of businesses encountered in a 2,5 and 10-minute walk around each building (analysis using the Urban Network Analysis Toolbox) • Estimated customer catchment necessary to maintain the quantum of businesses currently on site
Affordability	• Before & after	• Indoor living space (m2) per resident • Mean, Min. and Max. property and land values per m2 • Mean, Min. and Max. rent per m2 • Percentage of residents owning their house / land, and the locations (x,y coordinates) of their properties in GIS. • An assessment of what spatial features affect property values locally (adjacency to roads, entrance to the area, size of lot etc.)
Access to Services	• Before & after	• % of HH without utilities (water, electricity, sewage, drainage, trash collection) • Accessibility to citywide services and assets (schools, parks, transit stops, markets, post-offices) calculated in GIS
Demographics	• Before & after	• Population in a given slum area • Number of Households (HH) • Median HH income • Origin of current head of HH (Balinese, Javanese etc.) shown as percentage bins for the settlement. • Percent of inhabitants working on a daily basis • Percent of inhabitants in schools on a daily basis • Percent of inhabitants staying at home on a daily basis • Primary employment areas (%) of residents • Education levels of residents (in bins: none, primary, secondary, tertiary). • Access to health care of residents (%) • Possession of Denpasar resident ID card among residents (%)
Economic Development: Employment	• Before & after	• Employment per household • Building footprints

should provide as much, if not more opportunities for communities to share similar facilities.

Metrics

- Number and types of shared community facilities
- Geolocation of each type of facility in GIS

Open and Green Space

Overcrowding and lack of quality public space is a common feature of slum settlement areas. However, residents resort to very creative uses of limited public space. Streets and little squares are commonly used as venues for economic activity, community services and recreation. Narrow lanes ("gang") in front houses are used for washing dishes, cooking, working, drying rice, packing of merchandise for sale, or simply resting and people watching. Such activities make kampung lanes and public spaces into active community spaces where people see each other and are seen. It is important to maintain multi-purpose open space in consolidated projects so that a strong sense of community can persist. Additionally, slightly larger open spaces and new parks can increase the psychological wellbeing of residents, especially children, and improve health conditions. Public and green space areas should be surrounded by a diversity of uses (commercial, residential, recreational) to avoid becoming neglected and potentially dangerous.

Metrics

- m^2 of open space for street activities and play per resident
- m^2 of green space or landscaped space per resident
- Quantum and distribution of public, private and occupiable space (see Sevtsuk 2014, "Mapping the Elastic Public Realm").

Local Economy and Diversity of Uses

Informal housing areas in Denpasar exhibit a diversity of uses satisfying a range of tastes, needs and income levels. Activities vary from home-based shops to small-scale manufacturing, designated businesses, small factories and office spaces. The balance of use in these areas emerges from the community and is therefore uniquely suited to the community's collective needs. While use distribution in some cases can be significantly improved (by providing better access to city services for example), attention must be paid to the existing quantity, distribution and type of uses the community has already developed. This distribution not only offers livelihood and support to the community's needs, but also represents valuable socio-economic networks that take a long time to emerge and thrive. It is thus important to preserve and improve spaces for diverse activity patterns with upgrading strategies.

Metrics

- Number of business per local resident
- m^2 of business per resident

Small streets are the city of community activities.

Polluted green space in Jematang.

- Mean, Min. and Max. sizes (m^2) of businesses
- A tally of existing businesses, showing X,Y coordinate, business type, name and staff size
- Number of businesses encountered in a 2,5 and 10-minute walk around each building (analysis using the Urban Network Analysis Toolbox)
- Estimated customer catchment necessary to maintain the quantum of businesses currently on site

It is additionally recommended that a random sample of businesses in the pilot sites be surveyed to understand their business operations and costs. The results of this survey can be used to inform consolidation strategies to support local business. Survey questions should reveal:

- Monthly fixed costs for running the primary types of businesses (shop, home manufacturing, service, office)
- Percentage of total revenue used to cover fixed costs
- Space rent per sqm
- Typical space needed for running the primary types of businesses (shop, home manufacturing, service, office)
- Number of staff needed
- Average staff salary
- Minimum monthly revenue needed to stay in business
- Clustering preferences with other business types

Affordability

Land values typically rise with public investment, particularly in dense, urban core areas. Current residents of slum settlements, who were originally attracted to the area due to its affordability, are in danger of seeing rents rise beyond their reach after the upgrading strategy is implemented. Measuring property values before and after project implementation helps project managers understand the net valuation effects of the upgrading strategy, and incentivizes affordability programs for original residents.

Household ownership is considered a symbol of wealth and status. Even though the high value and scarcity of land in Denpasar prevent housing supply from matching demand, some slum area residents do own the land they live on. It is important to understand the owner/ renter dynamics of an area before designing a consolidation scheme, and to make sure land ownership patterns are respected in the new solution.

Metrics

- Indoor living space (m^2) per resident
- Mean, Min. and Max. property and land values per m^2
- Mean, Min. and Max. rent per m^2
- Percentage of residents owning their house / land, and the locations (x,y coordinates) of their properties in GIS.
- An assessment of what spatial features affect property values locally

(adjacency to roads, entrance to the area, size of lot etc.)

Access to Services

Accessibility to municipal services, public amenities and local businesses is an important health, economic and quality of life indicator. Access to services may also be an indicator of land value as some areas with greater accessibility rates are often highly valued for their convenience. Upgrading strategies should work to improve access to services, particularly in slum settlement areas that do not have access to public infrastructure.

Metrics

- % of HH without utilities (water, electricity, sewage, drainage, trash collection)
- Accessibility to citywide services and assets (schools, parks, transit stops, markets, post-offices) calculated in GIS

Demographics

Significant tension exists between native Balinese populations and Javanese migrants. Javanese migrants however, represent a significant skilled workforce that must be accounted for in slum settlement surveying, as they reflect growth potential and attractiveness of a given area. Surveys should include the number of migrant workers, their type of employment, income level and origin. Understanding how migrants' upward mobility changes over time will provide insight into how slum settlement upgrading may help integrate these populations into Denpasar's local economy. Citywide maps can be used to show how the broader population of migrant workers can be accommodated in Denpasar as a whole – whether distributed evenly across the city or concentrated in specific areas.

Household income is a critical indicator of economic growth. Slum settlement strategies should work to improve household income by mitigating rental prices as well as improving accessibility of services, businesses and transportation in the area.

Paid employment is an important factor in determining the quality of life via purchasing power for goods and services. Duration and nature of employment is important to assessing unemployment rates in slum settlement areas, and ideally should be improved by upgrading strategies that seek to improve living conditions.

Metrics

- Population in a given slum area
- Number of Households (HH)
- Median HH income
- Origin of current head of HH (Balinese, Javanese etc.) shown as percentage bins for the settlement.
- Percent of inhabitants working on a daily basis
- Percent of inhabitants in schools on a daily basis
- Percent of inhabitants staying at home on a daily basis

Informal trash collection in Ubung Kaja.

Community-funded streetscape improvements in Ubung Kaja.

Small business storefornts in Jematang.

- Primary employment areas (%) of residents
- Education levels of residents (in bins: none, primary, secondary, tertiary).
- Access to health care of residents (%)
- Possession of Denpasar resident ID card among residents (%)

Using the analyses listed above as indicators, simulations can be conducted to assess the impact of various proposed design typologies. CPL can support in the development of these design typologies by conducting the previously mentioned analyses and streamlining data collection into a manageable GIS database. Any consolidation or upgrade project should improve the present state of conditions while meeting the objectives outlined at the beginning of this section.

3.2.5 Design

Time: February – June 2015

The design phase, which aims to develop preliminary consolidation designs for the three pilot areas will occur through collaborations between CPL, related SKPDs and WB consultants. These collaborations will guide the development of potential design typologies that "try out" various consolidation approaches, so that critical questions and options for future large-scale slum upgrading can be anticipated and tested. The pilot design schemes will inform COL and Kota Denpasar whether the anticipated data and analysis are robust for supporting planning and design questions that arise in consolidation projects.

The analyses listed above will be used as indicators to assess the impact of various proposed design typologies on quality and liveability of housing areas. CPL will support the consultant team in the development of these design typologies by conducting the previously mentioned analyses and streamlining data collection into a manageable GIS database.

The goal of Pilot Project consolidation designs is not to develop detailed technical implementation schemes, but rather to focus on high-level schematic designs that can provide an initial framework for a technical consolidation feasibility study to follow. Particular emphasis should be placed on identifying typological approaches features, which could be replicable in a number of slum areas in Denpasar.

The design process should start with joint site visits between CPL and consultants and a joint discussion of analysis results from the existing conditions surveys. The consultant team should then work on schematic design development and re-engage with the Bappeda team at roughly six-week intervals to discuss the progress on proposed solutions. The final ideas should be presented as a graphically illustrated report in Bahasa and English, outlining both the analysis current conditions and the proposed improvement schemes.

3.2.6 Reporting

Time: June 2015

The results of the design process will be incorporated into a report, which the city may adopt as a guide for future Pilot Project implementation and for expanding slum-upgrading efforts to a citywide scale. As the report will document a comprehensive consolidation plan supported by existing data sets and analyses, it may also be used as a justification for funding acquisition or investment.

3.3 CITYWIDE ANALYTICS

Denpasar should focus not only on addressing existing slum settlement conditions, but also on preventing slum settlement growth in the future. Slum settlement conditions arise when the existing housing stock cannot meet the demand of a growing population. Migrants or young families then settle on the urban fringe, or in vacant urban-core areas and typically construct their own housing. The causes for population growth or influx of migration are almost always caused by conditions at the citywide or national scale. Kota Denpasar should consider preliminary inquiries into how citywide conditions, including those created by fiscal or social policy, affect the social, economic and physical characteristics of slum settlement development.

Building an up-to-date, high quality citywide base map and collecting basic data sets for analyses relating to city wide conditions is a first step towards addressing slum settlement prevention. Obtaining these items also opens opportunities for investigating other citywide planning issues, such as growth, housing, transportation and land use planning. Understanding how slum settlement sites interface with the existing street network enhances land-consolidation strategies and streetscape modifications. Social programs that address local economies must take into account where small businesses source and sell their goods. Understanding and settling land tenure disputes can be achieved by upkeep of a citywide cadastral map. It is strongly recommended that the city of Denpasar develop a high-quality citywide base map that can be used as a basis for a wide variety of planning and policy initiatives.

3.3.1 Base Map

A good base map performs the important function of consolidating a city's fundamental geospatial information into one manageable database which acts as a reliable resource for registering data, mapping and supporting policy planning and analysis. Cities often share a single base map across all departments so that planning policies are informed by updated, high quality information. Denpasar's base map would form the core of a citywide GIS system, and be the source of all official city maps and geospatial analyses relating to slum settlement or citywide planning issues.

The need for an updated, citywide base map arose repeatedly during work-sessions with SUTD consultants and CPL staff. Kota Denpasar's current data is incomplete, out of date, and irregular in its representations of features, creating many restrictions in the types of analysis it could be used for. A high quality base map is the primary means by which cities obtain and build accurate spatial information. A base map commonly includes: a high-resolution aerial photograph of the city, building footprints, transportation networks (street centerlines, pedestrian paths, motorbike paths, crosswalks, etc.), hydrography (visible natural and built water - rivers, irrigation, reservoirs, lakes, etc.), hypsography (contour lines and spot elevations), and land cover (parks and recreation areas, etc.). This data is typically traced from high resolution, orthorectified, stereo imagery. Supplementation by LIDAR creates the opportunity for more accurate mapping of elevation information for hypsography, hydrography, vegetation, and the built environment.

Orthorectification is a process for geometrically correcting imagery to remove distortions from topographic relief so the scale is uniform, like on a map, and measurements of true distance can be made because it is an accurate representation of the Earth's surface. Stereo imagery is flown with a percentage of overlap between each image. This ensures no area is missed, increases the feature capture rate since features can be viewed from multiple

angles, and also creates the possibility of obtaining elevation information and generating 3D models,

This information about the built environment is in turn used to support spatial, land use and infrastructure planning decision-making. For example, mapping and analyzing land tenure status as well as other socioeconomic and demographic factors at both the city and site-specific scales require accurate parcel information. Planning for solid waste routes, emergency services routes, streetscape improvement projects or public transportation requires accurate street centerline data. Reliable topographic data such as steep slopes and flood prone areas help identify environmental factors that constrain development.

Aerial photography is the foundation of a base map and is distinctly different from satellite images, which Denpasar currently has. Denpasar currently has two 60 cm resolution Quickbird satellite images, one from 2006 and the other from 2012. These images are single scene rather than stereo imagery, are not orthorectified and do not align with each other due to a lack of reliable, accurate ground control points and other base data. Most of Denpasar's GIS vector data was derived from tracings of the 2006 satellite image. While this data could be helpful for examining change over time, the rapid growth occurring in Denpasar is not represented by this older data as demonstrated in the figure.

CITYWIDE PRIORITY DATA LAYERS		
NAME	**TYPE**	**USE**
High Resolution Aerial Photograph	Aerial Photography	• Base map
Building Footprints with Heights	GIS Polygons	• Contain other data as attributes • Inventory existing built environment • Categorize growth
Transportation Networks	GIS Polyline and Polygons	• Develop accurate street network for network and route analyses
Hydrography & Hypsography	GIS Polygons	• Locate constraints on development • Identify environmental protection areas • Identify areas prone to flooding and risk
Land Cover	GIS Polygons	• Identify important cultural sites or public amenities for Reach analysis
Administrative Boundaries	GIS Polylines	• Identify jurisdictional areas • Target departmental responsibilities spatially
Parcels	GIS Polylines	• Contain other data as attributes • Locate property boundaries
Service Locations	GIS Georeferenced Points	• Find gaps in services • Calculate accessibility of services
Solid Waste Collection Routes & Points	GIS Polylines	• Identify gaps in service • Identify new routes or repurpose routes
Existing Drainage Network	GIS Polylines & Polygons	• Identify gaps in service • Target improvements to existing infrastructure
Population: Count & Age	Attribute	• Estimate impact of policies
Household Size & Income	Attribute	• Estimate impact of policies
Ethnicity & Religion	Attribute	• Estimate impact of policies • Target policies to appropriate groups

Table 3. Citywide Priority Data layers including their type and use.

Aerial photography can be contracted to have specifications that meet the needs of a dynamic, high-density urban environment, such as Kota Denpasar, whereas satellite imagery has preset specification limits. It is strongly recommended that Kota Denpasar invest in a professionally created citywide base map developed at a 1" = 40' accuracy mapping scale using digital photogrammetric techniques. Furthermore it is recommended the aerial photography flyover capture imagery at 10 cm resolution with 60-80% overlap for stereo imagery, collect ground control points for orthorectification of the imagery, generate a Digital Terrain Model and contours at 30 cm intervals. Several key physical data layers can be generated from the high-resolution aerial photograph.

The following physical data layers are recommended for Denpasar:

1. Building footprints with heights

2. Transportation networks

- street centerlines as network topology ready for routing analysis,
- street polygons (measurable width from imagery)
- bike path centerlines,
- pedestrian path centerlines as network topology ready for routing analysis,
- pedestrian path polygons,
- bridges,
- crosswalks,
- traffic lights,
- bus stops (SARBAGITA bus system)
- street lights

3. Hydrography / Water

- rivers (polygons and centerlines) – water flow analysis
- stream centerlines – water flow analysis
- visible irrigation and drainage system centerlines – water flow analysis
- reservoirs and lakes as polygons – water flow analysis
- dams / water flow control structures as points – water flow and flooding
- swimming pools – permitting, regulating, taxation

4. Hypsography

- Digital terrain model: contour lines and spot elevations

5. Land cover

- parks and recreation, religious sites/ cemeteries, landmarks/ monuments

This information helps define the current structure and state of the city. Features like Building Footprints can be used in GIS to store additional information as attributes including ownership, value, or tax IDs. As standard GIS analyses depend on the accuracy of this geospatial information, it is critical that Denpasar obtain this important citywide resource before investing in long term planning strategies.

Quick Bird satellite image of Kota Denpasar from 2012 with building polygons traced from a 2006 image overlaid. In places with rapid growth it is important to update data.

It commonly takes several months for contract preparation and budget planning, and 6-9 months for the data capture (on the ground field check preparations aerial flyover), processing of data captured and generation of base GIS data layers, and quality control checks. More information about accuracy standards and reporting can be found in the "FGDC Geospatial Positioning Accuracy Standards Part 3: National Standard for Spatial Data Accuracy (NSSDA)" at:

https://www.fgdc.gov/standards/projects/FGDC-standards-projects/accuracy/part3/chapter3

3.3.1.1 Additional Priority Citywide Data Layers

Though an accurate base map obtained from fly-over documentation covers a number of critical map layers, flyovers cannot detect features that are not visible from the air. It is therefore suggested that in addition to the above five base layers, the following data layers should also be documented citywide from pre-existing sources (e.g. BPN, BOS) or through surveys on the ground:

Administrative boundaries (priority: high)

Administrative boundaries are legally documented jurisdictional boundaries. In the context of Indonesian Government administration, Denpasar is divided into four Kecamatans (districts), each headed by a Camat (civil servant). Each Kecamatan in turn is divided into Desas (villages) headed by a Kepala Desa (village head). Official Kecamatan boundaries are available as GIS polygons. Mapped polygons representing the boundaries of Desas and Dusuns in GIS format would be valuable for analytics and policy discussions. These Desa boundaries could be mapped on the ground with the help of Desa leaders and GPS enabled mapping devices. The polygons should include unique Desa names, demographic attributes, such as population counts and household counts obtained from BPS. In the future, the attributes of Desas can be expanded with additional indicators, such as median income, educational attainment, employment status and other indicators.

