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Depicting the Landscape around Information Flows: Methodological Propositions

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MOTIVATION AND OBJECTIVES

Developers of software applications entering new markets want to know: "Where are our users (more formally, which actors in which organizations will benefit from using our products)? Where do they need our products (more formally, in which processes will the actors benefit from using the products)? Where are our customers (more formally, who has the authority to decide on introducing the products into the processes)?"

Similarly, Information Systems researchers starting to study a phenomenon in a context new to them need to understand the broad socio-political and organizational landscape around the actual object of research. This is particularly important when the same phenomenon is being studied in different countries – if differences in the broader context are not recognized, it is impossible to compare the results.

Most Information Systems theories, methods and textbooks are developed in the "North" (North America, Europe, Australia), in wealthy societies and mainly in the context of big private business – although often considered "universal". Practitioners, educators and researchers in the South work in contexts that can be very different from the "universal" in terms of economy, political structures, cultures, infrastructures, education, etc. They need to be able to identify and understand the differences and similarities between the "universal" and their actual context.

Particularly, healthcare is a complex domain. The healthcare delivery system differs radically between countries, particularly the activities that take place outside of hospitals. Can the *essential* features of the healthcare "landscape" in a given country be described in a sufficiently simple but sufficiently detailed way so that software developers or IS researchers can grasp the essential aspects of the context/environment before "zooming in" into the software requirements or detailed research?

In this is position paper we suggest a methodology for depicting the landscape around information flows, with examples from healthcare settings in different countries. We suggest that the methodology can be used in other domains as well. The methodology has its theoretical basis in Activity Theory (Engeström and Miettinen 1999; Korpela et al. 2004; Mursu et al. 2007; Luukkonen et al. 2007), but it can be applied without acquaintance with the theory.

THE PROPOSED METHODOLOGY WITH EXAMPLES

The idea of the methodology is to present the essential features of the landscape in a simple graphical form consisting of a "canvas" and four "layers" on it. The canvas describes the basic geographic/physical layout and the basic political structure around the object under study. The four layers deal with 1) the organizations, stakeholders and services, 2) structures of management, 3) financial structures, and 4) information flows around the object under study. Each layer is first developed as an independent dimension, after which they can be superimposed into a comprehensive picture. Only the *essential* aspects of each dimension should be included, i.e., aspects that are essential for IS developers' or researchers' understanding of the context.

The canvas and the layers are presented in the next sections first in an abstract way – what are the units of analysis and relations in it, how to identify them and what is the suggested notation for them. Two examples are then provided for each dimension, one from China and one from South Africa. Both cases deal with maternity healthcare (health services during pregnancy and for a short period after delivery) in a specific location. However, the objective is *not* to fully present the cases or to compare them, but to *illustrate* how different aspects of the landscape around the cases can be analysed and described. Therefore the scopes and purposes of the same type of diagrams of the cases are not always the same.

The first case is from Weifang area in the city of Shanghai in China and the second case from Vredenburg town in South Africa.

CANVAS: BASIC GEOGRAPHIC AND POLITICAL STRUCTURE

The basic canvas beneath the layers is about the physical aspects of the context. The basic idea is simply to identify geographic areas of political authority with "scopes of power" zooming in from national (or international, if needed) to local.

Only one unit of analysis is used at the canvas level:

- Geographically specified society, represented by a broad-line rectangular box with rounded corners, in blue colour if colours can be used (see the legend in Figure 1).

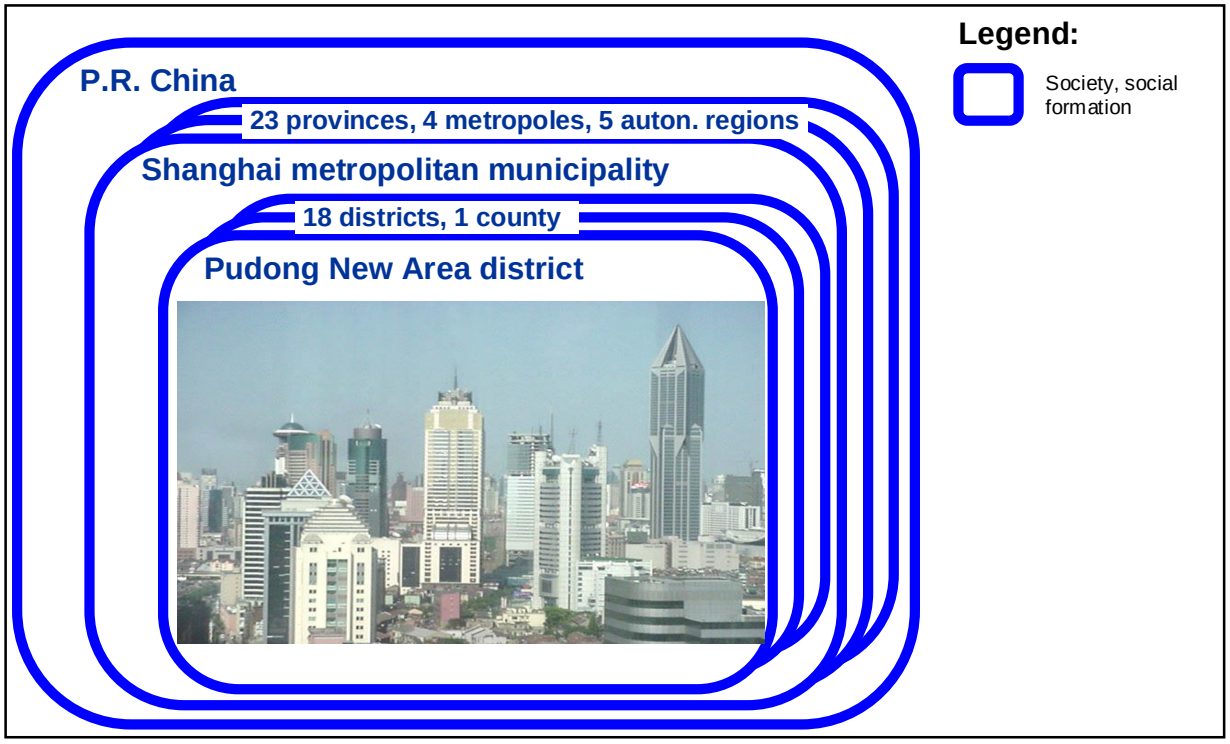

Figure 1: The geo-political canvas around Weifang in Pudong New Area District in Shanghai, China.

After some initial experiments, we realized that it is also important to provide the reader a touch and feel of the context under study, especially when describing a case study in a specific place. The suggested way to do this is to use maps or, better still, birds-eye photos. Google Earth

provides a nice tool for providing a sequence of space views zooming in from a country through a province/city to a neighbourhood displaying the kind of housing you have in your case.

Figure 1 illustrates the canvas around the Weifang case, showing the three levels of governance in China: national level, province/municipality level and district level. The Weifang area is part of the Pudong New Area District, which is part of the Shanghai Municipality. In Chinese terminology, a municipality is a metropolitan area that is governed at the same level as provinces. A photograph is used to show what kind of an area Pudong is; the most highly economically developing square kilometres in China. Weifang itself is not included in this diagram, which is arguable since it is not among the most high-rise neighbourhoods in Pudong.

