



Seeking good governance in participatory-GIS: a review of processes and governance dimensions in applying GIS to participatory spatial planning

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Abstract

The adoption of participatory spatial planning (PSP) approaches has been partially supported by developments in participatory-GIS (P-GIS), as seen in applications both in local resource management in developing South countries, and in community neighbourhood planning in the urban North. Such applications provide a basis for examining the relationship between the use of geo-information and governance, as many P-GIS initiatives claim to foster accountability, transparency, legitimacy and other dimensions of governance. Examples from recent literature illustrate the strengths and weaknesses of utilising P-GIS, and in particular, the implications for greater participation, empowerment, and ownership of and access to spatial information, and for governance in general. Some new developments in GIS technology, like 'mobile-GIS', have the potential to strengthen these impacts. While P-GIS is not an essential component of PSP, if used with an adequate regard and sensitivity for issues of ownership, legitimacy and local knowledge, it can contribute to the empowerment of communities in solving spatial planning problems.

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1. Introduction

Over the past decade, 'local-level' and 'participatory-GIS' (P-GIS) have been applied to participatory spatial planning (PSP) mapping community space—whether urban neighbourhoods

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1 or ancestral domains, analysing and ameliorating land and resource conflicts, participatory land
 2 use planning, awareness-raising, and efforts to build people's empowerment.¹ The geo-
 3 information tools used in these applications include collaborative spatial data collection using
 4 RRA/PRA methods,² participatory maps, aerial photos and remote sensing images; and P-GIS
 5 analyses and representations.

6 There is an implicit, sometimes explicit, assumption that using GIS at this local level is both
 7 efficient and effective, in that it is believed to simultaneously deal with the planning content,
 8 answer the questions asked of the geo-information, and also address and satisfy the local
 9 stakeholders' underlying interests. P-GIS is expected to be implemented in a participative manner
 10 and make use of local information, within which indigenous spatial knowledge (ISK) is a special
 11 category. As such there is an often-made assumption that this use of GIS is a tool for better
 12 governance.

13 This paper raises questions for investigating the validity of these assumptions.

- 14 • Can the goals of good governance be met in such applications of GIS?—with the governance
 15 criteria of accountability, legitimacy, respect for rights, equity, and competence?

16 To answer this, needs supplementary questions:

- 17 • What degrees of 'participation' are found in participatory mapping (P-mapping) and P-GIS?
- 18 • What motivations lie behind the promotion of P-GIS?
- 19 • Is local knowledge/ISK applied to better governance?
- 20 • Who has access to ISK? Do access and use respect cultural rights and entitlements? Ultimately,
 21 who is the owner?
- 22 • Does ownership of the spatial information output (and input data) accord advantages to the
 23 owner, beyond the boundaries of good governance? What difference does GIT (GIS
 24 technology) make to the distribution of power?

25 The paper begins in Section 2 with an inventory of local-level GIS applications.³ Section 3
 26 discusses the criteria behind 'good governance' and some spatial aspects of governance measures.
 27 Section 4 looks at the difficulties faced by P-GIS in practice, including the character of indigenous
 28 and gendered spatial knowledge. Section 5 questions ownership and accessibility of this
 29 knowledge, particularly in the context of good governance. Section 6 considers strengths and
 30 weaknesses of P-GIS—operational issues and whether GIS can 'represent' ISK. Section 7 draws
 31 some conclusions about the potential and promise of new GIT for P-GIS, tempered by the

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 37 ¹ A major driver in recording and analysing urban/community PSP has been the Varenus initiative of the National
 38 Center for Geographic Information and Analysis (NCGIA). Varenus studies were concerned with issues in power,
 39 control, and access in geo-information, mainly in the USA, including the impacts of unequal access to GIS technology
 40 and data, the feasibility of representing a 'community knowledge base' within GIS, the potential distortion of local
 41 knowledge by the GI format, and ultimately whether P-GIS can actually lead to empowerment in decision-making (cf.
 42 <http://www.ncgia.ucsb.edu/varenus/ppgis/ncgia.html>; Weiner et al., 2002).

43 ² RRA refers to rapid rural appraisal, while PRA is participatory rural appraisal.

³ For reviews and references in P-GIS employment—for urban community planning and management, see Craig et al.
 (2002); and, for local-level rural development and NRM, see McCall (2002) and King (2002).

1 realities of power and other governance dimensions. The way in which P-GIS is actually used will
 2 always reflect the power situation.

5 2. Local and indigenous communities using local-level mapping and participatory-GIS

7 Beyond the indistinct ideals of P-GIS like empowerment and participation, there are particular
 8 purposes behind local-level geo-information acquisition, analysis, and representation. General
 9 categories⁴ are given below, together with typical references for urban examples.

11 In a representative, though probably incomplete survey, [Sawicki and Peterman \(2002, Chapter 2\)](#)
 12 identify 67 organisations (educational institutions, NGOs, government departments and
 13 private companies) in 40 cities in the USA claiming to have some form of PPGIS.⁵

15 In rural and natural resource management (NRM), P-GIS is applied frequently amongst
 16 indigenous peoples of Canada, USA, New Zealand, and Australia. A British Columbia survey
 17 showed 44% of 109 ‘First Nations’ currently using GIS, with another 36% interested, with the
 18 commonest applications being “Traditional Use Studies”, treaty processes, and NRM ([AMN, 2002a, b](#)).
 19 [Poole \(1995\)](#) found multiple examples of P-mapping or P-GIS outside these big four,
 20 only in Brazil, Philippines, Indonesia, Peru, Thailand, and Kenya, and 15 other countries. ESRI’s
 21 PPGIS websites ([ESRI, 1997](#)) list one application each from six Asian or African countries,
 22 compared with about 75 cases from North America.

23 2.1. *Claiming ‘our land’—demarcation of community and neighbourhood, or legal recognition of 24 customary land rights*

25 Demarcation of customary tenure and traditional use areas in the rural context are most
 26 notable in Canada and USA, with their ‘First Nations’ constitutional status. New Zealand,
 27 Australia, and increasingly, the Philippines also designate ancestral domain. Conventionally, GIS
 28 is deployed in formalisation and commodification of land and property rights, although there are
 29 likely serious negative implications in this for common property regimes and the people dependent
 30 on them. The mapping/GIS process needs to follow procedures known and acceptable to local
 31 communities and in accordance with traditional decision-making. Concomitantly, the spatial
 32 (map) products must satisfy the formal, legal land tenure requirements for accuracy, reliability,
 33 and legitimacy.

35 In the urban context, ‘claiming our land’ is unlikely to be in legal rights terms, but a socio-
 36 cultural, or psychological claim. Communities, or at least their concerned, motivated, and
 37 capacitated members, demarcate and define the boundaries and contents of the place that they live
 38 in (e.g. [Elwood, 2002, Chapter 6](#); [Craig & Elwood, 1998](#)). This ‘community/neighbourhood
 39 mapping’ may include ‘historical mapping’. The mapping processes may remain very conceptual
 40 and abstract as befits mapping people’s perceptions and feelings, but they can be more systematic,

41 ⁴Categories are based on [Weiner et al’s \(2002\)](#) overview of urban applications; and [Poole’s \(1995\)](#) seminal review of
 42 ISK mapping in rural and NRM mapping contexts.

43 ⁵The distinction between P-GIS as the tool, and PPGIS (public participation GIS), as the planning context, is not
 44 always straightforward. This paper uses both.

1 for instance by maintaining a public record GIS (e.g. [Casey & Pederson, 2000](#); [Craig, Harris, & Weiner, 2002](#)).

3 'Claiming the neighbourhood' is usually the precursor to participatory community planning
 5 (see Section 2.2).