Parcels (priority: high)

Parcel boundaries show land ownership and are very important for many types of analysis and planning, such as quantifying land value, identifying legal development rights (e.g. allowable Floor to Area Ratios or FAR), finding potential redevelopment areas for municipal investments, or enabling planned consolidation to achieve desired development patterns. In GIS, a parcel database should include ownership (especially Kota vs private vs other), tax value, and unique IDs (such as the NIB parcel identification number or NOP tax object number). Sale and assessed values, frontage, zoning, and building-type attributes can also be very useful.

Service Locations (priority: medium)

To understand how settlements are located relative to important amenities, point data is typically used to designate service locations. Groups found planning exercises difficult without a clear understanding of how communities are currently being assisted by city services. Typical service locations surveyed by city governments include schools, police stations, fire fighting facilities (stations and water wells), disaster shelters, hospitals, parks and public transit stops. A typical master plan will take into account the accessibility of a development to these important amenities and assess whether additional services are needed to accommodate planned growth.

Solid Waste Collection Routes and Points (priority: medium)

In dealing with problems of solid waste management and sanitation, several groups saw the need to identify existing citywide trash collection routes and pickup points. A visual study of trash routes and pickup points can help identify underserviced areas and inform recommendations to improve service and efficiency. Identification of areas of solid waste accumulation leading to flood vulnerability on a citywide scale could be aided by up-to-date, high resolution aerial photography.

Existing Drainage Network (priority: future)

Groups found it extremely challenging to think about drainage and sanitation systems improvements without spatial awareness of current drainage systems. Understanding how informal drainage networks interface with existing city infrastructure was a particular challenge. A spatial inventory of this type of city service would enable analytics to address sanitation issues.

Transportation Network Classifications (for vehicles and pedestrians)

Transportation networks (street centerlines, pedestrian paths, motor bike paths, crosswalks, etc.) are vital for locating facilities and infrastructure, understanding traffic flow and conducting a variety of geospatial analyses ranging from walkability to accessibility assessments. Representing the network as centerlines enables one to run many types of network analyses. This can typically be obtained from fly-over data in the base map. In GIS all data layers can have attributes, which are another critical aspect to understanding the different components of a transportation network. In order to do routing analyses for waste management or traffic congestion, for instance, it is critical to understand what portions of the network are main roads which could support a city trash truck or larger numbers of cars, and which portions of the network are restricted in size to only allow for a motorbikes or pedestrians. These attributes can not be seen from aerial imagery and have to be surveyed on the ground or detailed based on pre-existing sources.

Transportation centerlines should include the road class (toll, arterial, collector, local, neighborhood), traffic direction, road dimensions, official names, and owning/ managing entity (private, city, regional, national). Kota Denpasar's current data is incomplete, out of date, and irregular in its representations of features, creating many restrictions in the types of analysis it could be used for. Transportation networks are typically created by professional photogrammetrists tracing from high-resolution aerial photography, as part of a base map investment.

Social, Economic and Cultural Demographics of Slum Dwellers (priority: high)

Denpasar needs a stronger inventory of the demographic factors that characterize growth, particularly in slum settlement areas. Demographic data, such as population counts, age, migrant status, ethnicity, median household income, and household size are important factors for the management of slum settlement areas in Denpasar. As many settlement areas are inhabited by migrants including the Javanese, plans and policies directed towards managing slum settlement areas must be sensitive to these social conditions and their political implications. Mapping areas of dense ethnic populations may shed light on the types of social policies and redevelopment strategies that are appropriate for specific areas. BPS currently provides census data at the Desa or Kelurahan (village) level. If Desa boundaries are documented digitally as described above, then BPS demographic data can be readily joined to Desas, allowing rich BPS data to be spatially visualized and analyzed. Demographics at this level of spatial understanding are useful for planning on a city scale. However, in potential upgrading sites, a spatial understanding at a parcel or building level of detail would create opportunities for more accurate planning policy.

3.3.2 Analytics: Citywide Applications

Slum settlements are not isolated entities, but are connected to the greater urban fabric of Denpasar. As such, it is important that slum settlement analyses address how the social, economic and physical conditions of slum settlements relate to their surrounding environment. For example, making planned improvements to drainage infrastructure in a slum settlement area requires spatial assessment of the surrounding city infrastructure. Historic examples of failed slum settlement upgrading or public housing projects often neglect a site's socioeconomic relationship to the city at large. These types of interventions tend to isolate project areas thereby limiting economic opportunities for residents. Effective planning decisions are instead built upon short and long-term projections of

ANALYTICS: CITY-WIDE APPLICATIONS						
CATEGORY	**PRIORITY**	**TYPE**	**OBJECTIVE**	**TIME *** *estimates assume complete data and performance by a trained GIS professional	**DATA LAYERS**	**BENEFITS**
Slum Settlement Locations & Definitions	Future	• Spatial clustering	• Develop consistent criteria for identifying slum settlement areas objectively.	1 week	• Building footprints • Administrative boundaries • Parcels	Ensure investment in upgrading strategies is effectively targeted
Land Ownership & Regulation	Near Future	• Cadastral map • Public & Private Space Mapping	• Understand and visualize layers of ownership. • Locate suitable areas for city-interventions. • Determine stakeholders for land consolidation projects	1 week	• Building footprints • Administrative boundaries • Parcels • Survey: ownership by parcel	Identify precise tax revenue opportunities, find opportunities for city ownership & intervention
Sanitation: Drainage & Water Systems	Future	• Network capacity • Urban extent	• Determine population currently serviced by drainage network • Identify suitable locations for future facilities	3 days	• SANIMAS Locations & capacity • DSDP Network locations & capacity • Population density • Building footprints • Topography • Water bodies	Enhance cross-departmental organization, understand extent of existing network, predict future needs based on growth
Sanitation: Solid Waste Management	Future	• Reach analysis • Route analysis	• Identify underserviced areas • Identify optimal routes for solid waste collection	1-3 days	• Street network • Existing collection sites • Buildings • Land use • Population density	Base policy decisions on existing & expected demand, resolve gaps in service
Access to Services	Near Future	• Reach analysis	• Identify underserviced areas • Propose service locations	2-3 days	• Street network • Hospitals • Police headquarters • Fire departments • Open space/ parks • Commerce/ grocery stores • Points-of-interest • Other services • Demographics • Building footprints	Shape zoning recommendations, assess need for investment projects, and choose locations for infrastructure investment
Distribution of Economic Establishments	Near Future	• Spatial clustering	• Identify patterns of commercial activity (both formal and informal) • Identify existing "typologies" of commercial districts	1-2 weeks	• Building footprints • Parcels • Land Use • Zoning • Households	Understand where entrepreneurial clusters are and support them, useful input for master planning so land use plans don't harm small businesses

Table 4. Summary table of Citywide applications of Analytics.

the spatial distribution of resources and demand at large.

The analyses proposed below aim to understand how slum settlement dynamics are affected by citywide conditions, including the existing infrastructure networks. These analyses can be performed using existing data already collected by Kota Denpasar at the citywide scale, but will also require additional investment in the priority data layers mentioned above. Data collected through Pilot Projects can also support these analyses. For example, parcel information collected at multiple Pilot Project sites can collectively contribute to a broader, citywide parcel database. In this context, data collected through Pilot Projects serves a dual purpose informing both site-specific upgrading strategies and contributing to a broader citywide database of geospatial information.

3.3.2.1 Updating the slum settlement locations and definitions (priority: future)

Benefits: Create citywide definitions of slum settlement areas to systematically identify such areas as they develop.

Previous surveys carried out in Denpasar to identify current slum settlements have faced important methodological issues. The present awareness of slum areas is therefore partial. It is advisable to repeat a citywide slum mapping exercise in the future, where clear definitions of what features constitute slum areas are introduced and uniform spatial clustering standards are used for slum cluster detection.

Best-practice definitions on what features constitute a slum settlement vary widely, but most definitions generally agree that slums are characterized by some of the following conditions:

- Absence of legal land tenure
- Inadequate health and sanitation standards
- High density occupation
- Limited or informal access to utilities (water, electricity, sewage, drainage)
- Inadequate streetscape or access routes
- Environmental degradation and hazardous structures
- Inadequate provisions of social and recreational spaces

A list of features that define slum areas specific to Denapsar should be discussed and agreed upon through cross-SKPD collaboration. Second, a definition of how many problematic buildings at minimum define a slum area, and how far at most they may be from each other to constitute part of the same slum area, is necessary. These two parameters – minimum number of slum-settlement buildings and maximum distance between these buildings – are standard features of cluster detection techniques.

The agreed definitions should be clearly documented and explained on printed maps to Desa heads. Desa heads can then be asked to take a survey team to sites that appear to correspond to the given definitions. Identification of sites to be surveyed can also be aided by high-resolution aerial photography. The choice of which areas are “tagged” as slums in need of upgrading should be made by a professional team who are in a position to apply the same criteria uniformly across the city.

3.3.2.2 Land Ownership and Regulation (priority: near future)

Benefits: Identify precise tax revenue opportunities, tie zoning to parcels, identify opportunities for city investment projects

Legal status of property rights in Indonesia remains a hotly contested issue. The 1960 Basic Agrarian Law (BAL) recognizes the Adat system of land tenure (customary land rights administered on the Desa level, based on traditional systems of governance). Additionally, informal tenure is not recognized in Indonesia, and separate rights are registered for various facets of property use including cultivation, building, use and management. Denpasar needs to organize its information regarding land tenure at the citywide level. Starting with Pilot Project areas, detailed information regarding land ownership can be collected for study-area parcels and folded into a larger database.

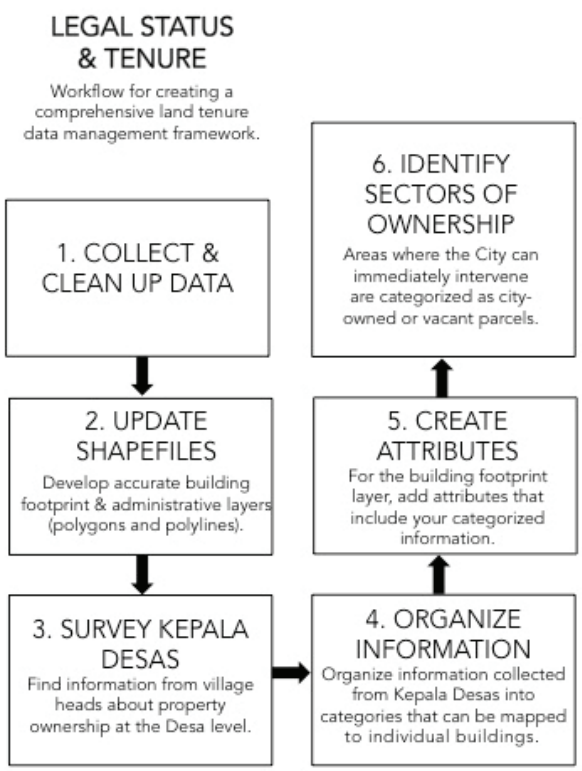


Figure 4. Building footprints and their centroids, Harvard Square, Cambridge MA.

Because land ownership is defined at the parcel level, accurate information regarding parcel boundaries is the first step towards building a land tenure database. Currently, Denpasar does not own any land making it difficult to undertake successful infrastructure upgrading and public housing projects. Denpasar has a successful history of land consolidation projects where parcels boundaries are realigned with consent from the owner in order to provide better infrastructure and services to the area. This is a promising approach for slum settlement upgrading in Denpasar, indeed one that the City is interested in pursuing; however accurate knowledge of existing parcel boundaries is necessary to make appropriate proposals.

DISPENDA has a parcel database that should include attributes regarding ownership (especially Kota vs private vs other), tax value, value and unique IDs (such as the NIB parcel identification number or NOP tax object number). This data could be stored in a streamlined format as a GIS database, or as attributes within shapefiles of existing building footprints. Ultimately, this would result in the development of an official GIS format Cadastral Map for Denpasar including:

- Parcel Boundaries
- GPS Coordinates: parcels & buildings
- Land Use/Type
- Parcel Value
- Dimensions
- Title Register

To begin, CPL could use the parcel database to distinguish areas of land ownership conducive to initiatives that the city could implement in the near-term easily obtainable land. CPL coordination with DISPENDA in standardization and improvements in data quality and consistency of collection could potentially help support increased efficiency and effectiveness of taxation of land for increased city revenues.

3.3.2.3 Sanitation: Drainage & Solid Waste (priority: future)

Drainage & Water Systems

Benefits: Enhance cross-departmental organization, understand extent of existing network, predict future needs based on growth

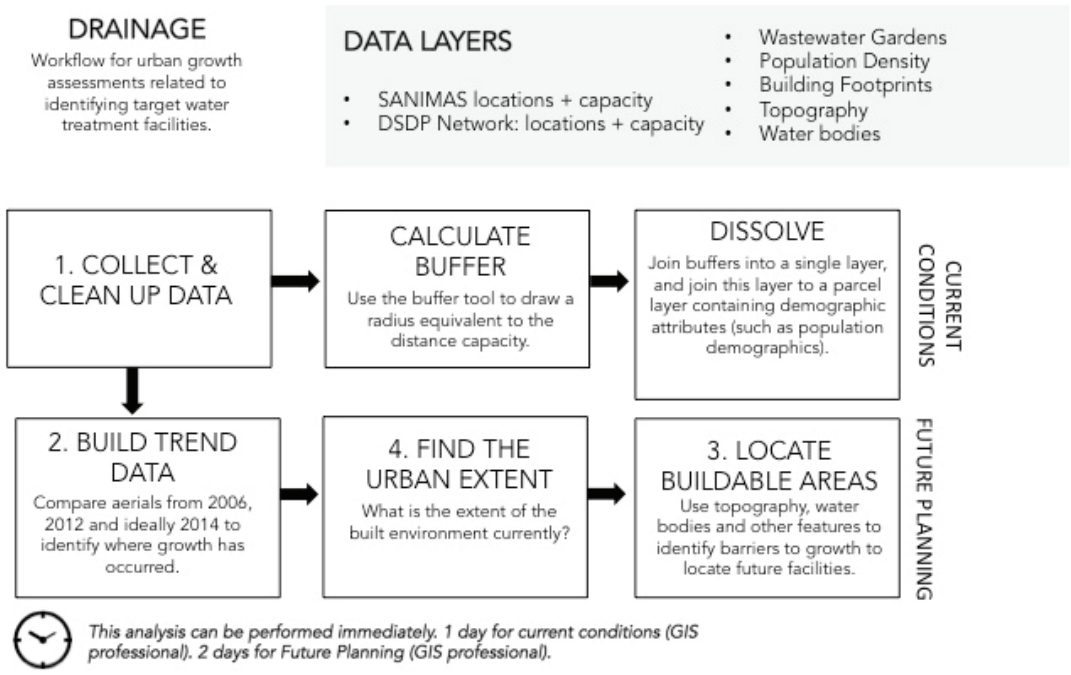
Key questions emerging from the workshop on the subject of water include:

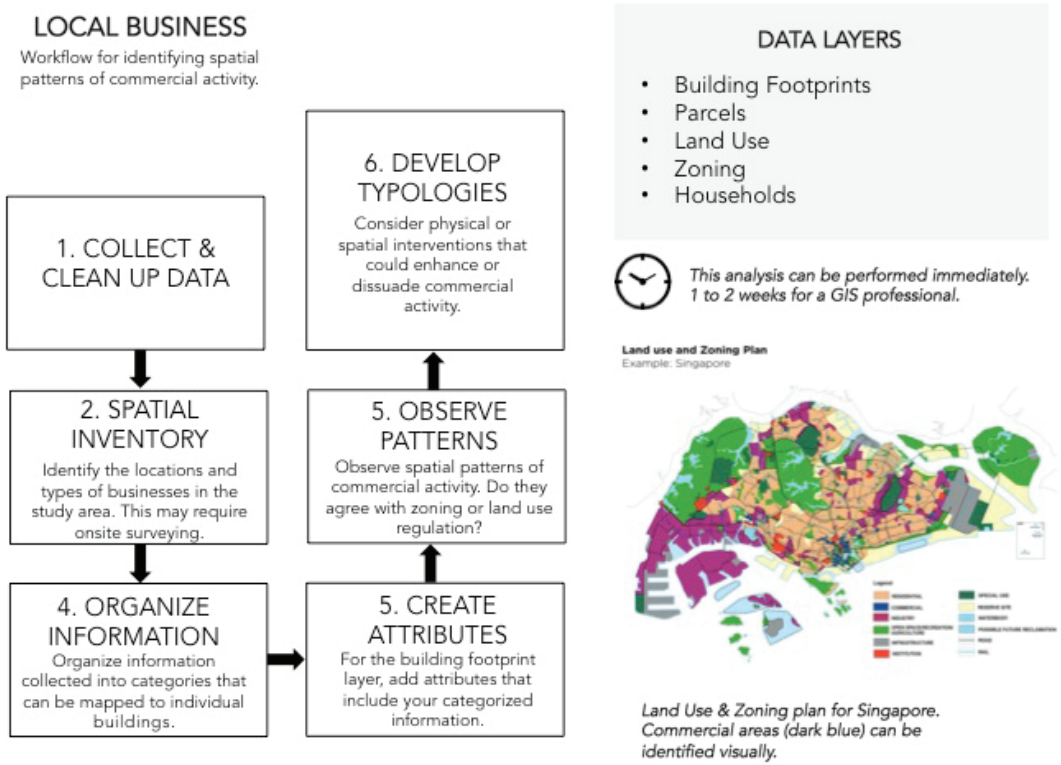
1. What areas are prone to flood?