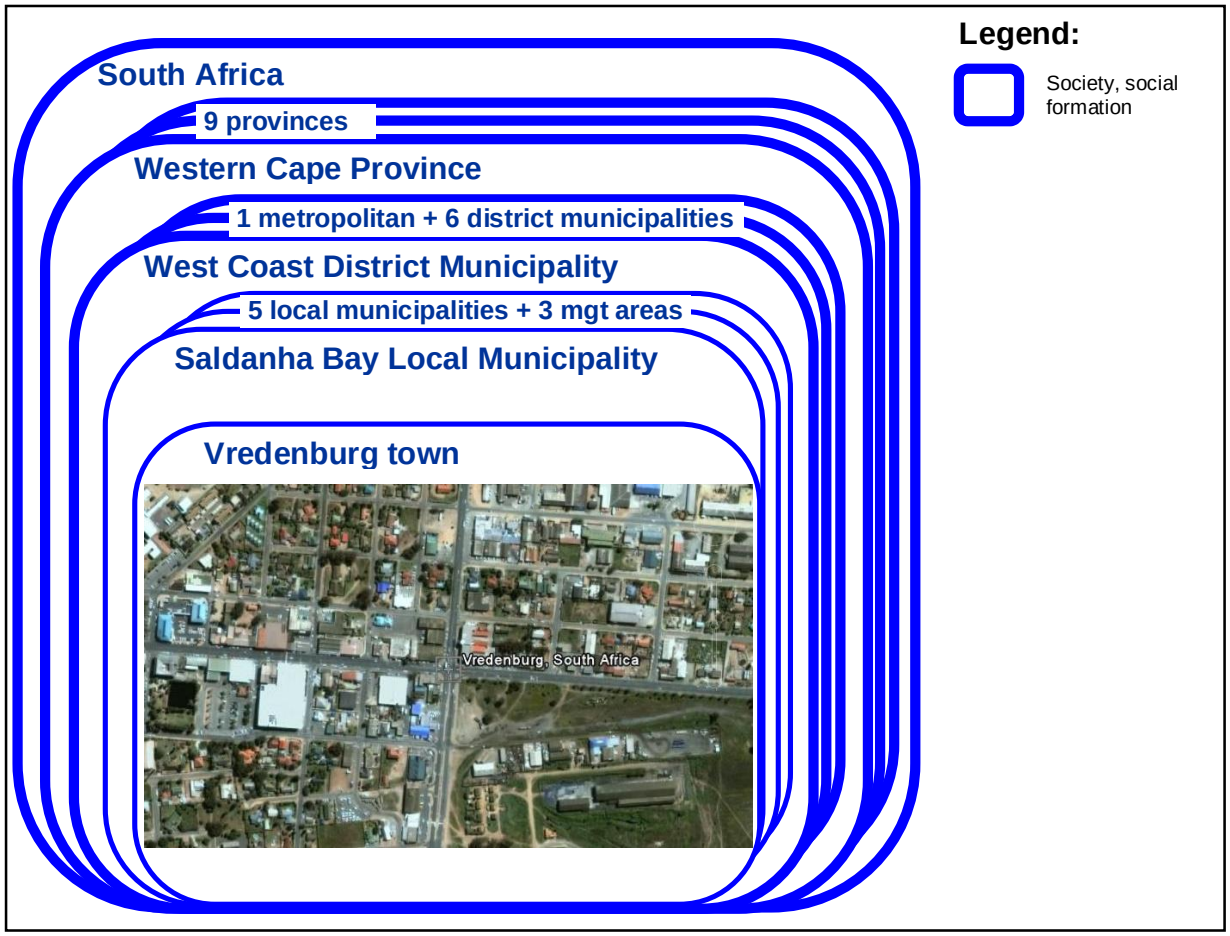

Figure 2: The geo-political canvas around Vredenburg town in South Africa.

Figure 2 describes the canvas around the South African case in a similar way. South Africa is divided into provinces which are further divided into municipalities. In other than metropolitan areas, there are two levels of municipalities – district and local. Vredenburg town is the commercial and administrative center of the Saldanha Bay Local Municipality, which is part of the West Coast District Municipality in the Western Cape Province.

Although "a picture tells more than a thousand words", we are not suggesting that pictures can work without text. In this case for instance useful demographic information about the elements in the picture might include *population* (according to the 2001 census quoted in Wikipedia, South Africa: about 45 million; Western Cape: 4.5 million; West Coast: 270,000; Saldanha Bay: 70,000; Vredenburg: 31,000), *ethnic makeup* (in the terms used in South African statistics, South Africa: 79.0% Black, 9.6% White, 8.9% Coloured, 2.5% Indian or Asian; Western Cape, respectively: 26.7%, 18.4%, 53.9%, 1.0%; West Coast: 10%, 17.5%, 72.5%, 0%) and *home languages* (South Africa: 23.8% isiZulu, 17.6% isiXhosa, 13.3% Afrikaans, 9.4% Sepedi, 8.2% English, 8.2% Setswana, 7.9% Sesotho; Western Cape: 55.3% Afrikaans, 23.7% isiXhosa, 19.3% English; West Coast: 89.1% Afrikaans, 7.4% isiXhosa, 2.3% English).

LAYER 1: FLOWS OF SERVICES BETWEEN ORGANIZATIONS AND ACTIVITIES

The first layer describes the organizational context and stakeholders on top of the canvas of geographic-political structures. There are four new units of analysis (see legend in Figure 3):

- Organizations are formal institutions, possibly within bigger organizations. They are depicted by sharp-cornered boxes in black line.

- Activities are what produce product and services in real terms, consisting of processes run by people (actors) using technologies (Mursu et al. 2007). In the landscape picture the inner elements of activities may not be essential. Activities are depicted by oval shapes, in green if colours can be used.

- Individual people are the main stakeholder groups – citizens, customers, patients, doctors, etc. Since activities are run by people, it is often self-explanatory who are the people involved in them, it suffices to name the activities. Individual people are depicted by small circles, in red if colours can be used.

- Need-service relationships connect people with activities, or activities with other activities. That is, people may need healthcare services, and the services are provided to them by some healthcare activities. Products are also seen as services. Service relations are depicted by middle-breadth arrows with triangular heads, in green if colours can be used (since they belong to the realm of activities).