7 *2.2. Management of traditionally held territory and land systems*

9 P-mapping and P-GIS have been applied to recording and analysing the whole gamut of
 11 indigenous NRM based on people's indigenous technical knowledge (ITK), from simply
 13 exploiting a resource or eco-unit, through maintaining a resource over time, to the complex level
 15 of managing the ecosystem nurturing the resource. [Poole \(1995\)](#) provides numerous local
 17 examples, whilst there are systematic approaches like 'Traditional Use Studies', and 'Bioregional
 19 Mapping' in Canada (e.g. [Aberley, 1993](#)), and 'Land Literacy' (environmental appraisal) in
 21 Kerala (e.g. [Chattopadhyay et al., 1996](#)). Mapping local knowledge of hazards is a particular
 23 focus (e.g. [Drew, 2002](#); [Bitter & Mathias, 1998](#)).

17 The local, participatory management of urban neighbourhoods usually follows on from
 19 'claiming the territory', and has to be made compatible with national or local authority
 21 regulations on administering, managing and planning urban territory. PPGIS applied to
 23 participatory Community/Neighbourhood Planning has been examined by, among many others,
 25 [Howard \(1999\)](#), [Carver, Evans, Kingston, and Turton \(1999\)](#), [Leitner, McMaster, Elwood, McMaster, and Sheppard \(2002, Chapter 3\)](#), and [Talen \(1999\)](#). Specific attention has been given
 27 to applications such as housing issues (e.g. [Elwood, 2002, Chapter 6](#)) or neighbourhood
 29 revitalisation (e.g. [Craig & Elwood, 1998](#)). Spatial databases along with the P-mapping are used to
 31 maintain a public records GIS or community land information systems (e.g. [Ventura, Niemann, Sutphin, & Chenoweth, 2002, Chapter 9](#)).

27 Participatory decision-making in neighbourhood management supposedly is furthered by
 29 interactive, real-time, web-based participation in approaches such as the 'electronic town hall' (see
 31 Section 2.5).

31 *2.3. Managing competition and conflicts*

33 In employing P-GIS in handling spatial competition and conflicts, the map outputs from
 35 territorial claims and local-level management are applied in spatial conflict analysis and
 37 management. The outputs are applied to delineating boundaries (not necessarily *clean lines*)
 39 between competing groups, or, initiating negotiation efforts between competing groups though
 41 mutually acceptable 'mapping' of actual or dormant spatial conflicts (competition) over resources,
 43 or, reducing conflicts by mediation or negotiation by using GIS, ultimately a real-time, interactive
 P-GIS.

41 P-GIS contributions to participatory, community conflict management are found in, for
 43 example, location choice for a utility transmission line ([Towers, 1997](#)); spatial housing choice
 ([Elwood, 2002, Chapter 6](#)); assessing impacts of traffic flows and accessibility ([Schulte, 1999](#)); and
 environmental mapping of hazardous areas and hazardous materials ([Drew, 2002](#)).

1 2.4. *Mapping equity and inequalities*

3 P-GIS has demonstrated strong potential as a tool for analysing and mapping indicators of
 4 ‘poverty’, ‘exclusion’, or ‘discrimination’ within rural and urban communities. The disadvantaged
 5 groups of society can be mapped as distinct spatial sites, or as zones of deficiency.

6 Applications from PPGIS practice and research include: mapping “environmental racism”, i.e.
 7 the spatial correlation between environmental degradation and the distribution of ethnic or socio-
 8 economic groups in urban areas (e.g. [Aitken, 2002, Chapter 27](#); [Kellogg, 1999](#)); social equity
 9 mapping, i.e. the identification of socio-economic groups that are relatively disadvantaged by
 10 economic class, employment status, ethnicity, language, caste, gender, age, or, by location;
 11 analysing differential mobility and people’s access to services according to social categories; a
 12 significant component of this item is the gendered differences in mobility and access (e.g. [Hall,](#)
 13 [1997](#); [Kwan, 2000](#)); empowering marginalised groups through supplying them with appropriate
 14 geo-information (e.g. [Sawicki & Burke, 2002, Chapter 7](#); [Poole, 1995](#)); and utilising GIS to
 15 promote transparency in decision-making (e.g. [Drew, 2002](#)).

16 Mapping social equity status frequently does not end simply with participatory maps, but
 17 applying them in development action plans (e.g. [Carver et al., 1999](#); [Talen, 1999](#); [Howard, 1999](#)).
 18 An innovative example in PSP was in Kerala, where Panchayat groups evaluated human and
 19 natural resources and thus, local development potentials ([Chattopadhyay et al., 1996](#)).

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23

24 2.5. *‘Building community’—promoting community awareness, institutional strengthening;* 25 *empowerment*

26 P-GIS is applied to developing community awareness of local situations, and to strengthening
 27 community institutions as an element in promoting people’s empowerment. In specific cases, it is
 28 often difficult to distinguish between these, the ‘empowerment’ is usually though not always the
 29 ultimate intention behind the awareness-raising or institution-building.

30 As with other P-GIS applications, there are more cases in rural development, than in urban
 31 situations. There are numerous examples of eliciting, structuring and guarding ITK and ISK in
 32 local NRM (e.g. [Poole, 1995](#)); a component of which is P-mapping of cultural–social spatial
 33 resources of indigenous peoples, such as sacred lands, burial grounds, and ancestral tenure (e.g.
 34 [Harmsworth, 1997](#)).

35 In the urban field, public GIS is maintained to build community feeling (e.g. [Casey & Pederson,](#)
 36 [2000](#); [Craig et al., 2002](#)); to promote transparency in decision-making (e.g. [Drew, 2002](#)); or to
 37 empower marginalised groups ([Sawicki & Burke, 2002, Chapter 7](#)).

38 Web-based, interactive, ‘electronic town hall’ developments towards “digital democracy” are
 39 reviewed by [Kingston \(2002, Chapter 8\)](#) for the UK, and [Ventura et al. \(2002, Chapter 9\)](#) for
 40 USA. A well-developed case is “Virtual Slaithwaite” from PFR⁶ ([Kingston, Carver, Evans, &](#)
 41 [Turton, 2000](#); [Carver et al., 1999](#); [Carver, 2001](#)).

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⁶ ‘Planning for Real’[®] exercise in Slaithwaite village, West Yorkshire.

1 2.5.1. Geo-information tools used

2 Geo-information acquisition and analysis tools used in PSP and P-GIS range from traditional
3 mapping tools of participatory sketch maps and ephemeral maps in an RRA or PRA setting, to 3-
4 dimensional (3-D) models⁷ and air photo interpretation (small-format oblique or vertical), to
5 satellite images and GIS.

6 The analytical tools applied are mainly from participatory, interactive, communication and
7 decision tools in collaborative planning—public meetings, Delphi models, gaming simulations, or
8 scenario assessment. They are, however, increasingly being used in distance-settings via email and
9 internet.

10 Representations are made from the maps, images, 3-D models and GIS outputs working with
11 new visualisation software. A focused tool which should be employed in PSP is ‘countermaps’—
12 maps explicitly displaying the needs and requirements of groups who are usually excluded from
13 scientific surveys because they are socially and institutionally marginalised. [Rocheleau, Thomas-
14 Slayter, and Edmunds \(1995\)](#), for example, contrasted gendered countermaps of resource
15 management constructed by and with rural women, with ‘conventional’ planners’ maps made by
16 men.

17 The modalities for delivery of P-GIS to relevant urban public stakeholders have been classified
18 by [Leitner et al. \(2002, Chapter 3\)](#) as community-based in-house GIS or NGO-based GIS centres;
19 university/research institute–community partnerships; publicly accessible GIS in institutions; map
20 rooms; and web-based internet map servers. Usually projects and communities use a mix of these.