2. How can drainage initiatives meet future demand?

3. Where are drainage needs currently not being met?

Denpasar currently supports three main sewage projects. The Denpasar Sewerage Development Project (DSDP) was constructed in 2002 as a collaboration between the Government of the Republic of Indonesia, Kota





Land Use & Zoning plan for Singapore. Commercial areas (dark blue) can be identified visually.

Denpasar, Badung Regency and the Japan Bank for International Cooperation (JBIC). It handles high volume wastewater treatment, serving 9,000 homes in Denpasarat a capacity of 51,000m3/day. Sanimas (Santasi Oleh Masyarakat) are community wastewater treatment systems serving areas not covered by DSDP. These operate at a capacity of 60m3/day. Finally, "wastewater gardens" have emerged in Bali as a popular sustainable wastewater treatment method. Not all areas are serviced by these projects, however. One of Denpasar's tasks is to identify gaps in these services.

To locate areas not serviced by DSDP or Sanimas, CPL analysts can make estimates of the spatial "reach" (weighted network accessibility of buildings to points of interest) of existing services based on capacity. With point or polyline layers showing the location of drainage systems or treatment plants, a buffer equivalent to the estimated radius of these services can be applied. By dissolving this buffer with parcel data containing demographics such as household size, the population served can be calculated. This figure can in turn be used to calculate population counts lacking services.

In the case of Denpasar and slum settlements, proximity to infrastructure doesn't always imply that the area or household is being serviced. In many cases, residents (especially those nearby existing bodies of water) avoid hook-up fees by drilling their own wells or finding other available resources. If information on which households have paid the "tariff" for services is obtainable, it may be possible to identify clusters of un-serviced areas. Comparing the location of these clusters to the results of a spatial access to services analysis would reveal important nuances for infrastructure planning and policy. Additionally, exploring the socio-economic factors tied to these locations could reveal important factors determining appropriate fiscal policy.

Ideally, a spatial analysis performed by CPL would locate the optimal spatial distribution of each of these three types of previously mentioned wastewater treatment facilities and drainage systems taking into account their capacities, costs and feasibility of onsite construction. A first step towards this goal is to identify the urban extent, and predict future growth in order to plan facility locations. Using topographic features including bodies of water and geographic characteristics that constrain growth, buildable areas can be identified and used to predict future urban expansion and target utility needs. The topographic features to be used in this type of analysis typically come from a base map generated from professional aerial photography. A similar type of analysis could be helpful for freshwater inflow systems developments by PDAM as well.

Solid Waste Management

Benefits: Base policy decisions on expected demand, resolve gaps in service.

To improve the existing solid waste management system workshop participants came up with three key questions that could be addressed with analytics:

1. Where is the demand for services?
2. Where are the gaps in service?
3. What would be an optimal solid-waste collection route?

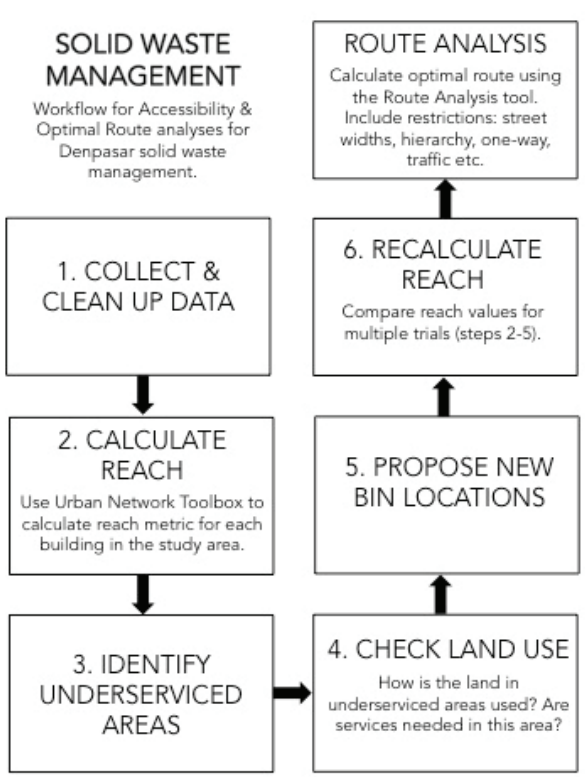
Using surveys of small-businesses and residents in the community, the existing waste management system for slum settlements can be mapped. Comparing "informal" waste-management systems across slum settlements and juxtaposing these with proximity to existing or planned services (determined via the Route Analysis mentioned below) may uncover interesting trends or patterns revealing how slum settlement areas adapt to lack of services through common means. Policy targeted towards solid waste management in slum settlement areas can then work with, rather than against, these existing systems where appropriate.

To identify under-serviced areas, one performs an "accessibility analysis" locating the level of each home's accessibility to a desired service. If the existing trash collection route (including stops) is known, an accessibility metric (the "Reach" tool if using the Urban

Network Analysis Toolkit) can be calculated for each building in the study area. This metric rates how accessible a service (in this case a trash collection site) is to an individual building. Using the visual output from the Reach tool in the Urban Network Analysis toolkit, under-serviced areas can be identified by locating areas with low Reach values. Closer examination of these areas can help analysts propose new bin locations, by creating point shapefiles in GIS. Reach values can then be recalculated to determine the impact of the proposed changes. Analysts can determine and refine optimal bin locations through doing multiple iterations of this process on the computer.

Proposing new bin locations using this process is the first step towards developing an optimized solid waste collection route. Proposed bin locations can then be used as "stops" in the Route Analysis tool. Route Analysis finds the optimal route depending on what type of "impedance" the user selects-- i.e., the optimal route is designated as the fastest, the shortest, or the least physical cost.

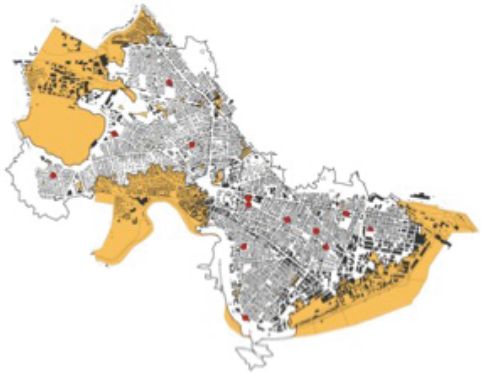
There are a variety of spatial complexities that affect route optimization, including street widths, traffic, one-way designations etc. These nuances can be captured by the model by specifying weighted features of the route. Some complexities in Denpasar's case extend beyond the capabilities of this model, as local communities often adapt their own bicycling



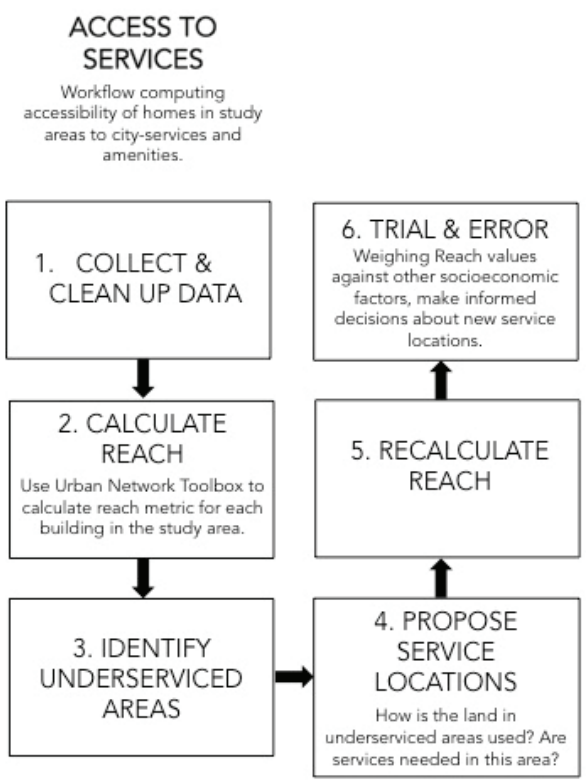
DATA LAYERS

- Street network
- Existing collection sites
- Buildings
- Land Use
- Population Density

This analysis can be performed immediately. 1-3 Days for a GIS professional.



Underserviced areas identified using the Reach tool.



This analysis can be performed immediately. 2-3 Days for a GIS professional.

Accessibility analysis of homes to coffee shops in Cambridge, MA.

or motor routes rather than those implemented by the City. Additional constraints appropriate to Denpasar's case include the limited number of vehicles in the fleet and street widths (many streets in Denpasar are not large enough for fleet trucks). These should be taken constraints should be taken into account for a holistic perspective on solid waste collection systems in Denpasar.

Street and pathway centerlines appropriate for routing analysis and measured path dimensions could be obtained through an investment in a base map generated from professional high-resolution aerial photography. High-resolution imagery could also aid in identifying areas of waste accumulation such as those prone to flood due to topographic features.

3.3.2.4 Access to Services (priority: near future)

Analyzing Access to Services

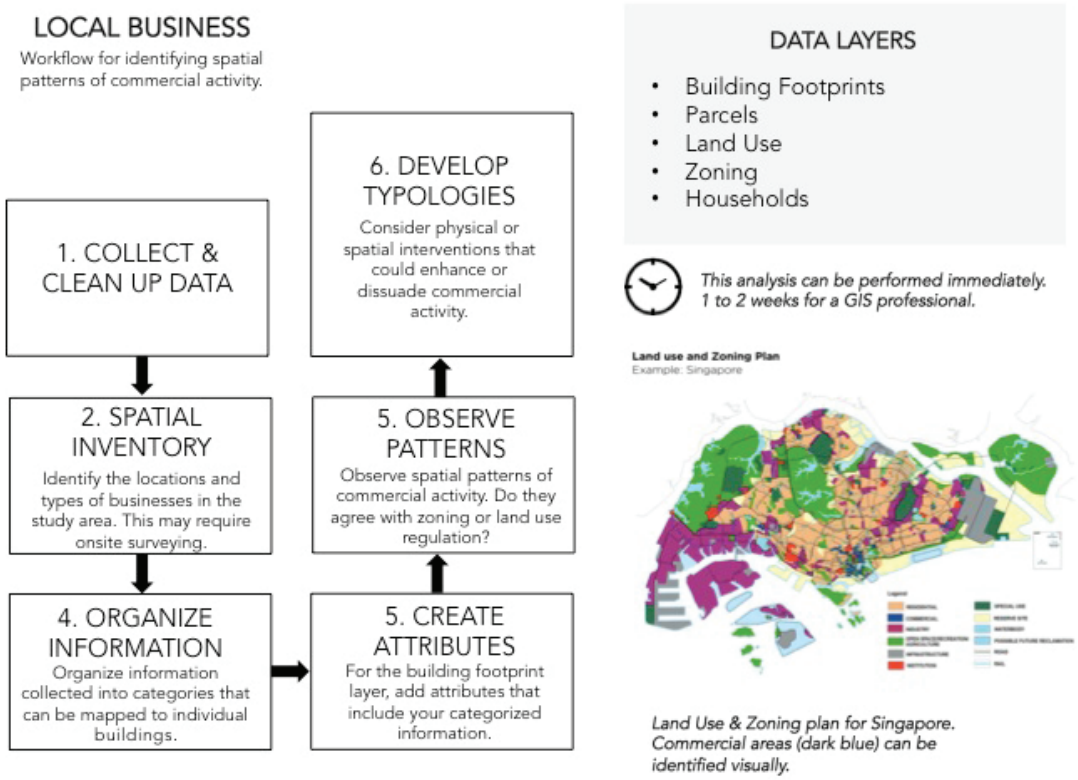
Benefits: Shape zoning recommendations, assess need for investment projects, and choose locations for infrastructure investment

Spatial information representing existing public facilities and resources (e.g. fire fighting facilities (stations and water wells), police stations, hospitals and health clinics, schools, disaster shelters, drinking water sources; drainage points; markets; public transit stops) can be used to estimate

accessibility of different parts of the city to these resources. This analysis should illustrate underserved areas and provide an empirical basis for future public investments.

Calculating access to services is similar in process to identifying areas under-serviced by the current solid waste collection route: a Reach metric is used to compare relative accessibilities of buildings to services. By identifying underserved areas, new service locations can be proposed pending their agreement with existing land use or zoning for the site. New zoning or land use criteria can be proposed or adjusted to reflect necessary changes. Analysts can also evaluate the impact of policymaker's decision-making by simulating accessibility values in light of proposed changes.

Such impact analyses can also be used for other ongoing public investment projects on a per need basis, such as collaborating with Public Works in selecting locations for new roads and bridges.



Land Use & Zoning plan for Singapore. Commercial areas (dark blue) can be identified visually.

3.3.2.5 Distribution of Economic Establishments (priority: near future)

Benefits: Understand where entrepreneurial clusters are and support them, useful input for master planning so the land use plan doesn't harm small business.

Workshop participants recognized many potential benefits from comprehensive surveys of existing small business locations, as well opportunities for micro-zoning within areas designated as purely commercial or residential districts. Workshop participants also observed unhealthy mixed-use typologies where hazardous commercial or manufacturing land uses occurred alongside residential uses. Understanding the spatial patterns of local economies helps to develop appropriate physical interventions (urban design typologies and guidelines) or policy interventions (micro-zoning and land use codes) that support the development of small businesses in a healthy and sustainable fashion.

To identify these spatial patterns in GIS, it is recommended that CPL first develop a categorical inventory of small businesses at the Desa level. By juxtaposing these against existing land use or zoning boundaries, it is possible to see where there are differences between existing zoning codes and actual uses. Policy interventions that encourage or dissuade certain uses from taking place would be enhanced by possessing a site-specific quality.

Accurate, micro-level planning ultimately requires a reliable database of all business locations in the city. But since collecting such data is laborious and difficult to manage, it is recommended as a future priority only.

3.3.3 Public Participation & Crowdsourcing Data Collection

Many of the analyses discussed above require additional information about local communities and conditions. In cases where this type of data collection is beyond the ability or budget of cities, crowdsourcing and public participation is often used to obtain local knowledge.

Public Participatory GIS (PPGIS) is a popular means to gather indigenous knowledge about communities. Some models of PPGIS use open source WebGIS platforms to enable public input on specific questions or crowd-sourced maps, while others have round-table discussions with community leaders. In conjunction with an awareness campaign or incentives for participation, PPGIS can be a successful means to acquire large volumes of information in a relatively short time period. There are some websites offer crowdsourced mapping services for free (such as http://www.imapbuilder.net) but may be limited by bandwidth, resolution or file formatting specifications. Ideally crowdsourced data would be captured in a consistent way to a reliable storage location, go through a verification process, and incorporated into interoperable systems accessible to everyone.

The existing Indonesian participatory planning process of Musrenbang or PNPM-Urban could be a way of introducing ideas, methodologies, and benefits of crowdsourcing data which could then provide support to the Key Concerns in this report. PNPM-Urban is a program supported by the World Bank that incorporates self-mapping practices at the Kelurahan and Desa level, where the information generated is in turn used to help develop short and medium-term city plans. Kota Surabaya and Kota Solo have also begun setting innovative examples of crowdsourced/ community mapping and data collection.

Interdepartmental collaboration is key to supporting data analytics.

Participation helps gather local knowledge.

4. IMPLEMENTATION & CROSS-DEPARTMENTAL COLLABORATION

Collaborative support for data maintenance, sharing, and communications between SKPDs and CPL is critical for success. The role of CPL should be discussed and further defined in order to appropriately allocate roles and responsibilities and improve the accuracy of an estimated timeline. Formation of a cross- departmental Working Group and the development of Pilot Projects could be instrumental in further clarifying and testing the best set of roles, responsibilities, and operating procedures for CPL and collaboration across SKPDs.

This report understands the ongoing and long-term roles of the City Planning Lab in the following ways.

1. CPL should support GIS data collection and maintenance in the City by taking the lead on planning, contracting, and sharing of official citywide base map data.

2. CPL should provide advisory technical support to different dinases for GIS data collection, quality, maintenance, updating, and sharing.

3. CPL should support GIS data sharing and access through Kota Denpasar WebGIS with different levels of access appropriate for different entities (e.g. administrator, dinas, general public).

4. CPL will produce spatial analyses that support urban planning and design initiatives in the city; and provide training, outreach, and encouragement with evidence-based planning within BAPPEDA and across SKPDs.