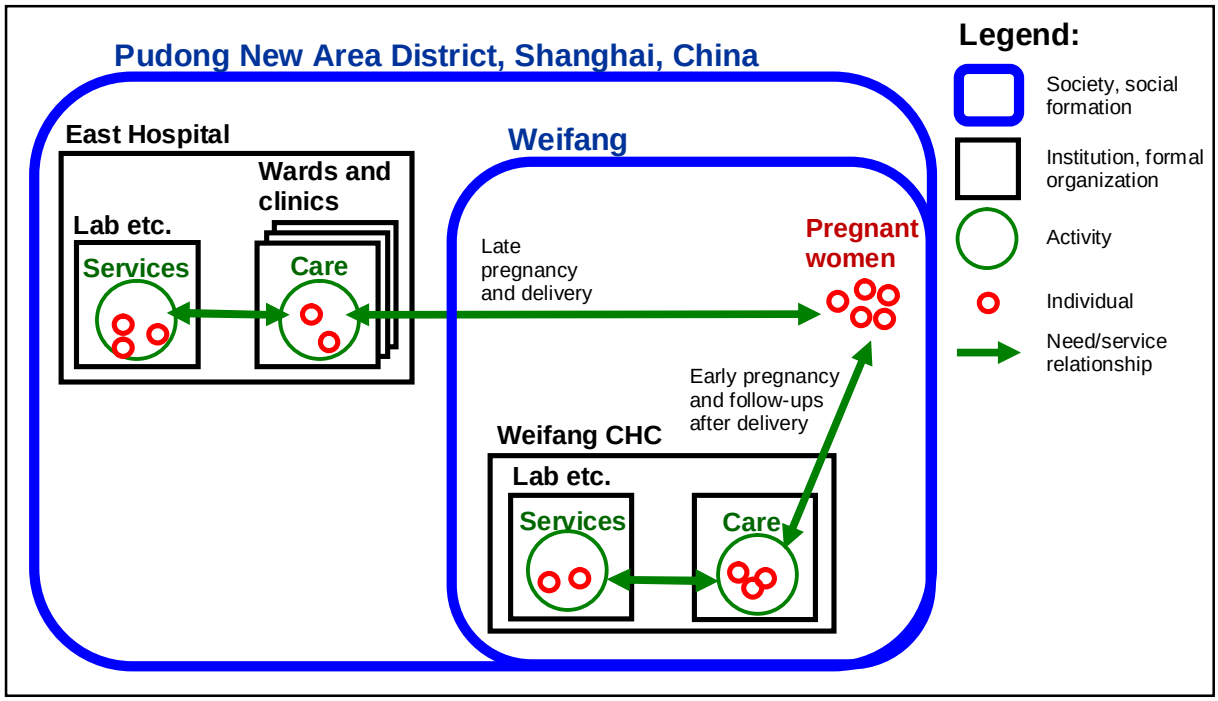

Figure 3: Pregnancy-related organizations, activities and services for inhabitants of Weifang area in China.

The main idea of how to identify the elements for this layer is to identify wherefrom can people get services for their needs, starting from the ultimate beneficiaries and moving upwards in value chains (or service chains). One should consider different groups of people who may be in a different position regarding their service needs and service affordances: urban vs. rural, employed vs. non-employed, etc. In the domain of healthcare, we suggest that one should consider different kinds of service providers like public vs. private, formal vs. informal, primary vs. referral, clinical (direct care) vs. auxiliary (pharmacy, laboratory, etc.).

Figure 3 illustrates the layer of organizations, activities/stakeholders and services in the case of maternity health care available to inhabitants of the Weifang area in Pudong New Area in

Shanghai, China. Citizens are free to choose any hospital at any level anywhere when they feel a need for health services. In the maternity case, women most often visit the Community Health Center (CHC; level 1 hospital) of their place of living during the first 16 weeks of pregnancy, and a higher level hospital after 16 weeks (e.g., the East Hospital shown in the picture). The delivery takes place in the maternity department of the higher level hospital. After child birth the health center takes care of follow-ups. So, in practice, there is a chain of healthcare services through different organizations. However, there are no referrals in use. The lack of a referral system in health care makes it difficult to transfer the information produced in one organization to the other organization in which it is needed.

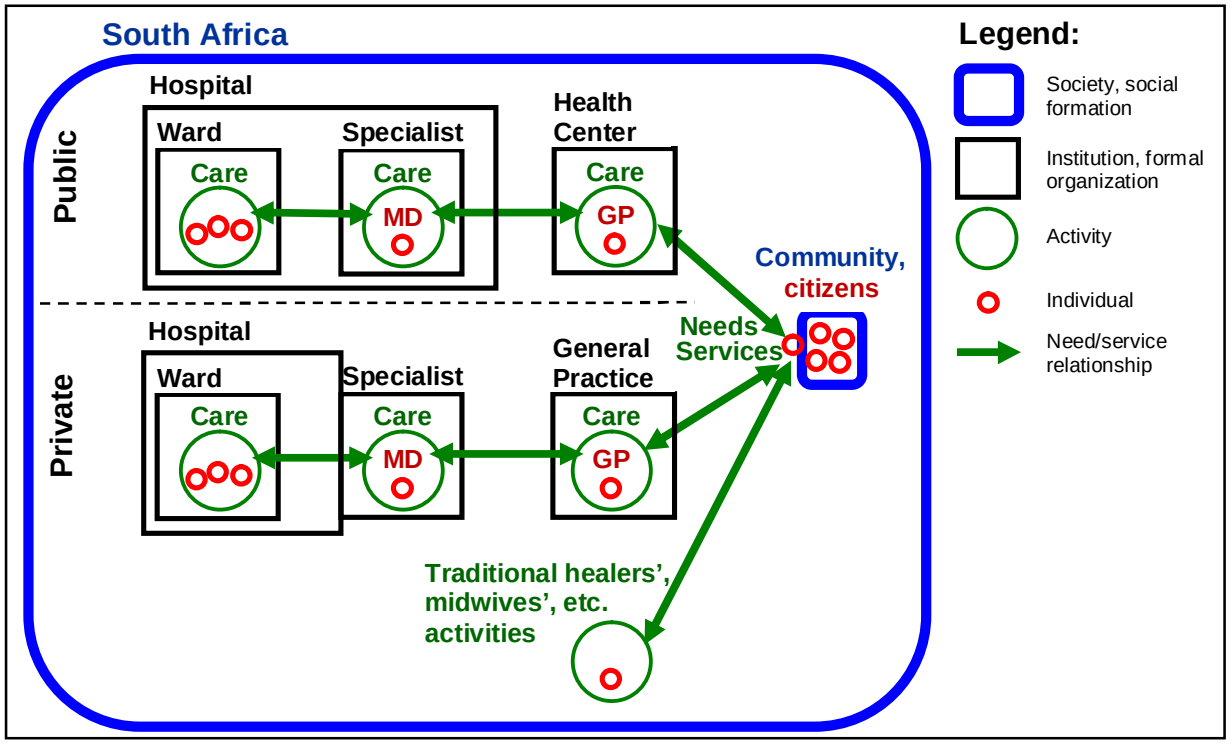

Figure 4: Organizations, activities and service relations in South African healthcare in broad terms.

Figure 4 illustrates the layer of organizations, activities/stakeholders and services in the case of healthcare in South Africa in a very general level, making the point that citizens within communities can get their services from the public, private and traditional sectors. In a bit more detailed level one could analyse which types of communities are served by which sector. The picture also identifies the two main levels of formal healthcare, i.e. the primary care level and the

specialist level. In the public sector the former is provided by health centres while in the private sector by individual general practitioners running licensed practices (which are therefore formal organizations). If the patients' needs cannot be addressed on the primary level, they are referred to the hospital level, where one needs to differentiate between the outpatient activities (appointments with specialist medical doctors) and the inpatient activities (hospitalization periods at wards). In the private sector, specialist consultants are not employed by the hospitals but running their individual businesses at the hospital infrastructure.