21 In rural and NRM P-GIS applications, the linkages are primarily through citizens’ groups,
22 traditional leadership or customary law authorities, NGOs, and CBOs (community-based
23 organisations), with limited input as yet from institutions and professionals (e.g. [Poole, 1995](#);
24 [Gonzalez, 2000](#); [Rambaldi & Callosa-Tarr, 2000](#)).

25

27 3. “Good GIS for good governance”—dimensions and criteria of good governance

29 Good governance is not just about *accountability* although accountability provides the general
30 context.⁸ Accountability can be expressed in terms of the transparency and visibility of
31 government decisions and policies, accountability mechanisms, and responsiveness to lower
32 levels—community involvement being a means to generate accountability.

33 *Accountability* (open government) is not the end in itself, it is a means of supporting higher-level
34 social–political goals of:

35

- 36 • Legitimacy, Participation;
- 37 • Respect for Rights, Empowerment;

39 ⁷The popularity of 3-D physical hardware models raises questions as to whether it is the tactile manipulability of the
40 device that has a special depth of meaning? e.g. the participatory 3-D models (P3-DM) of [Rambaldi and Callosa-Tarr
41 \(2000\)](#), or the PFR which used a 1:1000 3-D scale model of Slaithwaite.

42 ⁸Governance dimensions are developed from among others, [Goetz and Gaventa \(2001\)](#), [van Kersbergen and van
43 Waarden \(2001\)](#), [Riggs \(2000\)](#), and [UNDP \(1997\)](#) which defines about 15 core characteristics of good governance,
including: participation; rule of law; transparency; equity; effectiveness and efficiency; accountability; strategic vision;
legitimacy; ecological soundness; empowering; partnership; and, spatially grounded in communities.

- 1 ● Equity (not simply, equality); and
 2 ● Competence (including efficiency).

3

3.1. *Legitimacy (of the governing over the governed)*

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6 Do GI (geo-information) tools support or detract from good governance in PSP, in terms of the
 7 representativeness of regional, ethnic, class, religious, age, or gender interests of the ‘governed’?
 8 ‘Ownership’ by the governed, and ‘participation’ of the governed, are central elements of
 9 legitimacy in governance terms. Ownership as a totality implies owning the key sources of
 10 information, plus the processes of making the product, plus the final products. Allocating
 11 ownership is an element of building trust between governed and governing. A symbolic, but
 12 practical crux of ‘ownership’ is in the choice of the ‘map legend’.⁹ Even then, there are the
 13 questions of ‘*who* provides alternative names of legend items?’, and ‘what questions are asked to
 14 initiate the naming?’. Maybe not just the legend, but the whole ‘map’, has to be liberated.
 15 Empowerment is provoked by transferring legend and output ownership from the powerful to the
 16 disadvantaged with countermaps that challenge the (spatial) views of the powerful.

17 If the GI tools and approach build communicability between outsiders and insiders, this can
 18 legitimise the value of endogenous knowledge (ISK) and language, and make the tools more
 19 acceptable to local users.

20 Legitimacy demands *active participation* at all stages of PSP, and therefore, at all stages of the
 21 mapping processes, by ‘*all stakeholders*’, implying government agencies and the private business
 22 sector, as well as civil society (community representatives, traditional leaders, NGOs and CBOs.)
 23 *Partnership* is a characteristic of good governance (UNDP, 1997).

25 3.2. *Respect (by the governing for the governed)*

26 Do GI tools support or detract from good governance in respecting basic human rights, civil
 27 liberties, women’s rights, workers’ rights, cultural and regional rights; indigenous (technical)
 28 knowledge; laws and property rights, and not least, people’s rights to livelihoods? Among the first
 29 clients for improved spatial information are the tax collectors and police.

30 PSP using GI tools respects people’s rights by demonstrating that it has the ability:

- 33 ● To elicit and handle *local perceptions and conceptualisations of space and spatial values*:
 34 This would involve capturing and translating spatial concepts (‘mental maps’) of boundaries,
 35 locations, zones into mappable outputs; building GIS into local knowledge process; and
 36 considering future times and future generations by providing a strategic vision;
 37 ● To handle *ITK and ISK*:
 38 This implies promoting respect for ITK/ISK; presenting spatial output (maps and GIS) in
 39 such a manner that local people can recognise and interpret all relevant features; and taking
 40 into account the heterogeneity of local populations and the diversity of their knowledge.
 41 ● To operate at an appropriate resolution of output:

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⁹ Point stressed by G. Rambaldi (May 2002, pers. comm.).

1 This implies a scale “relevant to the local space” for local-level manipulation, therefore at a
 2 large scale, 1:5000–1:50,000. There seems to be a window of ‘natural’ scale appealing to users,
 3 which meets competing desires for coverage, comprehensiveness, and inclusion on the one hand,
 4 and on the other hand, information digestion, not information overload, simplicity, and
 5 comprehension.

7 3.3. *Empowerment*

9 The technology should be giving voice to local people, to the extent of putting local people on a
 10 more equal footing with external experts and decision-makers, such as claimed for P-GIS used in
 11 land reform in South Africa. A GI tool is more empowering when it has the asset of being
 12 convincing to external decision-makers, which strengthens the validity of the tool per se and its
 13 outputs, across both the governing and the governed groups. Furthermore, an effective
 14 visualisation of the outputs renders them more ‘attractive’ for insiders and outsiders and raises
 15 the transparency of the tool.

16 GIT can open the horizons of local users. Some argue that this enlargement of perspective is an
 17 aspect of ‘modernisation’ with negative consequences for the community, though others credit it
 18 for mainstreaming and empowering local peoples. Nevertheless, a ‘respectful’ GI tool would not
 19 unrealistically raise empowerment expectations of local communities—the ‘governed’—by
 20 proffering a pretentious technology that promises more than it can deliver.

21 3.4. *Equity, between governing and governed, and within the governed*

22 Do GI tools support, or detract from, equity goals of good governance in terms of the
 23 distribution of, access to, and take-up rates of public and private services for disadvantaged
 24 groups, or in terms of access to markets, laws, and property rights? Do GI tools support spatial
 25 equity by strengthening objectives of devolution or decentralisation, and following the
 26 subsidiarity principle? Do the GI tools reflect the reality of local-level PSP as ‘multi-actor,
 27 multi-objective, multi-sector, multi-scale, dynamic planning and decision situations’ dealing with
 28 competition and conflicts?

29 In resource-poor and low budget areas, planning and management are likely to be problem-
 30 driven and re-active, rather than pro-active. In these same conditions, there is an absolute scarcity
 31 of resources to be shared and overall poverty is the norm. In such cases, investing time and effort
 32 in P-mapping and GIS are probably luxuries beyond sensible behaviour.

33 Can the GI tool *map* equity? In Kiepersol, South Africa, the work of Harris and Weiner on
 34 ‘regional political ecology’ aims at representing local conceptualisations of environmental and
 35 health risks and spatial inequalities, especially post-apartheid access to land with ‘integrated’
 36 equity mapping (Harris, Weiner, Warner, & Levin, 1995, Chapter 9; Weiner & Harris, 2002).
 37 Similar equity objectives lay behind the ‘mapping for local development’ programme in Kerala’s
 38 socialist rural community planning (Chattopadhyay et al., 1996).