A key recommendation for Kota Denpasar in terms of the sustainability of the CPL initiative is the establishment of an official, long-term position such as a "GIS Manager". The consistent presence of a skilled individual within the CPL is vital for the sustained success of CPL activities, and is a staple for many planning departments in many cities worldwide.

Denpasar has invested in the creation of the City Planning Lab, hired technical staff, begun compilation of existing GIS data, and created data sharing opportunities through the creation of the Kota Denpasar WebGIS. The key next steps for Denpasar CPL include:

- Investing in a high-quality base map.
- Implementing Preparation and Data Collection phases for Pilot Projects at three initial sites.
- Collecting Priority Data Layers and performing citywide analyses addressing Key Concerns of the June 2014 Workshop.
- Addressing Management, operations, and cross-departmental collaboration issues.

These steps are summarized in the following sections including details of supporting organizational structures and timelines.

4.1 PILOT PROJECT

4.1.1 Organizational Structure and Output

The Pilot Project is envisioned as an iterative process, that is, a Pilot Project will be initiated at a single site, and later expanded to multiple sites throughout the year. By building capacity within CPL to handle a data collection and analysis process at successive sites it is expected that 10-15 sites can be reached within a one-year time period. Each report generated by the CPL will be an opportunity to reflect on lessons learned throughout the process for a specific site, thereby informing Pilot Projects conducted at multiple sites in the future leading to an expanded, citywide initiative.

Preparation, data collection, analysis, design and report phases of the Pilot Project are envisioned as results achieved through a collaboration between consultants, CPL and a third party, either internally sourced or a local University. This partnership would ultimately be responsible for developing a comprehensive report and consolidation plan for the Pilot Project sites. This report would be turned over to Bappeda by June 2015 (tentative), for review and action by appropriate authorities within Kota Denpasar.

The following sections expand on the content of each of these phases.

4.1.2 Summary of Pilot Project Process (iterative)

The Pilot Project process outlined below is intended as an iterative process to be repeated and refined at multiple sites in Denpasar.

1. Preparation (1 month, September 2014)
    a. CPL/Bappeda, SUTD & World Bank define Pilot Projects:
        i. Scope of data collection and analysis for the Pilot
        ii. Needs for surveyors & outside technical assistance
        iii. Project team (all stakeholders and decision makers)
        iv. Decision-making process and communication plan
        v. Roles and responsibilities. Examples:
            1) SUTD collaborates with CPL in development of surveys and design proposal
            2) CPL leads data collection initiative (with internal staff, interns, university students, or hired consultants)
            3) CPL performs analysis, with guidance from SUTD
        vi. Appropriate timeline & cost schedule
        vii. Risk communication strategy
        viii. Rules and procedures
        ix. 'Break points' at which to review and check progress (including how progress and results will be evaluated clarified at beginning of project)

    b. Develop objectives and methods of data collection
        i. Identify objectives for survey
        ii. Design survey questions and import to tablet/ iPhone software.
        iii. Design consistent data collection methodology (including electronic and paper options)

    c. Secure equipment
        i. Hardware: GPS enabled tablet devices (e.g. iPads, iPhones)
        ii. Software: Survey applications (Fulcrum)

2. Data Collection (2-3 weeks for a single pilot site, begin in October)
    a. CPL introduces data collection group to the data collection process, including technology to be used and how to properly fill in survey questions.
    b. Pilot test the survey instruments on one site partially.
    c. Administer Surveys onsite
    d. Return Data to CPL

3. Intake & Analyze Data (4 months, January-May)
    a. CPL manages incoming data from third party
        i. Consolidate data into appropriate formats for storage and mapping
        ii. Input into relevant databases (including WebGIS)
    b. Analyze formatted data (with guidance from SUTD) per analyses described in 4.4.5.

4. Develop pilot consolidation design proposals on three sites (4 months, February to June)
    a. Consultants and CPL develop design proposals for consolidation projects at Jematang, Ubing Kaja and Pemacutan Kaja.
    b. Check-in with Bappeda in 6-week intervals.
    c. Integrate analyses and proposals into a comprehensive report.

5. Reporting (2 months, June-July 2015)
    a. Submit report to Bappeda
    b. Receive feedback and integrate comments before submission to authorities
    c. Internal Evaluation: Identify and document lessons for future sites

6. Expand data collection surveys to additional sites. (Note: expansion could occur simultaneously with analysis and design phases at previous sites.)
    a. Identify site locations
    b. Evaluate lessons learned from

work on first site

c. CPL and local university repeat steps 2-3 for an additional site

4.2 CITYWIDE ANALYTICS

Section 3.3 suggests four types of general spatial analyses related to slum settlements at the city scale. These analyses are summarized below including suggested timelines and outputs.

4.2.1 Legal Status & Tenure

In order to plan realistic interventions in cities, planners must have a grasp of the current status of property ownership. By combining local information with spatial attributes planners can locate public and private property, and develop an understanding of property ownership nuances within Desas. Questions to be addressed include:

- What are the categories of property ownership at the Desa level?
- Which properties are for sale?
- What is the structure of ownership for this property?

Timeline: summer 2015 - ...

4.2.2 Drainage

Designing infrastructural solutions to support expected growth, and currently underserviced areas is an important planning priority for Denpasar. By tying departmental knowledge of existing infrastructure to identified changes in the urban extent, areas currently lacking service and requiring future investment can be identified. Questions to be addressed include:

- What areas are prone to flooding?
- How can drainage initiatives meet future demand?
- Where are under-serviced areas?

Timeline: January 2016 - ...

4.2.3 Solid Waste Management

Solid Waste management requires understanding current and future demands to provide efficient and cost-effective service. Identifying current gaps in service as well as latent demand is the first step towards developing an optimal collection routes and related infrastructure for Denpasar. Questions to be addressed include:

- Where is the demand for services?
- Where are the gaps in service?
- What would be an optimal solid waste collection route?

Timeline: summer 2015 - ...

4.2.4 Access to Services

Services include amenities such as hospitals, police stations, schools, public transportation stops and fire stations. Understanding the spatial distribution of services can help plan for improved amenities distribution and quality of life. Questions to be addressed include:

- Where are areas with poor access to services?
- Where are new potential service locations?

Timeline: summer 2015 - ...

4.2.5 Analyzing the location of local businesses

Local businesses are an important indicator of economic growth. Cluster analyses help identify emergent commercial districts and gravity metrics define accessibility of the customer base to these areas. Questions to be addressed include:

- Where are commercial districts?
- How many jobs do these businesses provide?
- How accessible are these businesses?

Timeline: summer 2015 - ...

4.3 BASE MAP INVESTMENT

A base map represents a strategic city investment commonly performed by an experienced professional company, which captures high-resolution aerial photography. Successful cities share this type of base map across all departments so that mapping, planning and analytics in all departments starts from a consistent foundation of high quality information. Aerial photography can be contracted to have specifications that meet the needs of a dynamic, high density urban environment, such as Kota Denpasar,

whereas satellite imagery has preset specification limits. It is strongly recommended that Kota Denpasar invest in a professionally created, reliable, accurate, up-to-date city-wide base-map created from a high resolution aerial photography flyover of 10 cm resolution stereo imagery, collection of ground control points for orthorectification of the imagery, and generation of 1"=40' scale accuracy mapping GIS data layers and Digital Terrain Model.

4.3.1 Timeline

It commonly takes several months for contract preparation and budget planning, and 6-9 months for the data capture (on the ground field check preparations aerial flyover), processing of data captured and generation of base GIS data layers, and quality control checks. Since budgeting for 2015 will take place in January 2015, it is recommended to use the remainder of 2014 to raise cross departmental awareness of the importance of strategically investing in the creation of the base map and to prepare contracting materials so a professional vendor could be contracted in the beginning of 2015.

4.3.2 Cost

A professional aerial photography and LIDAR base map investment generally costs in the range of 5-10 Billion IDR. This is a rough estimate as accurate numbers are affected by project technical requirements, accuracy and resolution of the imagery and data layer outputs, the size of the area captured and mapped, and typically obtained through official contracting, RFPs, and conversations across relevant stakeholders.

4.3.3 Participants

It is recommended CPL lead the initiative, with strategic technical guidance from experienced consultants. Involving key representatives from a cross departmental base map investment team to participate in contracting and data Quality Control (QC) checks for verifying that data being generated by the contracted vendor meets the City requirements will help ensure the data meets the city's requirements and will also assist in the development of the knowledge, skills, and understanding of the base data in CPL and across departments. A short term working group could draft a recommendation list of who should participate in which portions of the base map

4.4 MANAGEMENT, OPERATIONS, AND CROSS DEPARTMENTAL COLLABORATION

4.4.1 Connecting CPL with City Planning and Decision Making

It is important for data collection and analytic activities performed by CPL to be integrated with planning and decision making occurring across SKPDs in Kota Denpasar. Establishment of several types of long-term, ongoing relationships for CPL collaborations, each with different levels of formality and engagement could be very helpful. Expanding and increasing capacity of core CPL staff and developing partnerships between (a) CPL and government officials across SKPDs and (b) partnerships between CPL and a broader network are important for connecting CPL with city planning and decision making as well as it's long term development, effectiveness, and sustainability. These types of developments should be explored in the short term and be implemented as possible over the short to long term.

4.4.1.1 CPL core staffing

The original CPL concept suggested that CPL be setup within Bappeda and "both Bappeda, as well as the Department of Spatial Planning, provide two full time staff members to work as part of the Lab team." It is highly recommended Kota Denpasar establish a formal way of integrating CPL data collection and analytic activities with planning activities, particularly in Bappeda, but also across other dinas such as DKTR.

Longevity and stability of a leading CPL position, such as a City GIS Manager, is a key part of building a successful GIS program. It's also important that the City GIS Manager have an appropriate level of authority in order to make recommend and coordinate spatial

data collection, maintenance, and sharing, and analysis across various departments.

In most cities, it takes years to build up strong cross-departmental relationships and technical capacity, highly accurate, detailed, rich spatial data information, and reliable robust infrastructure and systems. For example, the City of Cambridge, MA a single GIS Manager has maintained the system for over 20 years, providing consistent leadership to establish a leading City GIS program in the USA. In King County, Washington, USA an 18-year Return-On-Investment study in 2010 of the City GIS program established in 1992 revealed that "GIS improves government operations and delivers significant value", with net benefits estimated around $1 billion USD. (http://www.esri.com/news/arcnews/summer12articles/king-county- documents-roi-of-gis.html)

A City GIS Manager with strong technical skills and experience to could champion development of the CPL program and cross-departmental relationships over time. The City GIS Manager could report to the Head of Infrastructure Division in which the CPL is managed. The recommended core CPL staff would include the following positions, and may report to the Head of Infrastructure Division in Bappeda:

1. City GIS Manager

2. 2-3 technical staff for GIS/ data collection/ web/ databases/ analytics

3. 2-4 City planning staff for analytics and planning

4.4.1.1.1 Cost

It is recommended the GIS Manager position be rated at an appropriate pay scale that matches competitive market rates for a highly skilled, experienced GIS technician and that the position be set at an appropriate level of authority. If not endowed with appropriate decision-making power, the GIS manager will be unable to oversee management and sharing of data across departments.

4.4.1.1.2 Timeline

Use the Working Group and other initiatives to clarify a plan in 2014. Establish new positions and budgeting for 2015 and ongoing into the future.

4.4.1.2 Partnerships between CPL and government officials across SKPDs (ongoing)

The formation of partnerships between CPL core staff and the staff across SKPDs who are responsible for generating and maintaining spatial data, analytics, and spatial planning could open an important pathway for ongoing cross departmental collaborations. These ongoing regular interactions could involve discussions, planning, and knowledge sharing/ capacity building activities. Example topics that would be helpful to have in ongoing cross-departmental collaborative discussions and engagements include:

- Best practices with existing data collection, sharing, and maintenance
- Coordinated future project planning related to data collection, maintenance, analytics, and city planning
- Increased knowledge and awareness of all government staff who work with data and hire consultants to create new data

Partners would be aware of CPL work, have some regular interaction appropriate to their job responsibility, and may participate in data sharing and analytics with CPL. Partnership engagements may take on different forms over time, depending on ongoing and project based needs. Some examples include:

1. CPL partnership group meetings: Information, ideas, and the latest CPL related updates could be shared with a City GIS user group via regular in-person meetings or lunch sessions, with meetings occurring monthly. This information could also be shared via email, newsletters, wikis, or a social media channel.

2. Training sessions: To improve GIS skills and capacity across departments could be led or coordinated by CPL.

3. Project based work: As projects arise there is also the possibility of CPL communicating or coordinating with a department regarding data collection, quality, planning, and analytics. Project based work would

only last the duration of the project. This type of work may typically begin with a kickoff meeting to discuss and determine the scope of work, roles, responsibilities, frequency of meetings, and duration of project.

4. Advisory committee: An advisory committee could be made up of department heads from across SKPDs and meet bi–annually to learn about CPL initiatives and discuss potential future projects. This could provide a forum for discovery and discussion of potential collaborative cross-departmental work and opportunities to establish cost sharing.

From the CPL concept note: "In order to ensure coordination across agencies, it is recommended that the Lab be advised by an Advisory Committee convened by the Mayor, with members from Bappeda, Spatial Planning, Public Works, Revenue, BPS, BPN and other planning related agencies or city departments. The committee may also include representatives from neighboring jurisdictions or regional governments, in order to ensure coordination across the whole metropolitan area. The advisory committee could also liaise between CPL and the Ministry of Public Works in order to inform the national level spatial planning by local analysis, data and plans. CPL in each pilot city will also assist the local governments by informing their planning enforcement systems of national plans. It is not recommended that the advisory committee intervene with the daily operations of the lab, which could be done more efficiently by the CPL staff."

Figure 2 provides a visual representation.

4.4.1.2.1 Timeline

Use Working Group and other initiatives to clarify plan in 2014. Establish new positions and budgeting for 2015 and ongoing into the future.

4.4.1.2.2 Participants

1. All city planners across DKTR and Bappeko.

2. A designated person from each city department that generates data used in spatial planning.

4.4.1.3 Partnerships between CPL and a broader network

A strong network across ABCG (Academic, Business, Community, Government) at local, metro, national and international levels can give CPL strength for learning and creating collaborative partnerships. For example, in Massachusetts municipal GIS staff network and learn from each other through events such as NEARC, and monthly Metro GIS manager's gatherings over lunch.

4.4.1.3.1 Cost

Local area contacts could be developed for free and could help support pilot project work. There are an increasing number of geospatial global communities, which communicate through the Internet for free. Participation in certain types of events, especially on a cross-city, national, or international basis could be a very effective way of professionally developing staff and advancing the CPL initiative, but could quickly add up in cost and should be considered carefully.

4.4.1.3.2 Timeline

CPL will begin to identify opportunities in 2014, starting with local area geospatial professionals and academics, which could help support pilot project work, and geospatial global communities which communicate through the internet for free. CPL begin collecting ideas for potential future interactions on a local, national, and global scale which may require professional development funds and consider forming budgetary requests in the future.

4.4.2 Systems and Infrastructure Investments Overview

Robust reliable systems and infrastructure are a critical foundation for a successful City Planning Lab. Reliable high-speed Internet connections are important for many reasons, including hosting data online so data can be shared across departments and with the public, and pushing large datasets up/down from

the cloud without errors. As CPLs become more established the amount and size of the data they will need to manage, share, and backup reliably will increase.

A high-speed Internet connection is critical for access to useful information hosted freely online and enabling CPLs to communicate and collaborate across cities, national partners, and the global community. Kota Denpasar has a reliable power supply and the city offices have Internet access, however Internet access is slow, overloaded, and unreliable.

Connection services each city has are advertised from 1 -3 mbps. However, it's common for connectivity to fail because the system is unreliable and overloaded with too many shared connections.

Bappeda has a server that meets the basic requirements for hosting a WebGIS, however the server hardware is capable of handling only a low usage load, the Internet connection that the server is connected to is overloaded and unreliable, and the server is not reliably maintained and is regularly inaccessible. Setting up and maintaining a robust online system requires a lot of expertise, is best handled by a team of professionals, and is very costly. Increasingly municipalities and other entities are subscribing to 3rd party hosting systems to provide online resources such as WebGIS. Kota Denpasar's WebGIS was developed on the server maintained by Bappeda and synced with a 3rd party hosting service by the company CloudKilat.

Systems, such as the new Kota Denpasar WebGIS need to be maintained, and would benefit from ongoing observation of system usage, and planning for new enhancements. At a minimum there should be an annual review of systems, which includes a look at system usage and experiences and new developments on the market to consider for potential upgrade.

4.4.2.1 Budget requests (July 2014)

The following is a summarized listing of the CPL budget request submitted in July 2014. Approved budget lines will become available for expenditure in October 2014. The next round of budget discussions will be in January 2015. Preparations for January 2015 budget requests should be prepared in October 2014.

Summarized CPL budget request for July 2014 includes the following:

Infrastructure improvements:

- 10 mbps Internet subscription dedicated to CPL (not shared with the rest of the building). Timeline: ongoing monthly subscription.
- 3rd party server hosting for Kota Denpasar WebGIS. Timeline: ongoing monthly subscription.
- Software: ArcGIS. Timeline: one time purchase until upgraded software version desired.