LAYER 2: FLOWS OF AUTHORITY

The second layer deals with structures of power. The main units of analysis are organizations and activities, with a new type of a relation between them (see legend in Figure 5):

- Relation of authority flowing from one organization or activity on another one or a range of other ones. Within each organization we have by definition always a management activity that has the authority over the substructures and activities within the scope of the organization (but beyond). This relation can be emphasized by enclosing the organizational substructures and activities within the box depicting the main organization. The flow of authority is depicted by a dual-line arrow with a sharp head, in black since it belongs mainly to the realm of formal institutions.

The main idea in identifying the elements and relations in this layer is to start from the first layer of organizations and activities and identify, who (which organization or activity) has power to guide, coordinate or command over the elements of the first layer. This should introduce additional organizations like political institutions and additional management activities within organizations. Again, only essential aspects should be included in the picture.

Figure 5 illustrates the layer of authority in the Chinese case. The healthcare authority on the national level is the Ministry of Health (MOH), on the municipal level the Shanghai Municipal Health Bureau (SMHB) and on the district level the Pudong Social Development Bureau (SDB). The SMHB is in charge of making health policy and regulations, unifying the guidelines and standards etc. for the whole Shanghai area. On the municipal and district levels, the healthcare administration is divided into *public health* and *hospital management*.

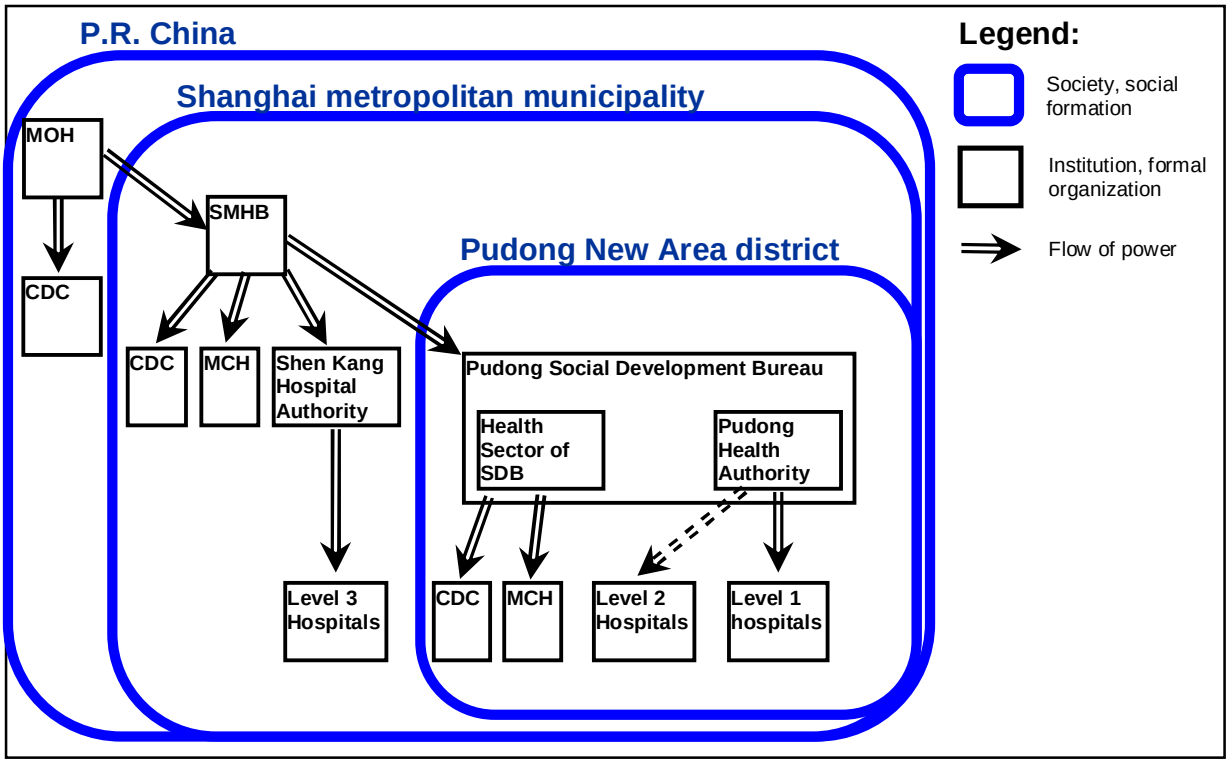

Figure 5: Structures of authority around healthcare in Pudong, China.

The public health organizations relevant to our case which are the Centers for Disease Control and Prevention (CDC) collecting public health data and the Maternity and Child Health Centers (MCH) collecting maternity and child health data, both on the municipal and the district levels.

Hospital management is in our case the responsibility of the Shen Kang Hospital Authority and the Pudong Health Authority. There are three levels of hospitals in China: community healthcare centers (CHC, level 1), general hospitals (level 2), and teaching and specialist hospitals (level 3). In Shanghai the third level hospitals are directly under the municipality and the Shen Kang Hospital Authority is in charge of the management of most of them. On the Pudong district level, the Pudong Health Authority is in charge of all the 29 community health centers, and might be managing all the general (second level) hospitals in Pudong in the next two years.