39 An important equity consideration in assessing GIS approaches for PSP is their practical
 40 *manageability at local level by local people*. This also covers the ‘sustainability’ of the tools and
 41 approaches, i.e. whether they continue to function after such a GIT project terminates.
 42 ‘Manageability’ covers a range of factors:

- 1 ● Feasibility—whether the tool is adapted to local operating conditions, including cultural and social, as well as technical and climatic;
- 3 ● Appropriateness of the spatial scale of input data and outputs for the local users;
- 5 ● Breadth of (community) participation in the enterprise, not just using “key informants” who are likely to be educated, adult, senior, Anglophone, males;
- 7 ● Comprehensibility and simplicity of use by participants; literacy, numeracy and computer-literacy requirements;
- 9 ● Cost effectiveness;
- 11 ● Maintenance of the currency of the data—updating information sets is costly, time consuming and liable to be overlooked in the enthusiasm of applying new tools; and
- 13 ● Ability of civil society to use GI tools for scenario building to visualise their alternative futures.

13 3.5. *Competence—efficiency and effectiveness*

15 Do the GI tools support or detract from the ‘competence’ dimension of good governance? This can be simply re-interpreted as the questions:

- 17 ● Are the tools efficient, and effective, for the delivery of services?
- 19 ● Do they add to administrative competence?
- 21 ● Can they effectively translate between indigenous and scientific spatial knowledge?
- 23 ● Do the tools understand and somehow handle ‘imperfect data’?—or, are they befuddled when coping with imprecision, incompleteness, fuzziness, and ambiguity?
- 25 ● Can the tools handle dynamic and flow data?
- 27 ● Can the tools handle knowledge about power relations?

27 4. Where is ‘participation’ in participatory-GIS? How does participatory spatial planning relate to governance and to indigenous spatial knowledge?

29 Participation in spatial planning is clearly related to legitimacy as a governance criterion, but a strong participatory approach also supports other governance imperatives of equity and respect for people’s rights.

33 4.1. *Intensities and purposes of ‘participation’*

35 ‘Participation’ means different things to different people; one reason is that many analysts confuse the *intensities*, with the *purposes*, of participation. Four intensities of PSP, from the least to the most ‘participatory’ level of the ladder, are recognisable:¹⁰

- 39 ● PSP as ‘Information Sharing’ implies one- or two-way communication between ‘outsiders’ and local people, and is primarily technical information, such as needs assessment. The topics and most information-gathering techniques are set by the outside agencies.

43 ¹⁰*Sharing of Benefits*—receiving goods and services or even political clout is sometimes considered a form of participation, but that is ‘recipient participation’, conceptually different from involvement in ‘doing’.

- 1 ● In PSP as ‘Consultation’, external agents refer certain issues to local stakeholders for
refinement or prioritising, but it is the outsiders who pre-define the salient problems, and
3 analysis is controlled by outside.
- 5 ● If all local and external actors are involved in ‘Decision-making’, they jointly identify priorities,
analyse current status, assess alternatives, and implement. ‘Participation is seen as a right, not
just as the means to achieve project goals’.
- 7 ● PSP as ‘Initiating Actions’ means that independent initiatives are made and ‘owned’ by
empowered local people, e.g. people self-mobilise to perform community activities; a different
9 situation from simply implementation with their own labour inputs.

11

13 There are critical differences in the underlying *purposes* or *intentions* of the parties (external or
internal) which are ‘pushing’ PSP as a strategy and/or promoting P-GIS (McCall, 1988):

- 15 ● *Facilitation*—‘PSP is promoted’ in order to ease outside interventions and interests to improve
external project efficiency, or to pass a share of the cost burden onto the “beneficiaries”.
- 17 ● *Mediation*—PSP is promoted to link (mediate) outside demands and local people’s priorities in
order to increase programme effectiveness, to build up local community capacity, or to modify
19 outside interventions towards local aspirations and needs.
- 21 ● *Empowerment*—PSP is promoted to reinforce local decision-making and responsibilities
towards community empowerment, to support equitable social redistribution, and to empower
23 weak groups in resource access and control.

25 There are significant obstacles to putting the ‘empowerment’ intention into practice. Frequently
there is high-level external political resistance to ‘allowing’ local empowerment or devolution,
27 local elites do not give up their power easily, and there are degrees of apathy or fatalism among
the community based on their historical experiences (cf. Carver, 2001).

31 4.2. *Communities are not homogeneous*

33 There are critical divisions in communities related to gender, age, economic class, socio-cultural
status, tribe and caste, life-style, etc., which lead to an extensive range of needs, opinions, and
35 interests between types of actors. Highly significant is the unequal distribution of access to power
for the ultra-poor, elderly, children, handicapped, inarticulate, minorities—e.g. ethnic groups,
37 castes, nomads. Women especially are frequently excluded from structural decision-making.

Therefore, the essential questions to ask of the degree of ‘participation’ in PSP or P-GIS are:

39

- 41 ● *Who* is participating? Who handles data and decisions? Who controls the process? Who uses the
outputs?
- 43 ● Who has accessibility to GIS tools and techniques? Is there ‘open access to the device’? Who
has accessibility to the outputs?
- How do the GI tools behave in terms of the *intensities*, and the *purposes*, of ‘participation’?

1 4.3. Cost efficiency in participatory approaches

3 The properties of information supply important to a decision-maker include speed and
 5 simplicity. Participatory approaches are seriously time consuming and often costly, all
 7 participatory data collection methods have a huge appetite for time and patience, and, solutions
 9 (*any* solution) are needed too urgently.

11 Eliciting local (confidential) knowledge from key informants means firstly, trust, built on
 13 lengthy discussions. For this reason, the typical senior decision-maker will acquire information
 15 from the ‘embodied knowledge’ of known and trusted subordinates, rather than from an
 17 impersonal, passive database. Of course such information is biased, but the decision-maker can
 19 adjust more easily for that than for the built-in biases of a geo-database. The underlying
 21 governance issues here are respect for citizens, and legitimacy.

23 When GIT is involved, the output may be fast, but the inputs certainly are not. Acquiring,
 25 checking, and inputting the spatial data in the GIS process is very time consuming, and commonly
 27 diverts time away from field activities, defeating the original purpose of the project. Similarly, a
 ‘limiting factor’ in a PSP process is simply the “restricted time” of the key informants. From a
 good governance position therefore, competence and efficiency are compromised.

29 The technology of *On-line Participation* extends the scope for decision-making and policy
 31 support. Although it is not yet widespread even in North countries, it is being developed for
 33 example in Bengal and Karnataka in India, and in Brazil (Goetz & Gaventa, 2001).

35 Some strengths of on-line participation are that spatial accessibility and geographical location
 37 are not constraints, there is universal access via the internet, and with 24/7 there are no time
 39 barriers. Anonymity can cut down cultural and psychological barriers of gender, status, ethnicity,
 41 age, and shyness (cf. Carver, 2001). The weaknesses however must also be clearly recognised.
 43 There is access *only* where people can use internet, and because, as recognised in diffusion-of-
 innovation research, this is not face-to-face, it is likely to lead to ‘awareness’ rather than
 ‘conviction’.

29 4.4. Indigenous knowledge and scientific knowledge

31 Participatory approaches to planning must involve the elicitation and application of ITK. ITK
 33 is embodied knowledge to be seen as a local resource that belongs to rural and urban people both
 35 as individuals and communities. It should not be denigrated only as primitive, unassimilated, and
 37 outside of the market. ITK is a key to PSP (McCall, 1988, 1995), because it may be the only
 39 resource that the poorest groups control whilst their land, property, resources, or labour are
 41 rapidly appropriated; it is a resource needing little investment for realisation; it reflects the
 43 capability and competence of the local community and can put them on an equivalent footing
 with outsiders; and, because local knowledge is operational.

One definition, of many, can summarise I(T)K and the significance for ISK and GI
 applications: “IK is the information base for a society, which facilitates communication and
 decision-making. Indigenous information systems are dynamic, and are continually influenced by
 internal creativity and experimentation as well as by contact with external systems” (Flavier et al.,
 1995, p. 479).