Equipment:

- GPS for field data checking and collection. Timeline: one time purchase until upgraded software version desired.
- Data storage and for workspace and backup archive. Timeline: more robust; recommend one time purchase mixed with more robust ongoing monthly subscription.
- Laptop. Timeline: one time purchase until upgraded software version desired.
- Maintenance for printers cartridges. Timeline: one time purchase until upgraded software version desired.
- Storage rack. Timeline: one time purchase.

4.4.2.2 CPL budgeting (ongoing)

Having a dedicated budget creates adaptability and enables important long-term investment planning and maintenance. With a dedicated budget CPL would not have to wait until the budget allocation in January or revision period in July for every financial transaction required.

Many organizations have equipment, such as computers, on a planned 3-year replacement cycle to ensure equipment will reliably be able to meet needs, rather than systems and procedures coming to a halt due to breakdowns. More expensive items, such as a large format plotter can be made available through a leasing agreement with a maintenance plan, which makes unpredictable repairs smooth and easy to take care of. Software is often

WB, SUTD, CPL and City Leaders.

a one-time purchase, with upgrades purchased "as needed."

Very large, capital expenditures, such as a citywide base map investment would continue to go through existing annual budget request and planning cycles, with understanding by high level officials of importance for regularized data updates. The cost would depend on what Kota Denpasar prioritized to invest in, but some common examples are listed in the tables below.

Timeline: Use Working Group and other initiatives to clarify plan in 2014. Establish CPL budgeting for 2015 and ongoing into the future.

4.4.3 Working Group (short term)

Description: Challenges identified during the workshop are complex and cross-departmental in nature. It is critical that CPL and key stakeholders from across departments work together in addressing these large challenges. The formation of a working group could establish a pathway for building collaboration and communication between the new CPL and SKPDs.

Timeline: Ideally the working group could be officially formed by August 2014 and output deliverables by October 2014 so outputs could help inform budgeting discussions and planning for 2015.

Participants: A successful working group needs to be officially recognized (so participants have time to contribute appropriately) and be limited in size for efficiency and productivity. One scenario could be to hold an initial kick-off meeting, convened by a high level official, such as the mayor or head of Bappeda, and attended by department heads from across SKPDs. This kick off meeting would explain the engagement, invite support from across SKPDs, and demonstrate support from city leaders. A core team of 2-4 people may conduct the majority of the work. After the core team completes fact-finding and report-writing deliverables, another gathering of department heads would be held to report findings and discuss priorities for next steps. It is recommended this working group be led by CPL, with strategic technical guidance from experienced consultants.

Suggested deliverables of a Working Group:

1. Data report addressing:

    a. Inventory of geospatial related data and attributes across all SKPDs including all procedures and departments where geographical changes are recorded (e.g. Traffic and Parking, Building Inspection and permitting, parcel tax objects)

    - Clarification of existing data, and procedures for collecting and maintaining data.
    - Future planned data collection projects.
    - Data format (paper vs digital, GIS vs CAD or other).
    - Data organization.

- Lead data contact.
- Develop maintenance plan (desired updates vs legally required updates) for each priority system (i.e., parcels, administrative boundaries, water and drainage networks, street updates, solid waste management systems)
- Current practices for data collection methodologies and analysis.
- Prioritize the update need for each GIS database element
- Current practices regarding data documentation, maintenance, and access.

b. Recommendations for data to be shared across SKPDs.

c. Recommendations for data to be shared with public.

2. Pilot project objectives and suggested cross departmental plan for reporting outputs of analysis, lessons learned and pathway moving forward.

3. Data sharing policy for Kota Denpasar.

4. Recommendations report for cross-departmental collaboration:

a. Assessment of needs and opportunities for spatial planning related training and capacity building and knowledge sharing.

b. Recommendations for fulfilling assessed spatial planning needs through training and capacity building from consultants and local academics, and through Kota Denpasar SKPD cross-departmental knowledge sharing.

c. Draft an SOP for ongoing collaboration between CPL and SKPDs.

d. Make recommendations regarding:

- Advisory committee – suggested framework, membership, roles and responsibilities.
- Core CPL staff – formal staff relationship with city planning government officials in Bappeda and DKTR with CPL.
- Partnerships between CPL and government officials across SKPDs.
- Partnerships between CPL and a broader network.

5. Recommendations report for CPL Advisory Technical Support Process for GIS data collection, maintenance, updating, and sharing across Denpasar SKPDs.

a. Defining the roles of CPL.

b. Opportunities and constraints

c. required resources.

6. Recommendation list of departments/ people to participate in contracting and quality control checks for Denpasar Base map investment in 2015.

4.5 TIMELINE OVERVIEW

There are some key recurring events that are important to consider in a timeline for Kota Denpasar.

Annual budget allocations for the year are set in January, with adjustments made in July. Budget suggestions are best made early in the process. Large budget items need conversations and planning started 6-12 months or more in advance, but small budget items for the following year may be possibly added as late as November or December, for January decision-making. Mid-year budget adjustments are needed. Budget adjustments made in July are not available for expenditure until October. Staff hires approved in January may not be able to start until February or March.

There are many important holidays in the Indonesian and Balinese calendar. It would be unwise to plan much work during the major holiday periods namely at the end of July, most of May, second half of December and beginning of January. It is also worth noting many of the holidays are based on systems where the exact dates change from year to year.

6. APPENDICES

- Workshop Output
- Proposed CPL Workplan Timeline
- Workshop Agenda
- Workshop Attendees List

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WORKSHOP OUTPUT

CONTEXT

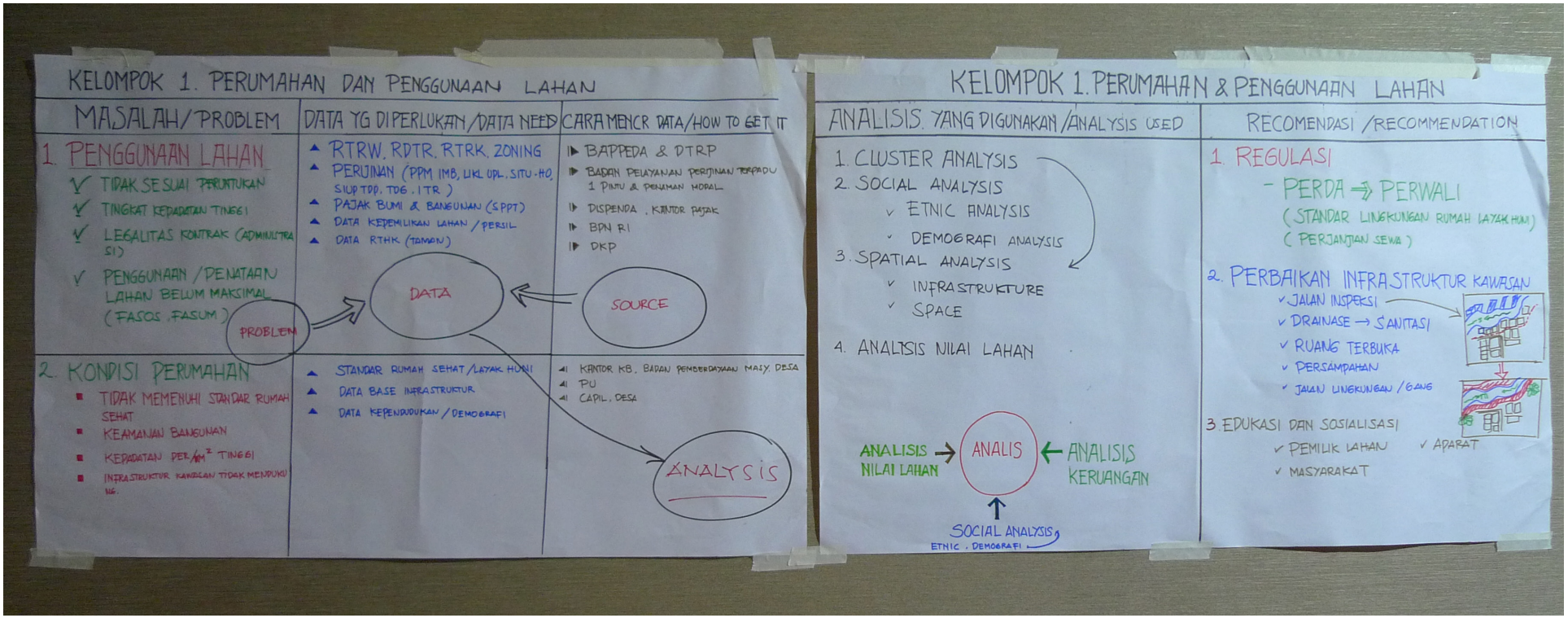
Cross-departmental groups collaborated to generate ideas for plans and policies for improving the conditions of slum settlements at three sites (Jematang, Ubung Kaja and Pemecutan Kaja) through the lens of six themes identified by Kota Denpasar: Housing & Tenure, Urban Infrastructure & Mobility, Local Economy, Social Inclusion, Hazard Risk & Vulnerability and Environment & Sustainability.

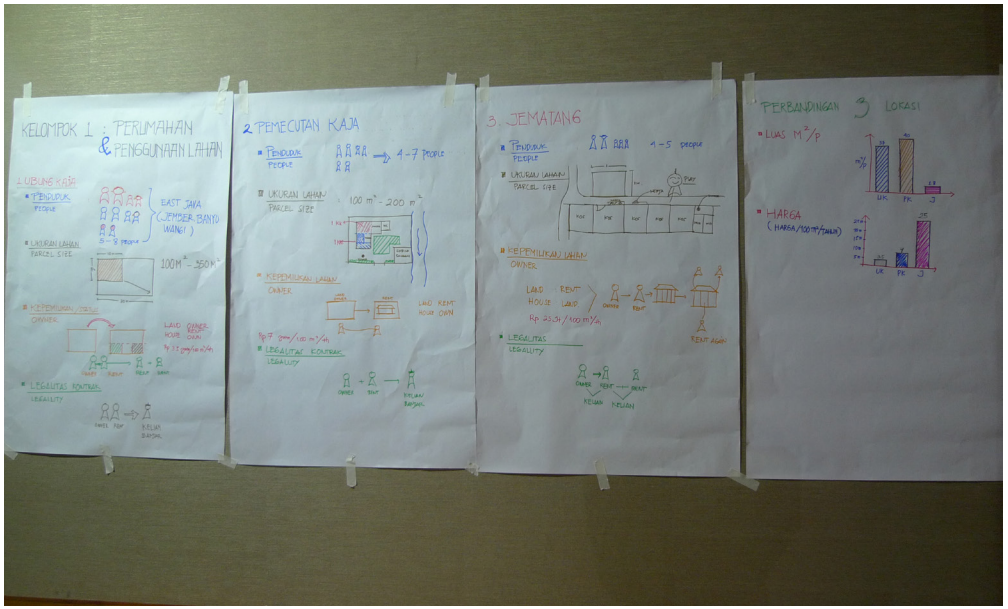
From group work Key Concerns for slum settlement housing emerged. These were identified in Section 3.1 of this report and include Sanitation (solid waste management, sewage & drainage), Access to Services, Legal Status, and Local Economy. Groups also identified a wide range of necessary data and data sources that were needed to support planning that addresses the Key Concerns. This data informed the Priority Data Layers identified in section 3.2 of this report. In addition to the Key Concerns listed here, Kota Denpasar also feels that two important factors are great barriers to previously executed slum settlement upgrading strategies including the complex landscape of land tenure (multiple layers of ownership and rentals) and issues related to demography of slum settlement residents (many residents are migrants from Java).

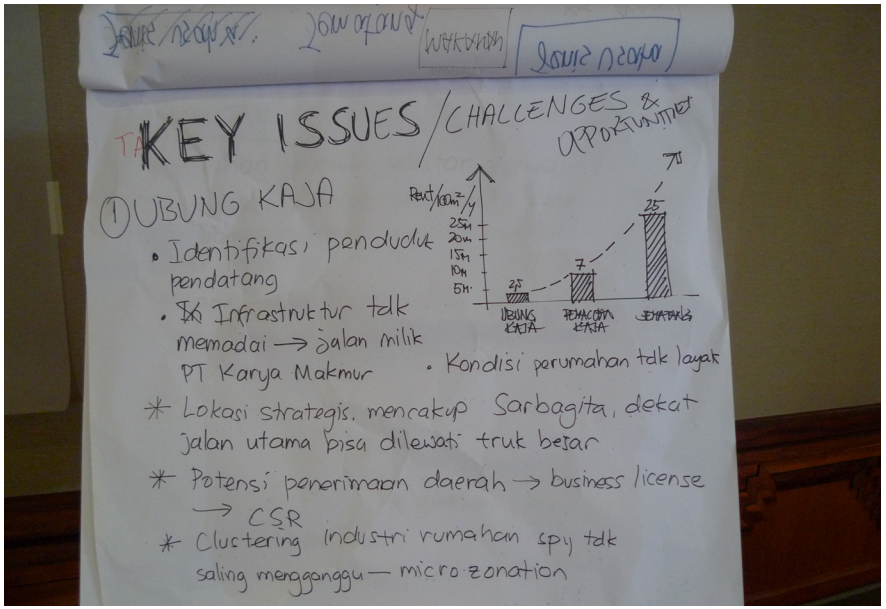
This appendix provides an inventory of the workshop's Group Work activities.

Group	Output	Key Concerns	Priority Data Types	Sources
Environment & Sustainability	3 Site Area Maps, City-wide challenges, priority data layers, data analysis types	Sanitation (Reduce Pollution), Trash Management, Clean Energy Sources	DSDP Network, parcel land use, demographics, Population density, growth expectations, location of public facilities, public health, electricity usage, air quality, trash collection points, trash bank capacity and location, wastewater network, location of dams	DSDP, Kepala Desa, BLH, PLN, DKP, PU, Dinas
Housing & Tenure	4 Diagrams, 2 Data charts	Land Use patterns not optimized or enforced and poor Housing conditions.	Land use: RDTR, RTRK, permits (PPM, IMB, LIKL UPL, SITU, SIUP TDP, TDG, ITR), land & building taxes, land parcels, open space. Housing Conditions: infrastructure database, demographics (population, household size)	Bappeda, DTRP, BPN, DKP, DISPENDA
Local Economy	Spatial plan (Ubung Kaja), two diagrams	Zoning & land use that supports small businesses	Inventory of small businesses, location of markets	PU, PDAM, DKP, Dusun & Desa
Risk & Vulnerability	3 Typologies, 2 Site Plans (Pemecutan Kaja)	Sanitation, Trash Management, Drainage	Street Centerlines, topography, bodies of water, number of households, parcels, building foot prints, existing routes	PU, DKP, Kepala Desa
Social Inclusion	2 site plans, Proposed analyses, Recommendations, Data needs & existing challenges	Ethnic tensions, conflict, environmental pollution, economic security	Demographics, topography, Incidents, Disease, Income, home locations, migrant status	
Urban Infrastructure & Mobility	Design typologies, two site plans, Data sources list	Sanitation, Trash Management, Drainage	Topography, trash collection routes, existing drainage infrastructure, household locations & size, population density	BPN, DISPENDA, PU, DKP, PDAM