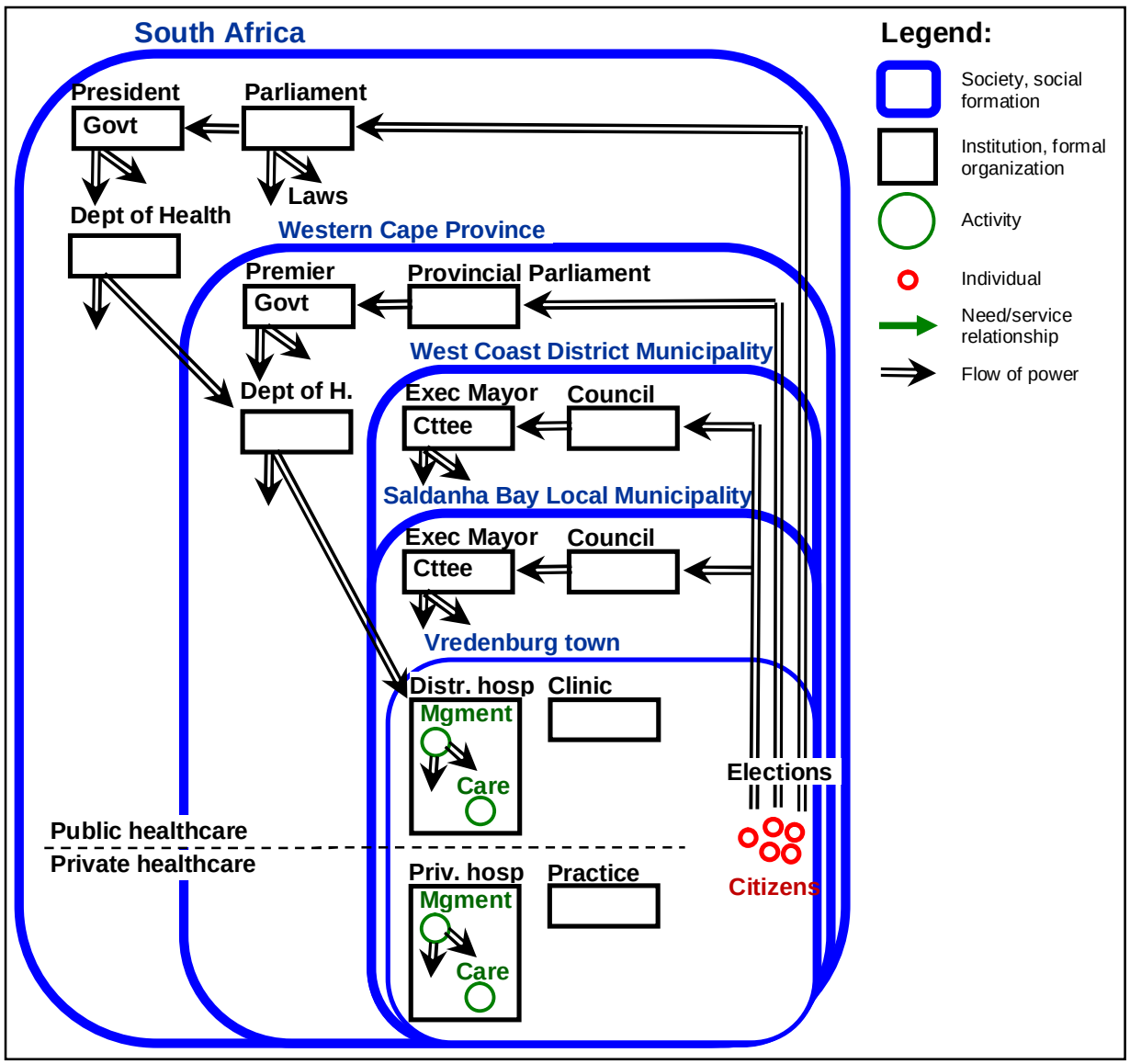

Figure 6: Structures of authority around healthcare in Vredenburg, South Africa.

Figure 6 presents the flows of authority around healthcare in the South African case. In this picture, the general political authorities are also included. Government in South Africa is divided into three spheres: Local, Provincial and National. Governments have a political and an administrative arm. The political arm creates the laws and policies. Citizens elect representatives to the national parliament, the provincial parliament and the local councils. (http://www.capegateway.gov.za/)

The administrative arm is the part of government that implements laws and provides services. It consists of all the Departments (e.g. Health). The public healthcare services are mainly provided by the provincial level of government. In our case there is a public hospital in Vredenburg town, which is owned by the Western Cape Department of Health. The district and local municipalities do not have specific health administration departments. The national Department of Health has direct administrative power on the entire public healthcare, and implements laws that govern the private healthcare sector as well. In our case in Vredenburg there is a private hospital and a number of private medical practices providing primary care service.

LAYER 3: FLOWS OF MONEY

The third layer deals with the material resources characterized by financial relations. The main units of analysis are organizations, with another new type of a relation between them (see legend in Figure 7):

- Flow of funding from one organization to another, or in some cases between individuals and organizations. Within an organization one can also analyse how the management activity distributes the financial resources among the spectrum of activities within its power. The flow of funding is depicted by an arrow with a blunt head, in orange-brown if colours can be used.

The main idea is to identify the types of flows of funding into and out from an organization. These can be between individuals and the organization (fee for service, out-of-pocket payments, taxation, etc.) or between organizations. Only essential flows of relative importance should be included, leaving the details to economists. In the domain of healthcare one should consider the healthcare provider organizations, government organizations, insurance organizations (social security and private ones), employer organizations (if they fund services for their employees), and donor organizations particularly in the South.

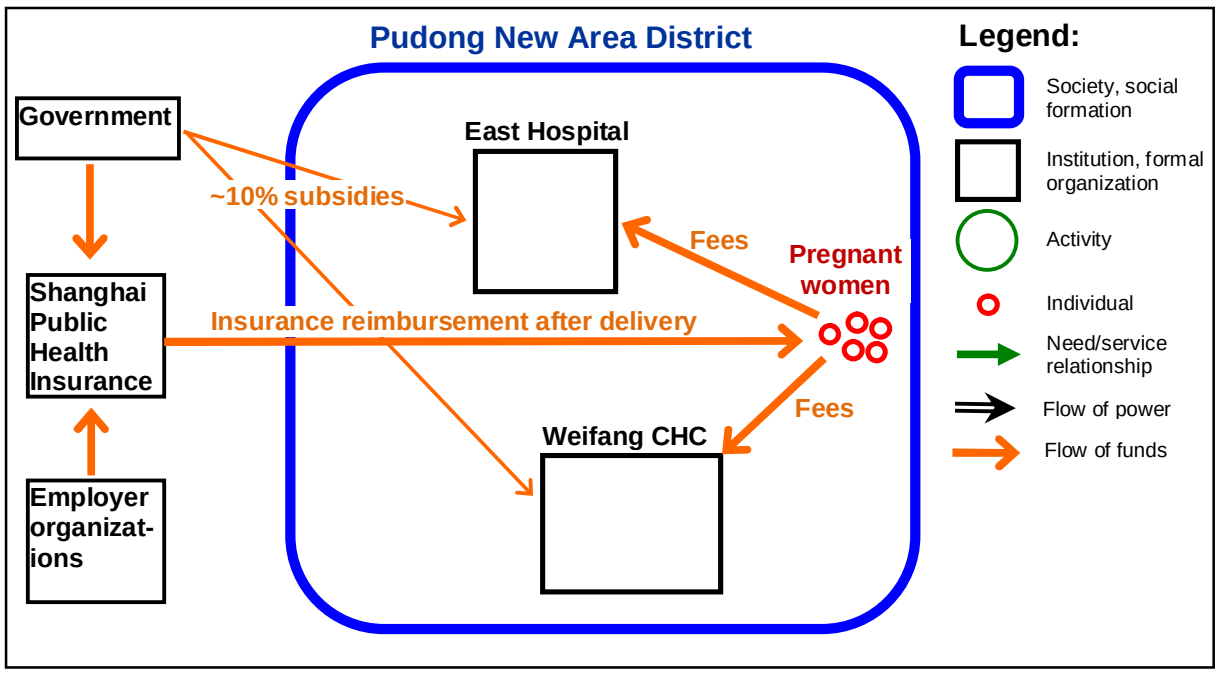

Figure 7: Flows of money around pregnancy-related services for inhabitants of Weifang area in China.

Figure 7 describes the main flows of money in the case of maternity care in Weifang. In China the bulk of funding to hospitals comes from citizens' out-of-pocket payments (fees for doctor's appointments, laboratory tests, drugs, etc). Only about 10% of the funding comes from the government, through the Public Health Insurance organization (which operates on the national and municipal levels; the national level is not shown in the picture). All levels of hospitals send summaries of payment information to the insurance offices, which in most cases return a small amount to the citizens. The maternity case is different, however, since there the amount of the returned money depends on the pregnant woman's salary. The salary information comes from the tax authority. During the maternity care pathway, pregnant women pay their healthcare services all along the pathway, and only after delivery they collect all the receipts of the payments and send all of them to the insurance organization at the same time. Insurance offices return a small amount of the hospital payments.