Local ITK may be distinguished from scientific knowledge because:

- 1 ● its derivation from close and long relationships between people and a specific land area give
- ITK its ‘localness’, or local focus;
- 3 ● ownership by the local community integrates ITK with social priorities, even though ownership
- is not homogeneous; and
- 5 ● classifications in ITK are likely to be based on the functionality of the objects, and/or the
- purposiveness of the actors; due to this, ITK depends more on holistic, combinatorial
- 7 explanations than on reductionism.

9 Nevertheless, local ITK has more elements that it holds in common with scientific knowledge:

- 11 ● Dynamism—the interest and ability to incorporate new knowledge from other (outside)
- sources, notwithstanding they may contradict held beliefs;
- 13 ● Taxonomies as the building blocks of explanations;
- Identification of specific conditions under which general ‘laws’ will hold; and
- 15 ● Knowledge is unevenly distributed within a community of experts.

17 4.5. *Indigenous spatial knowledge*

19 Much of ITK has spatial connotations. Consider for instance the locations of indigenous
 21 resources and local resource management activities, environmental hazards, ecosystems relation-
 ships, spatial correlations between local groups and resource units. This type of local knowledge
 23 can be termed ISK. ISK “describes home and action space, is innate and sustained knowledge
 about the land, identifies issues of immediate significance, and encodes the information about the
 environment in a language a regions’ inhabitants understand” (Duerden & Kuhn, 1996).

25 But beyond these easily identifiable, material items within ISK, there is a more slippery concept
 of spiritual or mystical knowledge associated with space, and particularly with specific areas of
 27 land (or certain land resources).

There are propositions about basic spatial cognition, or “naïve geography”,¹¹ that may be valid
 29 as generalisations about ISK, and therefore relevant to applying GIT. These propositions include:

- 31 ● Real space is “tightly coupled” with time in people’s conceptualisations. Urban landscape
- perception examples go back at least to the work of Kevin Lynch; whilst Egenhofer and Mark
- 33 (1995) name old European land units in which farming areas are related to time requirements.
- Reasoning about geographic space deals with incomplete information, i.e. people have to
- 35 interpolate much missing information using ‘common sense’ rules.
- Multiple levels of detail correspond to different conceptualisations of space; some cognitive
- spaces are continuous, and some discrete.
- 37 ● Boundaries are not necessarily discrete entities, and not necessarily seen by neighbours as
- symmetric; consider the boundaries in natural resource conflicts, or in the perceptions of urban
- 39 ‘neighbourhoods’.
- Distances are more likely than not asymmetric, depending on the means of overcoming ‘friction
- 41 of distance’ or movement hindrances.

43 ¹¹ “Naïve geography is the body of knowledge that people have about the surrounding geographic world” (Egenhofer
 & Mark, 1995).

- 1 ● “Community” Maps are distorted when they are only simplistic agglomerations of individual
3 mental maps. Group representations of space are needed, using PRA methods.

5 *Land* has strong spiritual and cultural values for many peoples, especially for indigenous
7 peoples very long settled in a unique location. For one example, of Maori values in New Zealand,
8 [Harmsworth \(1997\)](#) puts it that land units have specific characteristics of *tapu* (respect [for
9 resources]), *mana* (authority), and *mauri* (life force, life energy). Therefore, ‘land’ cannot be simply
10 defined as an economic commodity, and placed in narrow categories of ‘high value’, ‘marginal’, or
11 ‘wastelands’.

12 The ISK of land resources therefore incorporates customary laws and ancestor-directed
13 objectives in spatial decision-making processes. ‘Naming’ of sacred places and symbology in
14 spatial representations are elements of this. Such values are identifiable in the concepts of
15 probably all peoples who retain a spiritual feeling for land (e.g. [Bartolo & Hill, 2001](#), for
16 Australia; and the AMN website for North America, www.nativemaps.org). In the modern urban
17 context, some PPGIS practitioners are emphasising similarly a ‘sense of urban place’ as a form of
18 ISK (cf. [Casey & Pederson, 2000](#); [Carver, 2001](#)).

19 4.6. *Gendered spatial knowledge*

21 Gendered space refers to several dimensions: specialised gendered knowledge of distributions in
22 space, the differential access to and ownership of resources with their nested scales, and cultural
23 landscapes/townscapes associated with life experiences of men and women.

24 The gender component of ISK is often invisible. Much literally, *cannot be seen*—in NRM for
25 example, women’s use of forest resources is likely to be the collection of foods or medicines under
26 the closed canopy and forest gardening, rather than large-scale lumbering or agricultural clearing,
27 usually done by men. Satellite imagery is not sensitive enough to show the vital elements of
28 women’s specialised agriculture and natural resource use. “They may, in fact, be limited to
29 particular resources, or even particular products..., certainly much smaller than a single pixel in
30 most land use or property images...” ([Rocheleau et al., 1995, p.64](#)). Thus, women’s lands are
31 often denigrated as ‘unused wastelands’, and the products they make are not recognised as having
32 economic or even livelihood value. Moreover, the gender aspect *is not recognised*—because census
33 survey data do not show the richness of women’s real lives (nor much of men’s), because of the
34 focus on monetised activities, and the restrictive assumptions made about the roles and capacities,
35 and thus the spatial activity patterns, of women. The ‘no market value’ designation is often elided
36 into labels of ‘primitive’ or ‘worth-less’ activities (cf. [Scott, 1995](#)).

37 National employment or labour force participation data tend to ignore the labour for
38 ‘reproduction of the household’—care of children and elderly, or housework, and a result of this is
39 ‘misogynistic’ distortions of economic space. It follows that the mapped versions or other spatial
40 databases are unable to show gender distinctions. Gender differences in levels of mobility are seen
41 in the restrictions, and thus in the “invisibility”, of the large proportion of house-bound and non-
42 car owning women in the US ([Hall, 1997](#)). Additionally, there are the ‘real’ and perceived spatial
43 restrictions due to personal safety, security, or harassment locations. [Kwan \(2000\)](#) expects that

1 GIS tools will help planners to identify and understand urban women's constricted spaces and
 'fixity constraints'.

3 5 **5. Ownership and accessibility in indigenous spatial knowledge**

7 *5.1. Ownership of indigenous (spatial) information*

9 The ownership of ISK may be following the path of conventional geo-spatial information
 resources, where the trend is towards market rules, even for "patrimonial" information in
 11 foundation geo-data sets, including topo data, infrastructure, and census data. Spatial data are
 being sold off to the highest bidder to exploit the value-added of GIS, fuelled by the growing
 13 powers of the WTO and World Intellectual Property Organisation (WIPO).

15 At the local level, issues of ownership of intellectual property rights also appear in relation to
 privacy of land parcel information (e.g. in the high resolution PPGIS Slaithwaite case, [Carver
 et al., 1999](#)).

17 A very strong position on ownership, and therefore on limiting access, of 'secret', sacred, ISK is
 taken by [Harmsworth \(1997\)](#) in relation to Maori peoples. These protectionist views towards
 19 indigenous culture, found also in the US (e.g. [Madsen, 1995](#)), could however be interpreted also as
 protecting the privileges of an elite who thrive on the restricted knowledge of resource locations or
 21 uses, privy only to themselves. The commonest group to lose out are women, when men's secure
 control of resource knowledge and the consequent exclusion of women become legitimised by
 23 'community traditions'. In urban settings, the confidentiality/secrecy of ISK is not only related to
 illegal activities, although it would include such as drug dealing locations. But there are numerous
 25 'traditional' activities which fall under varying labels of anti-social or immorality, because they
 are not sanctioned by the majority society.