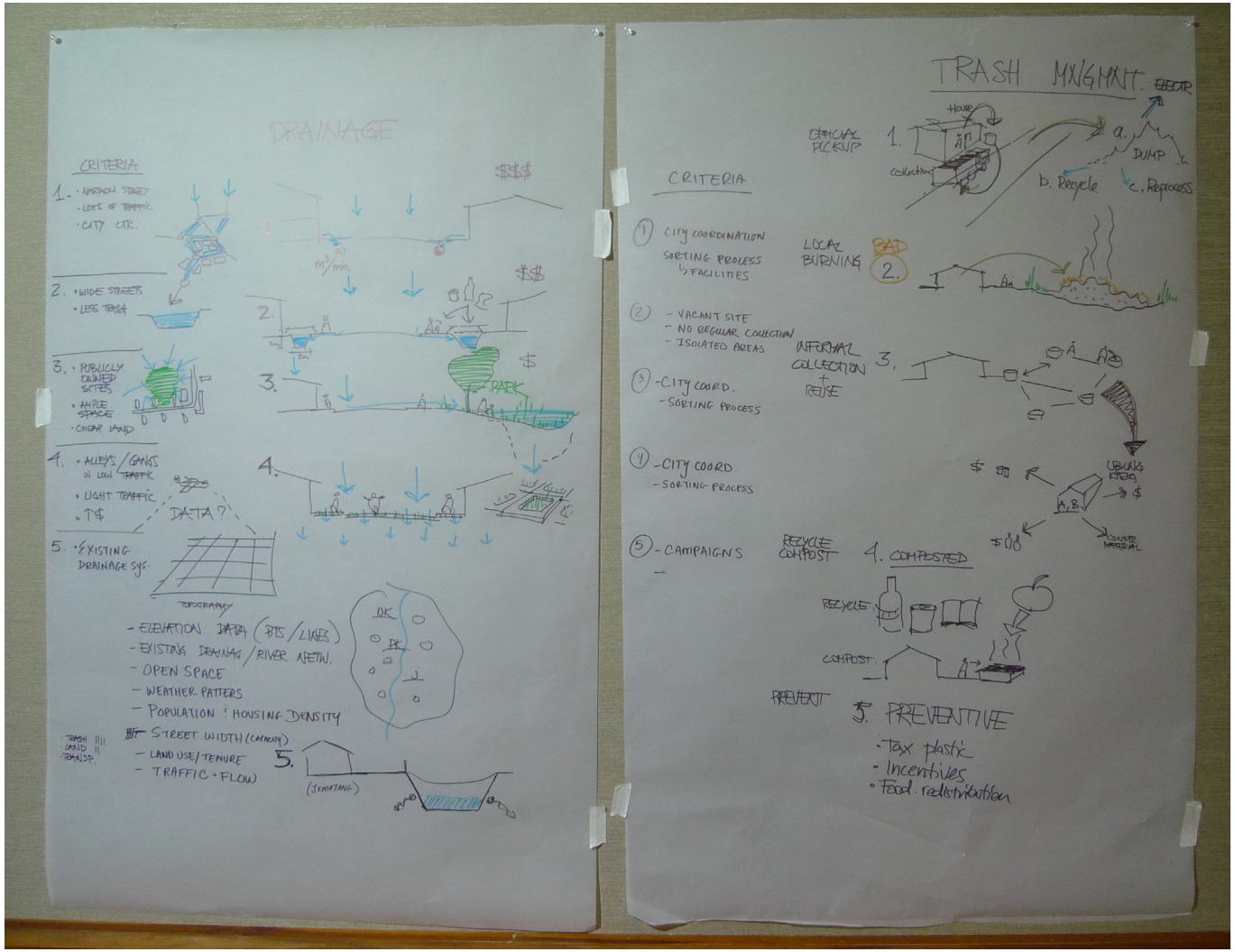
GROUP 1: HOUSING & TENURE



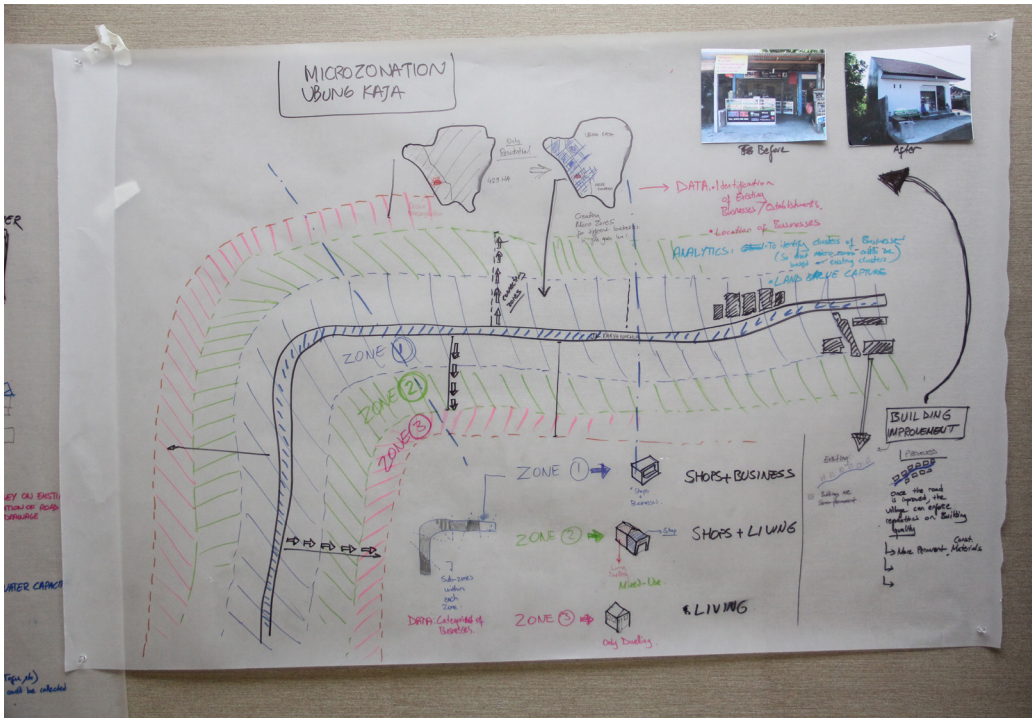


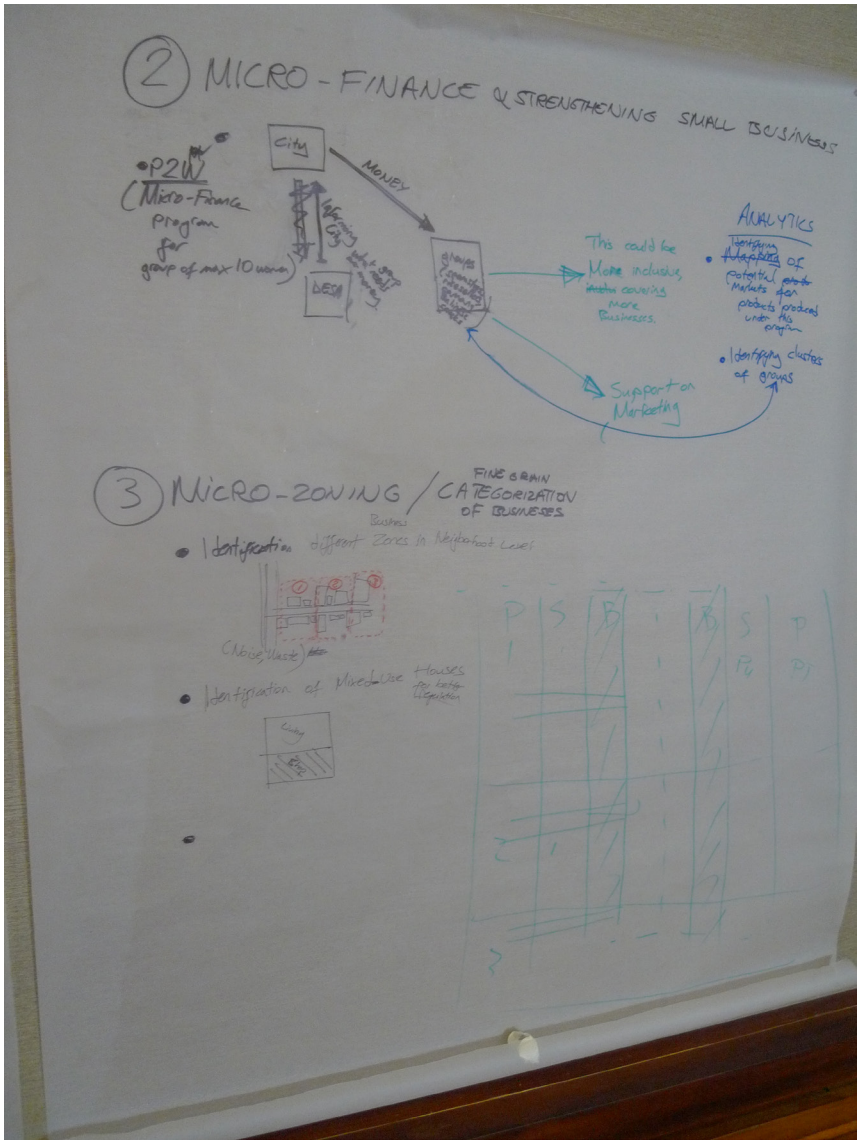


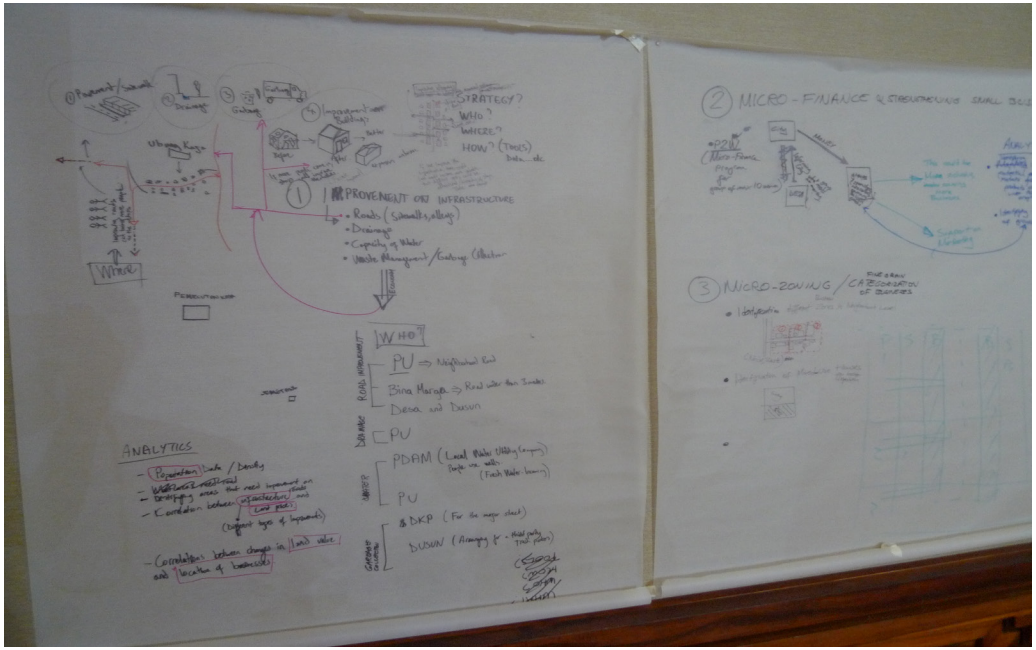
GROUP 2: URBAN INFRASTRUCTURE & MOBILITY