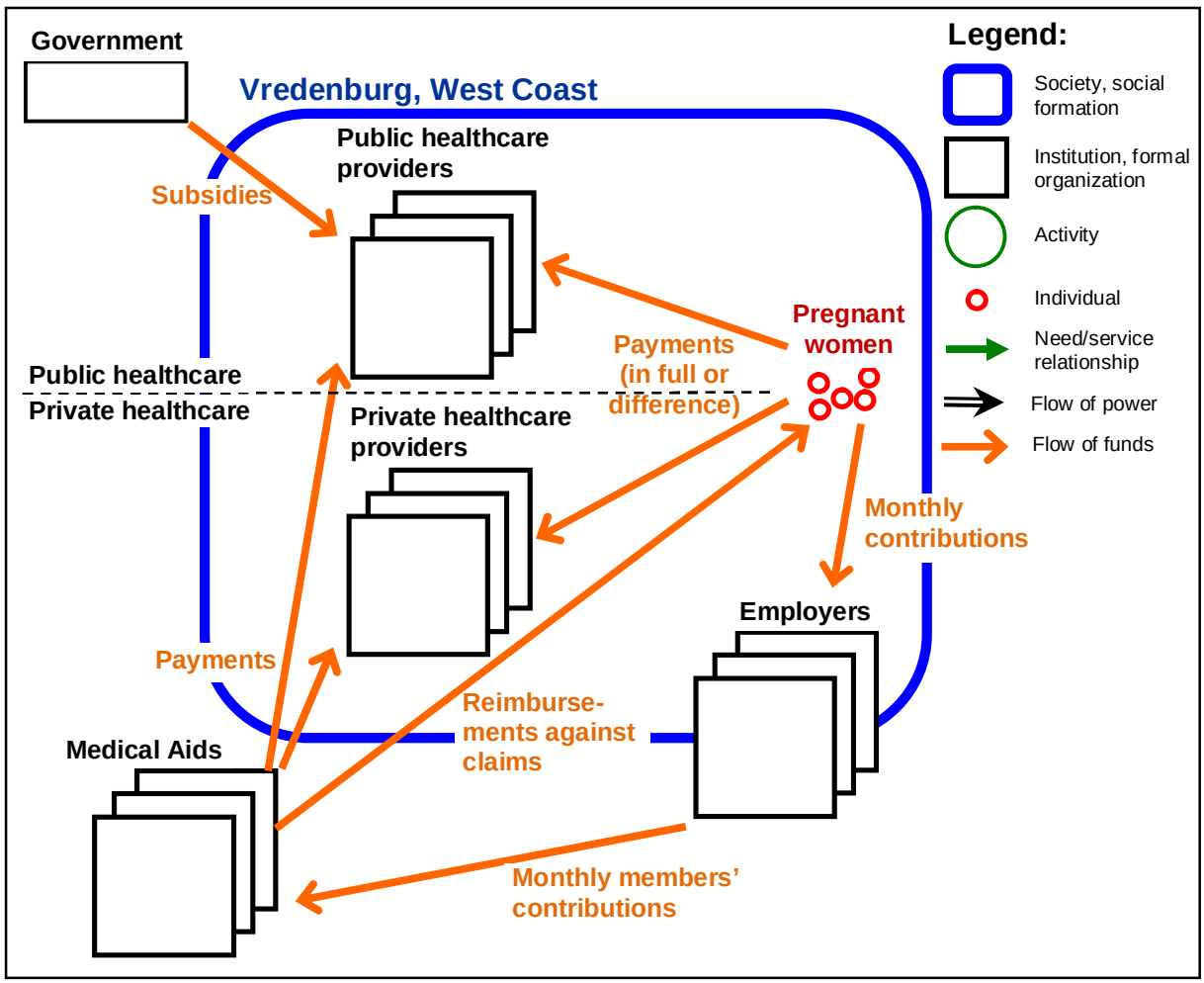

Figure 8: Flows of money around pregnancy-related services for inhabitants of Vredenburg in South Africa.

Figure 8 illustrates the financial layer in the Vredenburg case. In South Africa, all employees have to belong to a medical aid (non-profit medical insurance organization) and the employer organizations subsidize the members' contributions. Healthcare providers can provide a healthcare service at an approved rate in which case the medical aids will pay the full amount of the service. In those cases where healthcare providers charge more than the approved rate, the patient has to pay the difference. Some procedures and services will only be paid by the medical aid if prior authorization has been obtained. Once the member's fund is depleted for the year, the patient is liable for all the fees of the healthcare service. Some healthcare providers prefer an immediate cash payment after which the member can claim from the medical aid. With more restrictions and government control, most medical aids had to reduce their benefits and many

patients can no longer afford a medical aid with sufficient coverage and often opt for a hospital plan instead. Healthcare services at public healthcare facilities are provided at a cost that the patient can afford and are subsidized by the government. They are available to those people who are not employed and do not belong to a medical aid. Private patients belonging to a medical aid can in some cases obtain a healthcare service from a public healthcare facility too, in which case the same payment and claim procedures as for private healthcare providers apply.

The key role of medical aids in the private sector is apparent. The picture is an example of why the financial layer can be highly important for information systems research and design – when considering which stakeholders have the interest and capacity to implement life-long personal health records for continuity of care, it is apparent that the insurance organizations have that interest and capacity on behalf of their members. In the case of public national health insurance, the key actor is the public agency that runs that insurance, whereas in the case like South Africa one needs to search for possible joint forums of the medical aids as well. This aspect would not be seen from the first layer only.

LAYER 4: FLOWS OF INFORMATION

The final layer deals with the flows of information, which are certainly of ultimate interest to information systems researchers and developers. Now the main units of analysis are activities, with the last new type of a relation between them (see legend in Figure 9):

- Flow of information from one activity to another, or in some cases between individuals and activities. Although information is always produced, processed and utilized by activities, in a more general level of analysis one can depict it as taking place between entire organizations. The flow of information is depicted by a thin arrow with a triangular head, in blue if colours can be used. Since this layer is the main interest for us, a rich picture technique can be applied to identify the different means or carriers of information, e.g. symbols of paper forms, computer screens, telephones, meetings, etc.

When developing this layer, the main idea is of course to identify which information needs to flow along the flows of services, in both directions. One should also consider specific information management activities that are often related to the general management activities.