27 Examples of, what are to varying degrees, protected or confidential rural and urban ISK data
 layers:

- 29 ● Traditional hunting, fishing, grazing, medicinal herbs collection; areas used by urban groups
 31 for livelihoods or life-style activities.
- 33 ● 'Traditional', vulgar activities (e.g. hunting, drag racing, raves, street betting, prostitution, dog
 fighting), which are currently anti-social or inappropriate.
- 35 ● Customary boundaries and subdivisions of culture areas—tribes, neighbourhoods, customary
 property, *eruvim*, street gangs, male and female, gay and straight spaces, personal space.
- 37 ● Historic places, neighbourhoods, Holy sites, burial grounds, ceremonial areas, buried cultural
 objects.
- 39 ● Indigenous sacred place names, cosmological locations, sacred pathways, songlines.

41 A related question is whether ownership of knowledge includes the right to prevent others from
 using it. Amongst First Nations in North America and in Aotearoa there are legal-political moves
 43 towards a 'communal right of privacy'. This means customary leadership taking responsibility for
 data protection, and thus control over confidential GIS data layers.

1 Moreover, the rights of indigenous peoples can be asserted to include freedom from ‘wanton
2 exploitation’ of their natural resource data from aerial photography or RS platforms. In this
3 context, [Madsen \(1995\)](#) quotes from a US legal opinion, *Olmstead v. US (1928)* when Justice
4 Brandeis “called the right to be let alone ‘the most comprehensive of rights and the right most
5 cherished by civilized men’”. There is similar concern over the surveillance and policing
6 capabilities of GIS used in combination with hi-tech spatial data collection (e.g. [Harris et al.,
7 1995, Chapter 9; Pickles, 1995, Chapter 1](#)).

8 Landcare Research in New Zealand offers three protection options for sensitive, confidential
9 layers: recording the information as concealed files linked to a GIS and needing a permission;
10 recording the information as an overlay, e.g. a grid at crude scale, which prevents specific site
11 identification; or, providing a hyperlink to a recognised (Maori iwi) authority responsible to
12 answer queries ([Harmsworth, 1997](#)).

13 5.2. *Access to, and exclusion from, spatial information*

14
15
16
17 Whatever the actual ownership, people must have rights of access to the information stocks
18 held by the state, as a basic condition for good governance. There are limits to these rights, set by
19 national security or commercial confidentiality, and there are vast differences between what states
20 ‘allow’ their citizens access to—[Harris et al. \(1995, Chapter 9\)](#) instance the South African legacy
21 of distorted information under apartheid. The issues of public access to information held by the
22 large-scale, private commercial sector must equally be addressed in public debate and be subject
23 to public policy determination. There is a strong tendency to hide relevant spatial data in the
24 business sector camouflaged under commercial confidentiality.

25 Lack of financial resources however, is more persistent than are institutional hindrances. At
26 larger scale, the wealth (tax base) of communities is a determining factor in development of
27 PPGIS in the USA. [Haklay and Harrison \(2002\)](#) examine the financial differences between
28 utilising PPGIS in the UK and the USA, in terms of costs, ease of access and familiarity with geo-
29 data, such as OS maps and digital data. At the individual level, governance obligations not only
30 require the state to provide access to (geo-)information for their citizens, but at a reasonable price
31 [Casey and Pederson \(2000\)](#) look at the real costs of the time involved to acquire primary data or
32 visit databases. Accessibility is not only price-related, there are physical transportation and
33 communication constructs. Most of the world is in lower income countries/classes and not on the
34 web—even in urban areas, they must still walk or bus to obtain public geo-data.

35 The flip side of accessibility is exclusion—despite the improved access of many, a very
36 significant minority will become more marginalised—“adoption also implies non-adoption or
37 inability to adopt” ([Harris et al., 1995, Chapter 9, p. 202](#)). There are two levels of the exclusion
38 impacts, related to the ‘intentions’ of promoting participation for facilitation, mediation, or
39 empowerment (see Section 4).

40 Initially, there is the persistence of an ‘information underclass’ excluded from the decision loop
41 by the ‘digital divide (e.g. [Carver, 2001](#)). Because they are without the appropriate technical
42 training or ‘skills’, the off-line goats are separated from the on-line wired sheep. In these
43 situations, the role of information handler or interpreter will be taken by the professionals—
44 whether they be GIS experts, consultants, planners, or professional-level NGOs. There are many
45 critiques of this in PPGIS in the USA. In reviewing alternative locations for a power line in West

1 Virginia, citizens' groups complained that the planning professionals hi-jacked the GIS and
 2 multimedia tools and excluded local concerns over data categories and weighting of impacts
 3 (Towers, 1997; King, 2002). Technocratic planning models replaced 'neighbourhood discourse' in
 4 a Minneapolis Neighbourhood Association and introduced alien terminology, concepts and
 5 decision approaches which excluded the marginalised and less articulate—the elderly, blacks, and
 6 renters, whereas those who could adopt the jargon and the GIS milieu felt more empowered
 7 (Elwood, 2002, Chapter 6; Aitken, 2002, Chapter 27). Of course this phenomenon is just as
 8 pervasive where GIT is inappropriately introduced into rural, indigenous, 'non-technological'
 9 societies (e.g. Rundstrom, 1995; Abbott et al., 1998).

10 Beyond this, is the elemental lack of resources and access to power, which creates more
 11 implacable hindrances than being untrained (see Section 7).

13 6. How well can GIS represent ITK? Strengths and weaknesses of p-GIS

15 6.1. GIS distortions of perceived space

17 GIS outputs are liable to distort and trivialise spatial reality because they present patterns, not
 18 processes, even flows can be difficult to represent. They can only describe but not explain;
 19 alternatively, they examine but do not provide understanding. GIS can provide answers to the
 20 'what?', 'when?', 'who?', and of course, 'where?' questions, but not much of the 'how?', or 'why?'
 21 questions. Economic and social power, which is fundamental to explaining 'why?', rarely appears
 22 in GIS—though that is as much due to the ownership and objectives of most conventional GIS, as
 23 it is to technical limitations.

24 The sense of place associated with particular localities and by particular groups of people in
 25 mental maps is qualitative and fuzzy, metaphorical or mystical. It may not be reducible to
 26 Euclidean space. The distortions forced on people's perceived space by being embedded in a
 27 procrustean logical positivist GIS bed may throw away too much cultural information belonging
 28 to ISK. A minimal requirement is that the names used for objects/people/places should mesh with
 29 individual and community knowledge (Brodnig & Mayer-Schonberger, 2000).

30 Hall (1997) extends the argument to identify GIS as a "masculinist technology" which is
 31 materialist and positivist, handling only discrete bounded units of analysis that are often pre-
 32 defined and avoid fuzzy concepts. Her call is for work on the "feminisation of GIS". In a similar
 33 vein, Varanka (1997) interprets the stress on the principles of 'plain style' in cartography—the
 34 simplicity of context by eliminating competing viewpoints, emphasis on mathematical accuracy,
 35 utility, lack of iconography, plainness—as "manly"; as opposed to other objectives of recording
 36 ambiguity, fuzziness and spiritual values that are seen as "feminine and juvenile". Varanka (1997,
 37 p. 1) proposes that the "unacknowledged consequences of Plain style mapping are [masculinist]
 38 cultural...repression [of] emotive statements and abstractions such as worldviews and
 39 spirituality".

41 6.2. 'Preciseness'

43 Much of what is significant in spatial patterns in PSP, relating for instance to neighbourhood
 planning, cultural zoning, or local-level NRM, has spatial characteristics of fuzzy, multi-layered

1 zones and zonal information (areas, polygons, raster grids); blurred, flexible, and multiple
 2 boundaries (line data); uncertain, hidden or restricted spatial locations (point data); and
 3 dynamics—flows of physical resources, information or memes, flows of influence, power and
 4 control.