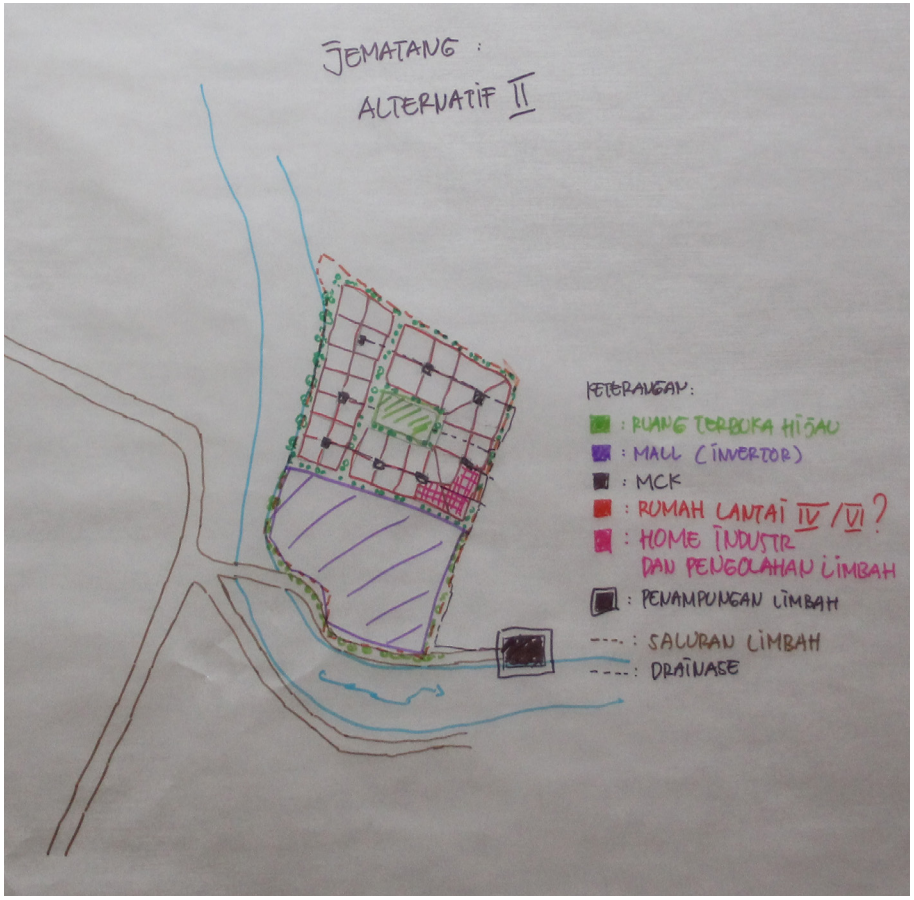
GROUP 3: LOCAL ECONOMY

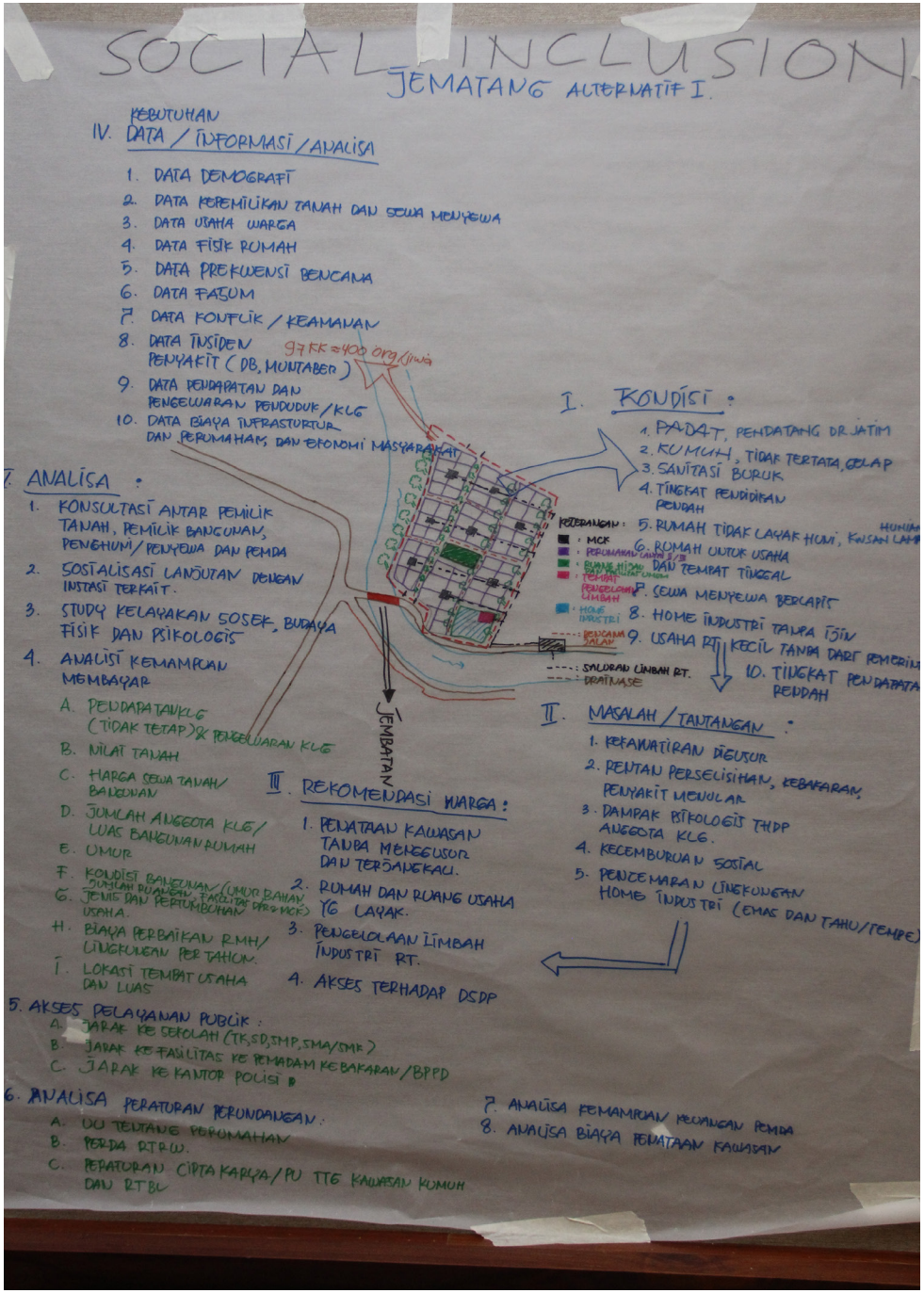




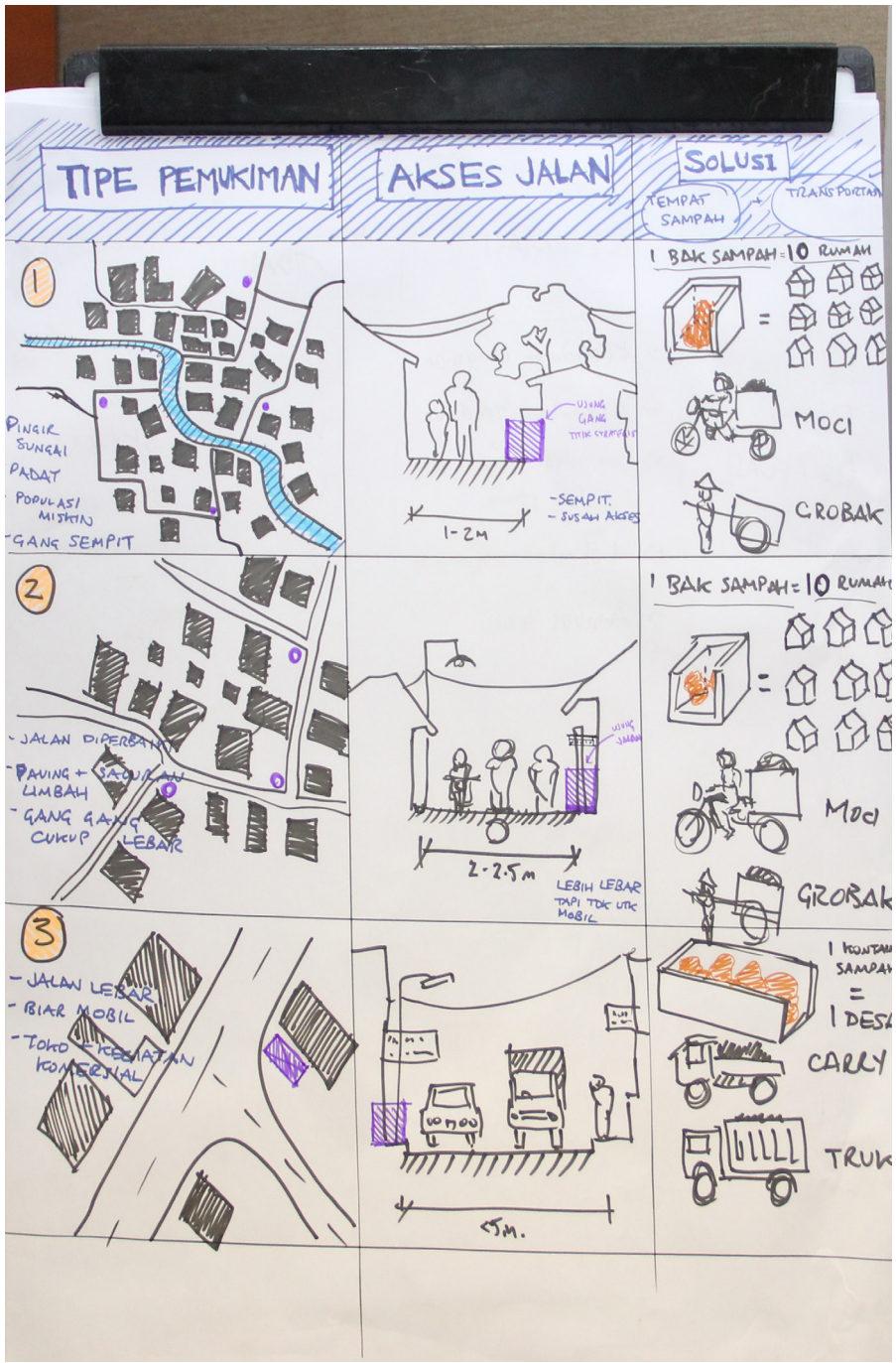


GROUP 4: SOCIAL INCLUSION



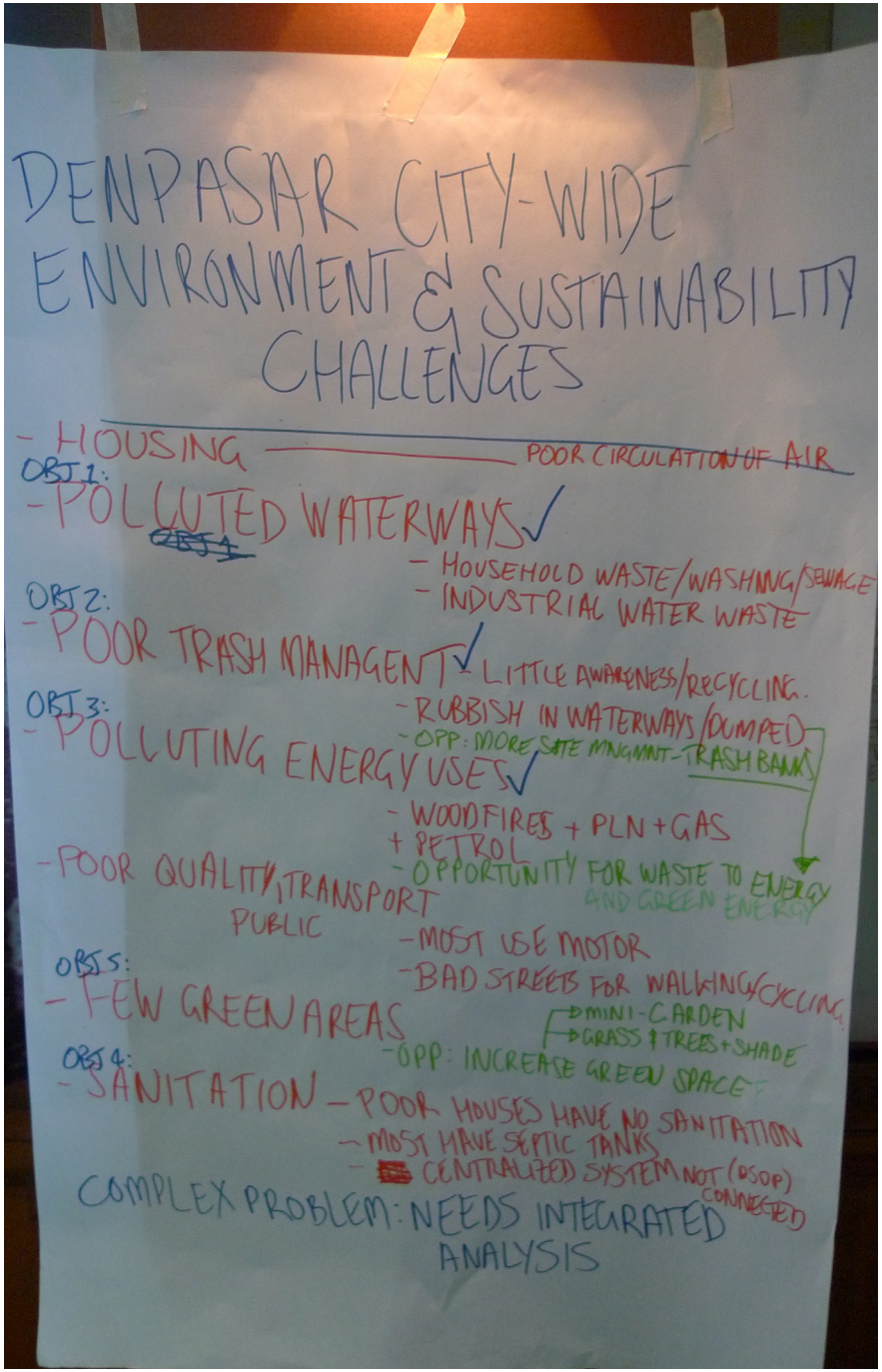


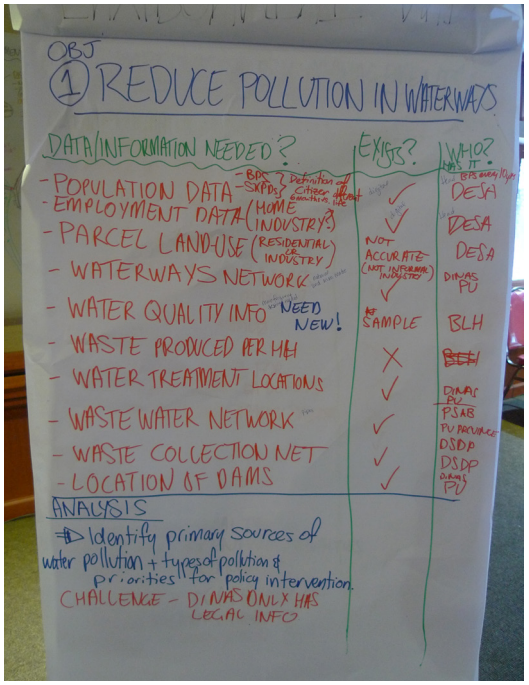
GROUP 5: HAZARD, RISK & VULNERABILITY

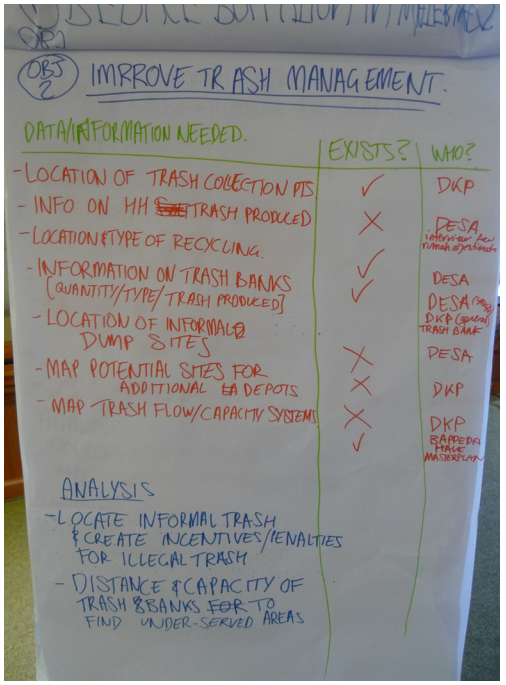


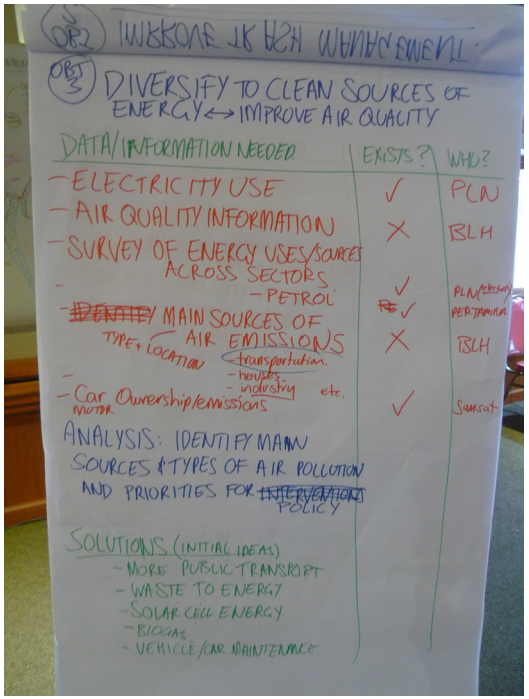
Bencana	Informasi	Ada/Tidak	Sumber
BANJIR	- TOPOGRAFI	✓	PU
	- KEPADATAN PEMUKIMAN	X	
	- KEMISKINAN	✓	DINAS SOSIAL
	- ALIRAN DAN SALURAN	X	
	- SUNGAI DAN CABANG SUNGAI	X	
	- USIA	✓	KEPALA DESA
	- JENIS KELAMIN	X	
SAMPAH	- RUTE MEMBUANG SAMPAH	✓	DKP
	- POSISI TEMPAT BUANG SAMPAH SEMENTARA	X	
	- DAERAH YANG TIDAK MEMPARAT	✓	KEPALA DESA

GROUP 6: ENVIRONMENT & SUSTAINABILITY









Proposed Timeline for Moving Forward		
Data, Systems, Analytics		2014
	Planning for analytic report outputs	
	Urban and Slum Growth Analysis: 1. Collect Data from university of Wisconsin 2. Perform Analytics 3. Benefits to consider: a. Base policy decisions on expected growth b. Identify types and drivers of urban growth	July-Aug
	Access to Services Analysis: 1. Use existing POI and street network data 2. Perform analytics noting that limitations of existing data will affect outputs of analysis. 3. Benefits to consider: a. assess need for investment projects b. choose locations for infrastructure investment c. Shape zoning recommendations	Sept-Oct
	Solid Waste Management Analysis: 1. Collect garbage pickup points and route data from DKP 2. Clean up and process data for use in GIS 6. Use existing street centerline data for routing. Consider focusing on clean up of data for a pilot area such as Jematang or its Desa, Dauh Puri Kauh 3. Perform analytics noting that limitations of existing data will affect outputs of analysis. 4. Benefits to consider: a. Improved service and efficiency with existing resources	Nov-Jan
	Local Business Analysis 1. Collect parcels from DISPENDA 2. Consider clean up and update of data for a pilot area such as Jematang or its Desa, Dauh Puri Kauh 3. Perform analytics noting that limitations of existing data will affect outputs of analysis. 4. Benefits to consider: a. Understand where entrepreneurial clusters are b. Useful input for master planning to avoid making community businesses illegal	Feb-Mar
	Legal Status and Tenure Analysis 1. Collect parcels from DISPENDA 2. Collect officially designated Desa Boundaries from BAPPEDA 3. Clean up and update building footprints and other data for a pilot area such as Jematang or its Desa, Dauh Puri Kauh 4. Perform analytics noting that limitations of existing data will affect outputs of analysis. 5. Benefits to consider: a. Identify opportunities for city investment projects b. Identify tax revenue opportunities c. Link zoning with parcels	Nov-Feb
	Drainage Analysis: 1. Inventory and collect data from PU 2. Consider focusing on clean up and processing of data for GIS in a pilot area such as Jematang or its Desa, Dauh Puri Kauh 3. Perform analytics noting that limitations of existing data will affect outputs of analysis. 4. Benefits to consider: a. Understand extent of existing network b. Predict future needs based on growth c. Plan to reduce flooding and improve access to services	Feb-May
	On ground pilot project - data collection and test with ideas derived from analytics performed	Oct-Feb
	Continue use of and evaluation & planning for WebGIS Version 2, followed by recommendations for 2015 budgeting if upgrades are to be recommended	June-Oct
Cross Departmental Collaboration		2014
	Working Group Formation Regulation request to Mayor	July
	Working Group Formation	August
	Partnership Formation Pilot - CPL and BAPPEDA planners	July-Oct
	Partnership Formation Pilot - CPL and planners and data leads from BAPPEDA, DTRP, PU, and DISPENDA	August-Oct
	Partnership pilot evaluation for success and possible expansion	Oct
Budgeting		2014-2015
	2014 Budget adjustment allocations - focus on improving infrastructure	July
	2014 Budget adjusment expenditures	Oct
	Contracting setup and budget planning for aerial photography and LiDAR surveys to create professional basemap	July-Oct
	Planning budget requests for 2015: 1. CPL staffing (salary, title, job description, status/permanency) 2. data/basemap investments 3. infrastructure investments 4. pilot project implementations support 5. creation of ongoing CPL operations budget 6. WebGIS version 2 development	Aug-Nov
	2015 Budget allocation	Jan
	Professional Basemap creation from Aerial Photography and LIDAR flyover	Feb - Oct
	2015 budget expenditures	Feb - March
	2015 Budget adjustment allocation planning	Feb - June
	2015 Budget adjustment allocation	July
	2015 Budget adjustment expenditures	Oct

Major Milestones Accomplished	2013	2014
CPL implementation engagement with World Bank commenced	end Sept.	
CPL space constructed, staffing explored, new equipment purchased	Oct-Dec.	
CPL leadership transition from Pak Made to Ibu Rini		Jan
CPL opening: staff hired, new equipment setup		March
Collection, evaluation, and processing of GIS data discovered in BAPPEDA		March-May
CPL open house and discussion to Korea Green Growth Trust Fund (http://www.worldbank.org/en/topic/sustainabledevelopment/brief/korea-green-growth-partnership)		May 7
Budget request for CPL infrastructure improvements		June
Introduction of CPL and WebGIS to Kota Denpasar		June
Kota Denpasar WebGIS development and training of CPL staff		June 2-6
Kota Denpasar Disadvantaged Housing Workshop		June 10-12

PERMUKIMAN DAN PERUMAHAN KUMUH DI DENPASAR: PENGELOLAAN DATA UNTUK PENYUSUNAN KEBIJAKAN

SLUM SETTLEMENTS AND HOUSING IN DENPASAR: DATA MANAGEMENT FOR POLICY MAKING

BAPPEDA DENPASAR, WORLD BANK, SUTD CITY FORM LAB

Selasa, 10 Juni 2014

Tuesday, June 10, 2014.