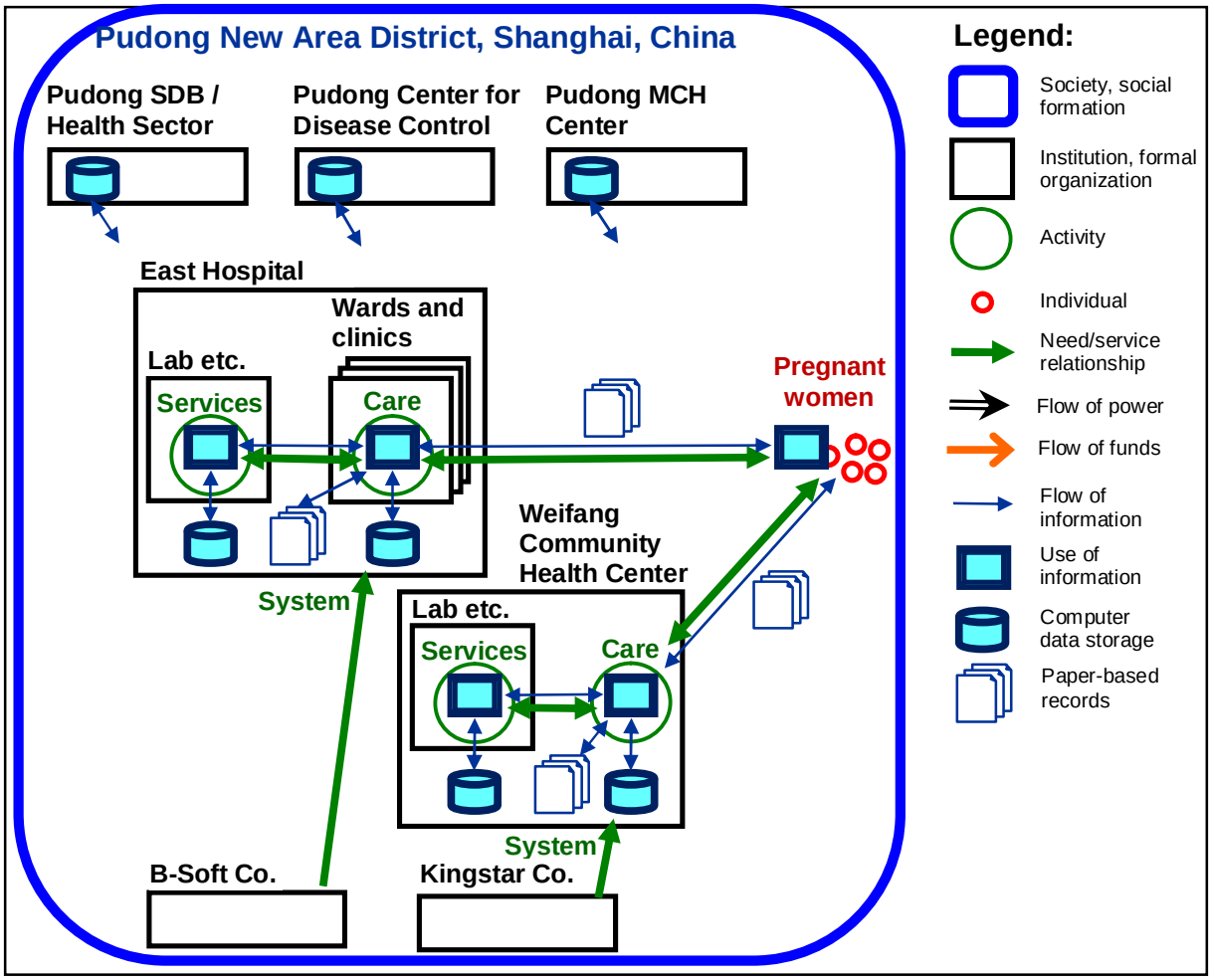

Figure 9: Flows of information around maternity care for inhabitants of Weifang, China.

Actually, all the previous types of flows (services, authority, funding) are related to respective flows of information. In the healthcare domain one should consider the different uses of information – for clinical purposes, for managing a healthcare provider facility, for public health administration. As information systems researchers and developers, we can then finally ask where can the processes or activities be better facilitated by software systems.

Figure 9 illustrates the fourth layer in the case of maternity healthcare provided by the Weifang community health centre and East Hospital in Pudong district in China. The main chain of services is shown, and the obvious flow of information that must follow the services. This very rough picture identifies two additional aspect of the information flow: where is information

needed (depicted by a computer screen, although the use of information can presently be based on paper) and where is information preserved (depicted by the database symbol, a barrel shape). For practical purposes the picture also identifies that the computer based systems storing information in the two main organizations under study are developed and maintained (need-service relation) by two different healthcare software companies, which may have implications for the information flow between the systems.

Clinical healthcare information is currently not shared between the different healthcare provider organizations; the clinical data is still isolated in each hospital. Within maternity care, the paper based Patient Card and Maternity Card are the most important tools for information sharing, because the pregnant woman brings them with herself to all the maternity care activities in different healthcare facilities. Most of the maternity related information is paper based, e.g. different maternity health and appointment records, which are kept in each hospital. Actually, as depicted in the picture by the absence of information arrows between the computer systems, there is no electronic transfer of information between the organizations.

Administrative information flows are depicted in the upper part of the picture. Health centers and hospitals send reports about patient volumes, numbers of laboratory tests taken etc. to the Health Sector of Pudong Social Development Bureau (for healthcare quality management and decision making), reports about diseases to the Pudong CDC (for public health purposes), and reports concerning maternity issues, e.g. the number of pregnant women and deliveries by community, to the Pudong Maternity and Child Healthcare Center. These district level organizations summarize the data and report further to the municipal level.

Figure 10 illustrates the main flows of information between the different healthcare facilities in Vredenburg as well as the flows of information for pregnant women who are referred to larger and more sophisticated hospitals in Cape Town and larger surrounding towns. The diagram at this stage only show the main flows and more research is required to depict these in more depth.

All the healthcare facilities use a combination of paper based patient folders and some form of electronic patient records. The electronic patient record systems were developed by different software developers and it is not clear at this stage to what extent these records are integrated and

standardized across applications in the same facility and between facilities. Although there are some computerized applications within the facilities, the flows between facilities are still mostly paper based in the form of referral letters to the next level of care; paper prescriptions to pharmacies; lab sheets to laboratories; reports to the referral facilities; and appointment cards to the pregnant woman.