5 GIS approaches, especially those built on RS data, may place misleading emphasis on spatial
 6 accuracy or preciseness of the output information. Most development activities, especially in rural
 7 settings, do not need a high degree of spatial exactitude. They are concerned with interventions at
 8 the level of communities or ecological zones, which are relatively large spatial entities, and may
 9 not have precise boundaries. Many social interventions are aimed at communities of people who
 10 do not have a unique or fixed location (women, pastoralists, students, the “poorest 10%”).
 11 Precision is needed for special situations, especially legal actions, such as customary land rights vs.
 12 the state or a forestry concession.

15 6.3. *Visualisation and technical flim-flam*

17 Conventional projects to disseminate GIS have commonly been driven from outside, as a
 18 ‘solution looking for a problem’. “GIS and RS demonstrations [in general] are ‘technology-
 19 driven’ rather than ‘demand-driven’” (Hutchinson & Toledano, 1993). This raises questions of the
 20 legitimacy and respect dimensions of governance.

21 GIS software marketed to community groups is often inappropriate in its functionalities and
 22 data appetite, and key hardware or reliable electricity may be missing. Community customers
 23 have learnt to preview software options; for example, the Shuswap Nation in Canada assessed
 24 pertinent factors of learning, information interchange, support, ease of use, as well as cost
 25 (Johnson, 1997). On governance criteria, software decisions relate both to accountability and
 26 competence/efficiency.

27 It is impossible to overestimate the visual impact of GIS output, RS images and, to some extent,
 28 maps (cf. Monmonier, 1996). It is not only the quantity of information bits that can be
 29 summarised in an image (compared with a written report or data tables), but the quality of the
 30 information imparted is also different—the “clarity”, the simplicity of “distinguishing”, and the
 31 ease of making comparisons. As many observers note, GIS displays can have too convincing an
 32 impact on the audience—the ease of layering and of changing maps, the apparent objectivity and
 33 scientific content of the display, can have a blinding effect (cf. Abbott et al., 1998; Obermeyer,
 34 1994), although this should decline as decision-makers become more familiar with the techniques.
 35 Even proponents of GIS applications, point out (in the context of land claims) how “...GIS can
 36 provide an air of scientific objectivity required within the legal system” (Johnson, 1997).
 37 “Spurious” could easily be added to the quote.

38 GIS activities are often treated as short-term, limited projects, rather than as on-going
 39 processes, despite being marketed as structural investment.¹² In most PSP applications, however,
 40 the benefits of participation are neither fast, nor necessarily in a financial currency; and where
 41 there are economic returns from P-GIS used for community development, they are not accruing to
 42 the commercial players who could fund high-tech GIS.

¹²Compare experiences of municipal GIS in Cebu and Lilongwe (van der Vegt, 2001).

1 There are concerns here for accountability, as well as for efficiency in a practical sense. Flashy
 2 GIS images create in fact non-transparency and non-visibility, so that representations and
 3 decisions are distorted or confused by the image.

5 6.4. Layering

7 On the positive side, a great strength of GIS and P-GIS with respect to ISK is the performance
 8 of the layering capabilities. Multiple perspectives always demand multi-mappings, and it is
 9 arguable that this capability means that GIS can significantly represent a holistic, non-
 10 reductionist, *weltanschauung* of indigenous/local peoples. The thematic layers easily created in
 11 GIS mapping can reflect the social or environmental images from different groups. Layering has a
 12 synergistic result in that the combinations of themed spatial information, from different social
 13 perspectives and sources, and both quantitative and qualitative, create a whole greater than the
 14 sum of its parts. Thus, layering has a fundamental relationship with respect for rights, and to
 15 some extent with equity categories. Moreover, layering is anyway used to improve competence/
 16 efficiency of delivery even in conventional planning approaches.

17 Multimedia and interactive web-based mapping/GIS can show multiple views and voices, layers
 18 of information, and layers of time. Typical spatial and temporal constraints of standard map or
 19 GIS representation are removed by using multimedia or a web presentation (e.g. [Weiner & Harris, 2002](#)
 20 in South Africa; [Kingston et al., 2000](#) in UK; [Shiffer, 1998](#) in USA). The easy ability to click
 21 on a map to find a magnification, or a photo or sketch, or written information, helps even the
 22 inexperienced user to overcome map-reading problems ([Kingston et al., 2000](#)).

25 6.5. Operational issues—can ‘civilians’ work with (P-)GIS?

27 Positive experiences with P-GIS show that an affinity—‘feeling comfortable working with geo-
 28 spatial information’—is not difficult to stimulate. For instance, techno-professionals have
 29 appreciated for a decade that untrained people, with local ISK, can work effectively, easily and
 30 happily interpreting aerial photos (e.g. [Groten, 1997](#); [Jordan & Shrestha, 1998](#)). Working with
 31 GIS software and hardware is not only feasible, but with the appropriate approach—culturally as
 32 well as technically—it is very effective. Although most packaged GIS training or capacity-building
 33 is geared to computer literates, there are alternatives, as shown by the experiences of AMN and
 34 ESRI, and by the experiences both, of long-run intensive training (e.g. [Gonzalez, 2000](#); [Weiner &](#)
 35 [Harris, 2002](#); [Sawicki & Burke, 2002, Chapter 7](#)), or, of more rapid PRA exercises.

36 Where there are constraints against local people or organisations working with GIS, they are
 37 due to exclusion—whether economic, social, and/or political, and not because of technical
 38 incapacity (e.g. [Obermeyer, 1994](#); [Johnson, 1997](#)). On the other hand are the sceptics who
 39 consider that the public should know their limitations (e.g. [Casey & Pederson, 2000](#); maybe
 40 [Carver, 2001](#)). GIS is too ‘complex a beast’ liable to distortion of its results, and amateur
 41 applications of GIS are at least prone to ridicule, at worst, dangerous.

42 Loss of skilled staff from P-GIS units is a related issue ([Casey & Pederson, 2000](#); [van der Vegt,](#)
 43 [2001](#)). To avoid fast turnover of trained GIS staff to more lucrative jobs, a pre-condition is a
 strong local organisation.

1 7. Conclusions—(spatial) information, power, and participation in spatial planning

3 7.1. *Indigenous spatial knowledge and its ownership*

5 Much ISK in agriculture and NRM is equivalent to scientific knowledge, in many respects
 6 better, because it embodies decades or generations of specific practical knowledge which is
 7 interactive and holistic, thus incorporating real linkages. It is harder to argue similarly for ITK/
 8 ISK in urban settings, though consider our familiar acceptance, and the impact of, non-
 9 professional, local knowledge of travel patterns, locations of life-style activities, or safety/security,
 10 for instance.

11 Beyond this, there is indigenous knowledge that is symbolic, metaphoric, and visionary, though
 12 often functionally related to land and land features. This deep knowledge, with its obligations of
 13 stewardship of the land—as in customary restrictions on using ‘sacred lands’ which are also a
 14 protected forest—together with the location- and resource-specific, problem-oriented ITK,
 15 provide the basis for local people’s participation.

16 The challenge is to integrate the insiders’ pragmatic, if sometimes also mystical, knowledge
 17 (ISK) which reflects local needs, with the external demands that are ratcheting up with
 18 globalisation. The rationale behind this integration is analogous to seeing ‘community
 19 participation’ as ‘mediation’, the ‘third way’ between facilitating external projects, and,
 20 autonomous empowerment. ITK/ISK are keystones in this process, because they are a measure
 21 of the capability and competence of the local community, and their ownership has the potential to
 22 place the community on an equal status with outsider ‘experts.’