Waktu ***Time***	**Agenda** ***Agenda***	**Pembicara** ***Presenter***
08.30 – 09.00	Registrasi *Registration*	Tim Bappeda *Bappeda Team*
09.00 – 09.15	Pembukaan, Menyanyikan Indonesia Raya dan Pembacaan Doa *Opening remarks, singing The National Anthem, and prayer*	Protokol,Tim Bappeda *Protocol, Bappeda Team*
09.15 – 09.30	Laporan dari Bappeda Kota Denpasar *Report from Bappeda Kota Denpasar*	Tim Bappeda *Bappeda Team*
09.30 - 09.45	Sambutan Walikota Denpasar *Welcome remarks from the Mayor of Denpasar*	Tim Bappeda *Bappeda Team*
09.45 – 10.00	Sambutan dari bank Dunia *Welcome remarks from The World Bank*	Taimur Samad
10.00 – 10.15	Presentasi dari Bappeda: (1) Tujuan workshop dan output yang diharapkan	Ir. Rini Ambarwati, M.T

	(2) Tantangan dan kondisi Permukiman kumuh di Denpasar, kebijakan dan program yang sudah dilakukan atau yang sedang dilakukan terkait Permukiman kumuh, (3) Pengenalan fungsi dan tujuan dibentuknya City Planning Lab (CPL) *Presentation by Bappeda:* *(1) The purpose of the workshop and expected outputs* *(2) Challenge and conditions of housing settlements in Denpasar, policies and programs that have been implemented towards housing conditions.* *(3) Introduction of the function and purpose of the City Planning Lab (CPL)*	
10.15 – 10.40	Presentasi tim CPL terkait: (1) Status CPL (2) Data yang dibutuhkan untuk CPL dan kemungkinan kerjasama *sharing* data dengan SKPD (3) Peluang terhadap perencanaan kota dan perumusan kebijakan yang bisa diperoleh dengan adanya CPL (4) Pengenalan terhadap aplikasi webGIS Kota Denpasar *Presentations by the Denpasar CPL team:* *(1) Status of CPL in Denpasar* *(2) The data required for the CPL and the opportunities for cooperation on data sharing across departments* *(3) Opportunities for city planning and policy making created by CPL* *(4) Introduction of Denpasar City WebGIS*	Putu Perdana Kusuma Wiguna, S.Si, M.Sc.
10.40 - 10.50	Istirahat *Coffee Break*	
10.50 – 11.30	Presentasi dari ahli eksternal mengenai pengembangan Kampung: (1) Pemetaan teknis terhadap kawasan perumahan (2) Pentingnya data spasial dalam pengambilan keputusan *Presentation by experts on kampung improvement:* *(1) Experience of technical mapping of housing areas* *(2) The importance of spatial data for policy-making*	1) Stephen Cairns 2) Nyoman Kami Artana
11.30 - 12.00	Perencanaan dan potensi analisis untuk perumahan di Denpasar; penjelasan mengenai agenda/ kegiatan workshop *Planning and analysis for housing in Denpasar and the explanation of workshop activities.*	Andres Sevtsuk
12.00 – 12.45	Makan Siang *Lunch*	
12.45 – 13.10	Pengantar untuk kunjungan lokasi dan distribusi peta dan data yang tersedia dalam ukuran A3 kepada masing-masing peserta (masing-masing mendapat tiga peta untuk tiga lokasi kunjungan).	Fasilitator: Andres Sevtsuk

	Peserta dibagi kedalam 6 kelompok yang masing-masing akan mendapat tema sebagai berikut: (1) Perumahan dan penggunaan lahan (2) Infrastruktur permukiman kumuh (3) Ekonomi lokal (4) Kondisi sosial masyarakat (5) Bahaya, risiko dan kerentanan (6) Lingkungan yang keberlanjutan *Introduction to site visits and the available maps and data. Distribution of base drawings and base data. Each participant is given an A3 map of each of the 3 areas to sketch on.* *Participants are divided into 6 groups that will focus on the following themes:* • *Housing and tenure* • *Urban infrastructure and mobility* • *Local Economy* • *Social inclusion* • *Hazard risk and vulnerability* • *Environment and Sustainability*	Pimpinan Kelompok: Nyoman Kami, Josie McVitty, Indira Dharmapatni, Stephen Cairns, Rizqi Abdulharis, John Taylor *Facilitator: Andres Sevtsuk.* *Designated group leads: Nyoman Kami, Josie McVitty, Indira Dharmapatni, Stephen Cairns, Rizqi Abdulharis, John Taylor*
13.10 – 13.20	Persiapan meninggalkan ruangan, menuju ke bis *Leaving the room, getting onto buses.*	Tim Bappeda *Bappeda Team*
13.20 – 16.40	Masing-masing kelompok mengunjungi tiga lokasi yang menunjukkan tiga komunitas perumahan yang berbeda • Jematang • Pemecutan Kaja • Ubung Kaja Masing-masing kelompok mengamati dan mengumpulkan data terkait kondisi perumahan di masing-masing lokasi sesuai tema yang diberikan. *Groups visit to three different sites, illustrating different housing communities:* • *Jematang* • *Pemecutan Kaja* • *Ubung Kaja* *Each group observes and gathers data about each of the settlements according to their assigned theme.*	Tim Bappeda Tim World Bank Tim SUTD Estimasi Waktu: Lokasi: 3x 45 menit Perjalanan: 60 menit *Bappeda Team* *The World Bank* *SUTD Team* *Length of time estimated at each site = 3x 45 minutes* *Travel time = 60min*
16.40 – 17.30	Masing-masing kelompok melakukan rekapitulasi, berbagi hasil terhadap anggota kelompok dan mulai merencanakan peta analisis perencanaan untuk pemetaan di esok hari *Teams gather to recap, share the findings with team members and start planning analysis maps for the next day*	Tim Bappeda Tim World Bank Tim SUTD *Bappeda Team* *The World Bank* *SUTD Team*

Rabu, 11 Juni 2014

Wednesday, June 11, 2014.

Waktu *Time*	Agenda *Agenda*	Pembicara *Presenter*
08.30 - 09.00	Registrasi Registration	Tim Bappeda *Bappeda Team*
09.00 – 09.30	Presentasi oleh SUTD City Form Lab mengenai studi kasus tentang fungsi dari pengambilan keputusan dan perencanaan berbasis analisis data spasial *Presentation by SUTD City Form Lab on case studies that demonstrate the functionality of the analysis-based policy-making and planning.*	SUTD City Form Lab
09.30 - 09.45	Penjelasan mengenai jadwal hari kedua dan contoh-contoh dimana masing-masing kelompok yang telah dibagi di hari pertama mulai mengidentifikasi isu-isu dan peluang terkait permukiman kumuh *Introduction to the day's schedule + example deliverables. Groups work across all three sites identifying cross-cutting issues and opportunities.*	Andres Sevtsuk
09.45 - 12.15	Diskusi kelompok: tantangan dalam manajemen perumahan dan perencanaan Permukiman. Diskusi dan pemetaaan tantangan utama dan peluang terkait Permukiman pada tiga lokasi kunjungan di Denpasar sesuai dengant tema-tema yang telah ditentukan (masing-masing grup didukung oleh fasilitator, peta dan sarana penunjang yang disiapkan oleh SUTD) *Group work: challenge of housing management and planning of settlements.* *Groups brainstorm and map the key challenges and opportunities of housing across the three sites in Denpasar, related to their designated theme (each team is supported by a facilitator, discussion is assisted by maps, materials prepared by SUTD Team).*	Pimpinan Kelompok: Nyoman Kami, Josie McVitty, Indira Dharmapatni, Stephen Cairns, Rizqi Abdulharis, John Taylor *Designated group leads: Nyoman Kami, Josie McVitty, Indira Dharmapatni, Stephen Cairns, Rizqi Abdulharis, John Taylor*
12.15-13.00	Presentasi singkat oleh masing-masing kelompok mengenai analisis peta yang sudah dihasilkan (masing-masing 5 menit) *Quick group presentations of analysis maps (5min each)*	Presenter dari masing-masing grup *Designated local presenter from each group.*
13.00 – 14.00	Makan Siang *Lunch*	
14.00 – 16.00	Kerja Kelompok. Persiapan penggambaran peta dan analisis guna menjelaskan isu tematik masing-masing kelompok sebagai sebuah proses. Setiap proses (cara mereka bekerja, cara mendapatkan hak atas tanah) diilustrasikan dengan proses menggambar secara geografis seperti menggambar dalam peta. Masing-masing grup diminta untuk mengidentifikasi dan menuliskan data serta informasi yang dibutuhkan untuk mengembangkan tinjauan singkat tentang proses-proses yang sudah dipelajari.	Pimpinan Kelompok: Nyoman Kami, Josie McVitty, Indira Dharmapatni, Stephen Cairns, Rizqi Abdulharis, John Taylor

	Group work. Preparation of key map drawings and analytic drawings to explain the group's thematic issues as processes. Each process (e.g. typical journeys to work; process of obtaining land tenure) is illustrated with a process drawing graphically as well as sketched on a map. *Each group is asked to identify and list the data and information needed to develop an accurate overview of the processes studied.*	*Designated group leads: Nyoman Kami, Josie McVitty, Indira Dharmapatni, Stephen Cairns, Rizqi Abdulharis, John Taylor*
16:00-17:00	Presentasi peta perkelompok dan analisis *Presentations of group maps and analytic process drawings.*	Presenter masing-masing kelompok *Designated local presenter from each group.*

Kamis, 12 Juni 2014
Thursday, June 12, 2014.

Waktu ***Time***	**Agenda** ***Agenda***	**Pembicara** ***Presenter***
08.30 - 09.00	Registrasi *Registration*	Tim Bappeda *Bappeda Team*
09.00 - 09.30	Presentasi mengenai contoh kebijakan sharing data dan SOP untuk pemeliharaan dan manajemen data secara teratur *Presentation on best practice examples of Data Sharing Policies and SOPs for regular data upkeep and management.*	Lisa Sweeney/ John Taylor
9.30 - 09.45	Penjelasan mengenai jadwal hari ketiga dan penyampaian contoh-contoh *Introduction to the day's schedule and example deliverables.*	Andres Sevtsuk
9.45-10.00	Alokasi lokasi per kelompok: setiap kelompok memilih satu dari tiga lokasi kunjungan untuk difokuskan. Fasilitator dapat memastikan kalau tiap lokasi mendapat alokasi. *Allocation of sites to teams: each team picks one of the three sites to focus on for the day. Facilitators ensure that each site gets allocated.*	Pimpinan Kelompok: Nyoman Kami, Josie McVitty, Indira Dharmapatni, Stephen Cairns, Rizqi Abdulharis, John Taylor
10.00 - 12.30	Analisis dan perencanaan untuk pengembangan kebijakan. Berdasarkan proses pemetaan partisipatif dan analisis yang telah dikembangkan sebelumnya, masing-masing grup mulai untuk mengembangkan perencanaan dan kebijakan yang dapat digunakan sebagai dasar manajemen eprmukiman kumuh dalam jangka waktu 1,5 dan 10 tahun ke depan. Masih-masing kelompok akan diminta untuk mengembangkan 1 sampai 3 perencanaan dan kebijakan yang konkret bagi lokasi yang ditinjau pada hari pertama. Masing-masing gagasan harus dilengkapi dengan ilustrasi terkait: 1) Rencana dan gambar dari rencana atau kebijakan yang dirumuskan 2) Ringkasan berupa poin-poin dari gagasan yang diajukan 3) Diagram proses atau peta yang menggambarkan	Pimpinan Kelompok: Nyoman Kami, Josie McVitty, Indira Dharmapatni, Stephen Cairns, Rizqi Abdulharis, John Taylor

	analisis spasial yang dapat digunakan untuk menunjukkan keutungan dari proposal yang diajukan 4) Informasi tentang kebutuhan data, (yang diidentifikasi oleh tiap kelompok di hari kedua) kemudian dikumpulkan menurut sKPD yang terkait. Diskusi kelompok dilakukan untuk: • Mengetahui data apa yang ada, data apa yang perlu ditingkatkan, yang perlu diidentifikasi terlebih dahulu. • Peluang yang bisa diperoleh dari sharing data, saran-saran terkait kebijakan sharing data dan SOP • Gagasan untuk kolaborasi antar SKPDdengan CPL untuk mewujudkan gagasan dan perencanaan yang sudah digagas. *From analysis to planning and policy development. Based on the mapping and process analysis developed previously, each group starts developing planning and policy ideas that could improve the chosen housing settlement within a 1, 5 and 10-year timeframe. Each group is asked to develop 1-3 concrete planning or policy ideas that would improve the site. Each proposed idea should be illustrated with:* *1) A plan and drawings of the proposed intervention or policy.* *2) Key bullet points summarizing the proposed idea.* *3) A process diagram or map illustrating what spatial analysis can be used to demonstrate the costs and benefits of the proposal and who they spatially accrue to.* *4) The information and data needs (identified by each group on Day 2) are aggregated according to responsible agency. Groups discuss* *a. What data exists, updates needed, what data identified by this process would need to be collected for the first time.* *b. Opportunities for data sharing, suggestions toward a data sharing policy, and Standard Operating Procedures* *c. Proposed CPL/ cross departmental collaborations to address suggested ideas and activities*	*Designated group leads: Nyoman Kami, Josie McVitty, Indira Dharmapatni, Stephen Cairns, Rizqi Abdulharis, John Taylor*
12.30 – 13.30	Makan Siang *Lunch*	
13.00 - 15.00	Kerja kelompok berlanjut untuk menghasilkan materi presentasi final. *Group work continues on production for the final presentation materials.*	Pimpinan Kelompok
15.00-17.00	Presentasi Final dan analisis peta per kelompok, kebutuhan data, gagasan dan analisis yang efektif berbasis bukti yang diusulkan guna merealisaisikan gagasan-gagasan yang muncul. Presentasi diikuti oleh diskusi panel tetnang prioritas untuk CPL, dan kolaborasi antar SKPD dalam merealisasikan gagasan-gagasan terkait perencanaan di Kota Denpasar *Final presentations of group analysis maps, data needs, ideas and proposed evidence-based cost-benefit analyses of these ideas.* *Presentations followed by a roundtable discussion on CPL priorities and cross-departmental collaboration on addressing important planning issues in DPS.*	1 atau 2 presenter dari masing-masing grup *1-2 designated local presenters from each group.*

INVITEES LIST

Kota Denpasar

Walikota Denpasar
Mayor of Denpasar
Majelis Madya Kota Denpasar
Assembly Associate Denpasar
Kepala Badan Pelayanan Perijinan Terpadu Satu Pintu dan Penanaman Modal Kota Denpasar
Head of Licensing Services and One Stop Investment Denpasar
Kepala Dinas Sosial dan Tenaga Kerja Kota Denpasar
The Head of Department of Social Welfare and Labor Denpasar
Kepala Dinas Kependudukan dan Catatan Sipil Kota Denpasar
The Head Office of Population and Civil Denpasar
Kepala Badan Pemberdayaan Masyarakat dan Pemerintahan Desa Kota Denpasar
The Head of Community and Village Government Denpasar
Camat Denpasar Utara
Camats North Denpasar
Camat Denpasar Barat
Camats West Denpasar
Camat Denpasar Timur
Subdistrict of East Denpasar
Camat Denpasar Selatan
Camats South Denpasar
Kepala Desa Dauh Puri Kauh
Village Head - Dauh Castle Kauh
Kepala Dusun Jematang
Neighborhood leader - Jematang
Kepala Desa Pemecutan Kaja
Village Head – Pemecutan Kaja
Kepala Desa Ubung Kaja
Village Head – Ubung Kaja
Kepala Badan Lingkungan Hidup Kota Denpasar (BLH)
Environment Agency Head of Denpasar
Kepala Dinas Kesehatan Kota Denpasar (DINKES)
Chief Medical Officer of Denpasar
Kepala Dinas Kebersihan dan Pertamanan Kota Denpasar (DKP)
Chief of Department of Hygiene and Denpasar
Kepala Dinas Pekerjaan Umum Kota Denpasar (PU) – roads and drainage
Dept. of Public Works Denpasar
Dinas PU Werdhapura
Department of Public Works Werdhapura
PDAM
Freshwater systems
Kepala Dinas Perhubungan Kota Denpasar (DISHUB)
Chief of the Department of Transportation Denpasar
Kepala Kantor Pertanahan Kota Denpasar (BPN)

Chief Land Office Denpasar
Kepala Bagian Program Pembangunan Sekretariat Daerah Kota Denpasar (BAPPEDA)
The Head of the Secretariat of the Regional Development Program Denpasar
Kepala Bidang Data dan Pelaporan Badan Perencanaan Pembangunan Daerah Kota Denpasar (BAPPEDA)
The Head of Data and Reporting Regional Planning Agency Denpasar
Kepala Dinas Tata Ruang dan Perumahan Kota Denpasar (DTRP)
Dept. of Housing Spatial Planning and Denpasar
Kepala Dinas Komunikasi dan Informatika Kota Denpasar (DISKOMINFO – IT)
The Head of Communications and Information Agency of Denpasar
Kepala Dinas Pendapatan Kota Denpasar (DISPENDA)
Chief Revenue Service Denpasar
Kepala Kantor Badan Pusat Statistik Kota Denpasar (BPS – city level – didn't come)
The Head Office of National Statistics Agency of Denpasar
Badan Penanggulangan BencanaDaerah Kota Denpasar (BPBD)
Disaster Management Agency Denpasar
Perusahaan Listrik Negara Kota Denpasar (PLN)
The State Electricity Company Denpasar

Tambahan (Tanya Bu Julia):
Supplement (Ask Mrs. Julia) :
Kepala Desa dan Kepala Dusun
The village head
Sekretaris dan kepala bidang Satker pengembangan permukiman (I Ketut Suarnata, ST)
Secretary and head of Satker development of settlements (I Ketut Suarnata , ST)

Academic

Jurusan Arsitektur Universitas Udayana
Department of Architecture, University of Udayana
Program Studi Perencanaan Wilayah dan Kota Universitas Hindu Indonesia
Studies Urban and Regional Planning Indonesian Hindu University
Kelompok Ahli Pembangunan Kota Denpasar
Development Expert Group Denpasar

Consultants

Bapak Made Arca Eriawan (Konsultan)
Bapak Nyoman Kami Artana (Konsultan)