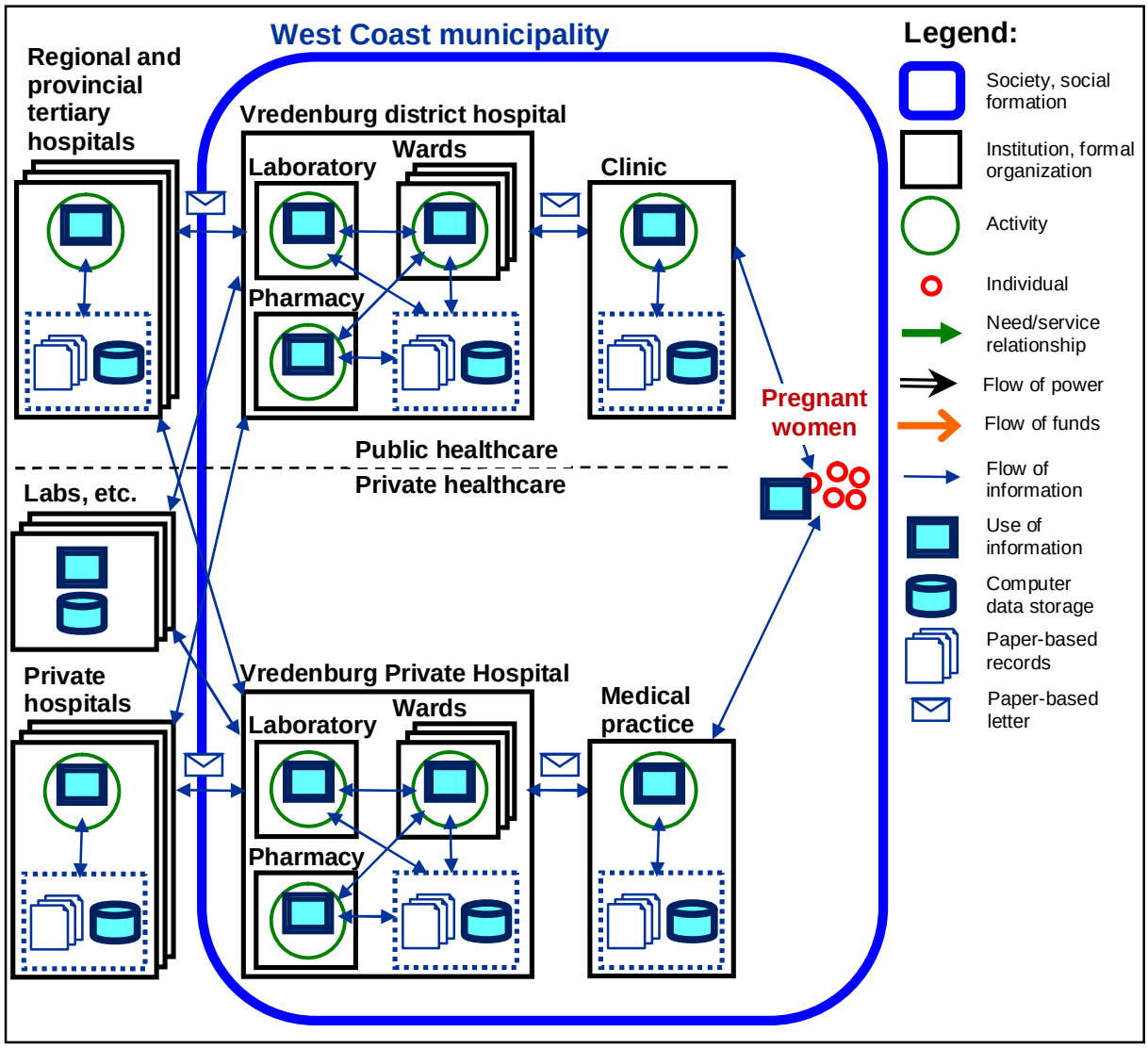

Figure 10: Flows of information around maternity care for inhabitants of Vredenburg, South Africa.

Pregnant women go the facility of their choice based on their ability to pay for the healthcare service. Healthcare facilities in the private sector mostly care for pregnant women belonging to a

medical aid or who can afford to pay from their pocket for the more expensive healthcare service of the private healthcare sector. Pregnant women who cannot afford a healthcare service go to the community health clinics as their first point of care. Although private clinics mostly refer pregnant women to the next level of healthcare service in the private sector, they can also refer to the public healthcare facilities. The same applies to pregnant women from the public healthcare sector. In extreme cases where pregnant women require highly specialized care, they may be referred to the tertiary teaching hospital which is in the public healthcare sector.

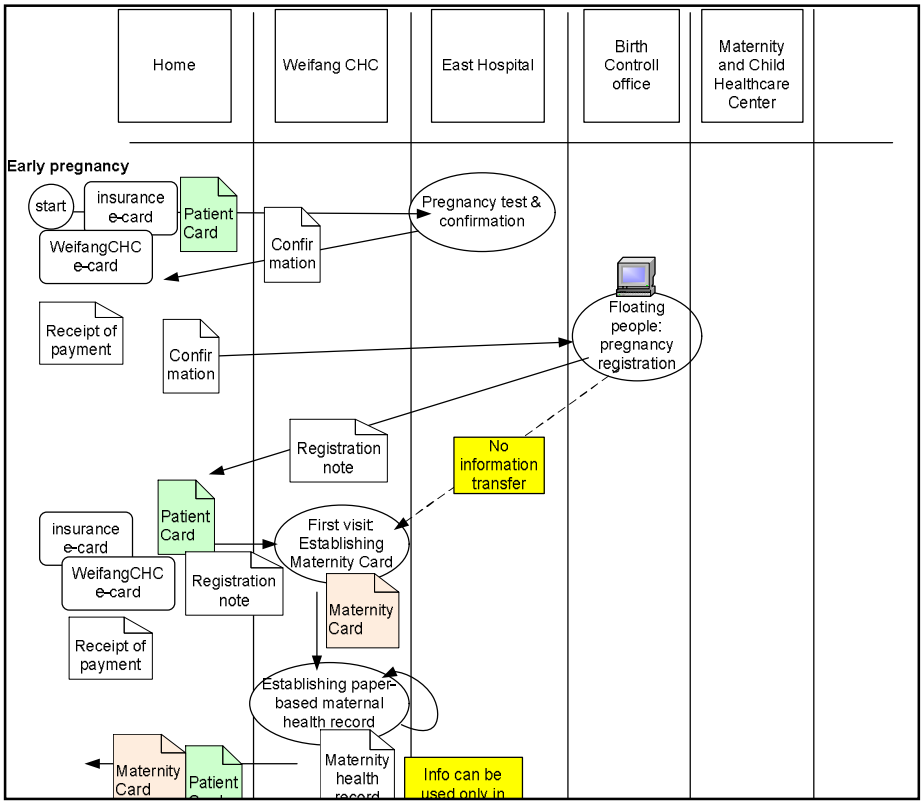

Figure 11: Zooming in to more detail in the Weifang maternity health case.

FROM LANDSCAPE TO DETAIL

As implied by the term itself, the landscape picture is to provide a broad overview around a case under study. For any practical purposes one then needs to dig deeper into the case itself by using methods and techniques other than those suggested in this paper. However, the concept of activity provides a theoretical and methodological bridge from the landscape level into depicting

the processes, actors/stakeholders and means/technologies with more detail, as illustrated in the "swimming lane" notation in Figure 11 (Luukkonen et al. 2008).

DISCUSSION

The methodology outlined above has been partially used in a number of bigger and smaller cases in Africa, China and Finland. However, there is as yet no experience in applying it systematically in a variety of situations. It is therefore provided as an open-ended suggestion for researchers to test in describing their landscapes, make modifications and report their experiences so that the methodology can be improved. Besides the main question – does it work? – we are particularly interested in learning if there are aspects in it that are too much (not essential, noise) or missing.

We suggested in the introduction that "landscaping" the context is particularly relevant in the South, the highlight differences from the context often seen as universal in theories and textbooks. It would, however, be very useful to see similar cases from different countries, North and South, been described in a way that makes comparisons possible.

We have mainly been developing the methodology in healthcare contexts, so its potential applicability to other domains remains to be studied. Our own future work focuses on 1) applying the methodology in comparisons between contexts, and 2) making the methodology, or parts thereof, so simple to use that it is practicable to graduate students and information systems practitioners without personal guidance by senior researchers.

CONCLUSION

In this position paper we suggested a methodology and notation for describing the broad essential aspects of a context, a landscape, around information flows. We propose that the landscape view is important for information systems researchers and developers in grasping a context or domain relatively new to them. A shared way of describing the landscape is exceptionally important when comparing between contexts, e.g. between healthcare delivery systems in different countries. We suggest that "landscaping" the context is particularly beneficial for researchers, educators and practitioners in the South.

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