25 7.2. *Ownership or control of ISK can empower the community*

26 Empowerment is the deepest of the intents of participation, and promoting ISK by, within, and
 27 for, the local community is a major instrument towards this. P-GIS should provide the potential
 28 for a more equal exchange of information and values and understanding between the parties
 29 involved, as frequently asserted (e.g. [Aberley, 1993](#); [Poole, 1995](#); [Gonzalez, 2000](#); [Weiner, Warner,
 30 Harris, & Levin, 1995](#)). Carrying out a GIS exercise with the proper involvement of local parties
 31 affects empowerment, and strengthens the capabilities of those parties. Being involved in a GIS
 32 means that “the stakeholder parties are being taken seriously...[through]...greater openness and
 33 accountability on behalf of decision makers” ([Carver, 2001](#)).

34 However, if the input data or (GIS) output are not participatorily processed in situ, the
 35 empowerment benefits may be lost, because an alienation between people and ‘their’ data can
 36 arise ([Jordan & Shrestha, 1998](#)). This is overcome when the GIS per se is integrated into, and is
 37 seen as, a vital component of, the whole process of decision-making in PSP; thus the importance
 38 of using participatory research as the methodological approach, and GIS as the technical tool.
 39 Conversely, GIS and maps are a necessary but not sufficient condition by themselves for local
 40 development. They must be definitively embedded in participation, not just as an operational
 41 mechanism, but deliberately as a tool for empowering local people.

1 7.3. Power

3 This positive spin on ISK and empowerment must be countered by the idea that ‘information
 5 per se is *not* power’. Social-economic development and implementation are directed much more by
 7 relative power and access to and control over, resources, than by (geo-)information.¹³ The nexus
 9 and delivery mechanisms of social–political power are formed by “...‘things like the political
 11 process, the property market, property development’...” according to the London respondents
 13 quoted by [Haklay and Harrison \(2002, p. 15\)](#). These same respondents demonstrated their
 “...healthy scepticism of the ability of PPGIS to alter power relations”. Similarly, in evaluating
 why a GIS transfer-of-technology project in India was unsustainable, no deficiencies in GIS and
 computing capabilities were found, “no computing problem seemed beyond their ability to solve”.
 That is not where the problems lie, “the problems of development are driven... by socio-economic
 considerations” ([Hutchinson & Toledano, 1993](#)).

Wherever some actors gain from introduction of GIS, other social groups will lose out,
 becoming yet more marginalised. (P-)GIS simultaneously both ‘empowers and marginalizes’
 ([Brodnig & Mayer-Schonberger, 2000](#)). Only where (geo-)information shifts the balance of powers
 from the “strong publics” to the “counter-publics”¹⁴ and changes differential access to resources,
 as well as to information, can it be considered to progressively re-orient development.

There is a relationship here with the ‘exclusion’ of the information underclass (Section 5). The
 GIT-literate are anyway the economically and socially powerful, and though critical of
 government decisions, are unlikely to be upsetting the whole social appercart. Even with a
 degree of ‘open government’, information accrues to those already with most resources, thus
 further accumulating their power. Information is a resource whose value is *realised* only in
 combination with other social/political resources, especially power and access to policy
 instruments. This is equally true for customary knowledge within indigenous societies liable to
 control by an older, male, or class, elite. Local society, whether urban community or rural village,
 is not equitable, and ‘participation’ has to struggle to reach the power–poor, marginalised and
 inarticulate. ‘We realised that some rich and powerful people in the community objected to the
 open and participatory uses of GIS’ in rural Ghana ([Kyem, 2002, Chapter 16](#)).

[Carver \(2001\)](#) begins a review of ‘participation and GI’ with the pessimistic idea that possibly
 the general public do not want to be more closely involved in decision-making, but he adds the
 significant question of whether policy-makers and power-brokers actually value public input.
 Development and installation of improved (spatial) information capabilities (such as GIS) need to
 run in parallel with improved institutional safeguards for reasonable public access and use.

There is a yet unburied myth about ‘value-neutral GIS’. GIS is no more neutral than statistics
 or bulldozers, it all depends on what it is being used for, and on who is controlling it. “A GIS
 reflects the mandate [and the values, goals, biases] of the agency that operates it” ([Harris et al.,
 1995, Chapter 9](#)). It is axiomatic that good governance rests not on the tools, but on how they are
 used, and by whom.

41

¹³Critiques along these lines are not new—e.g. [Yapa \(1991\)](#), [Pickles \(1995, Chapter 1\)](#), [Rundstrom \(1995\)](#), [Harris
 et al. \(1995, Chapter 9\)](#), debates in the Varenus project, [Craig et al. \(2002\)](#).

¹⁴Terms from [Aitken \(2002, Chapter 27, p. 363\)](#).

43

1 7.4. *Dimensions of governance and (P-)GIS*

3 Given the messages that on the one hand, ‘ownership’ and use of ISK can empower, and on the
 5 other hand, (geo-)information is the servant of the status quo power structure, in what respects
 7 can P-mapping/P-GIS support good governance? For the GIS proponent, the aim must be to
 identify those features that make P-GIS utilising ISK more compatible with the tenets and
 measures of good governance in PSP.

9
 11 7.5. *Legitimacy*

13 P-GIS (and P-mapping) create opportunities to visualise the (spatial) interests, needs and
 15 potentials of groups disparate in terms of locality, ethnicity, gender, or class. Thus, they can work
 towards better governance, in that the ‘governing’ recognise and appreciate the representations of
 the legitimate interests of the ‘governed’.

17 However, much of what terms itself ‘P-GIS’ and ‘participatory planning’ corresponds to the
 19 weakest of the participation intentions (Section 4) and is concerned only with ‘facilitating’ more
 ‘efficient’ implementation. In such applications, a lazy approach is taken in terms of what sorts of
 indigenous knowledge are collected, and there is usually very little ‘triangulation’ (cross-checking)
 which is a *sine qua non* of PRA.

23 7.6. *Respect for rights*

25 Explicitly, P-GIS provides a framework for legal, political and administrative (planning)
 27 legitimacy, such as with P-GIS/P-maps used for registering and legalising customary land or
 29 neighbourhood claims. P-GIS is capable of systematically identifying and representing the spatial
 rights of people to their land and land resources, in terms of ownership, access, use and
 management.

31 Implicitly, the application of P-GIS respects the value and integrity of indigenous local
 33 knowledge as an essential element in participatory planning; and P-GIS works to operationalise
 ITK/ISK by locating, analysing and presenting it.

35
 37 7.7. *Equity*

39 When P-GIS is applied to equity mapping, it reinforces a respect for minorities, the inarticulate,
 and the resource- and power-poor.

41 The distribution over space of services, functions and resources (from government or private
 43 sector) are highlighted in P-GIS indicators, more than in a conventional GIS. Moreover the
 sources of information for these indicators are the people affected, not just the technical planners.
 It is pertinent that P-GIS implies ‘people’s participation’ at least to some degree, which forms the
 basis for equity as well as legitimacy.

1 7.8. *Competence (efficiency)*

3 On this governance dimension, P-GIS is not so different from conventional GIS, but the
 5 participatory element in P-GIS adds the factor that the efficiency and effectiveness of the
 governing towards the governed—in terms of service provision, response to needs—can be
 transparently tested.

7
 9 7.9. *Accountability of the governing to the governed*

11 Running throughout the P-mapping approaches and procedures are the improved transparency
 and visibility of the relations between governing and governed that are shown up by P-GIS
 outputs.

13 The lengthy and enlightening process of developing a GIS in a fully participatory manner is
 15 itself capacity-building and empowering, and therefore adds considerably to devolution and
 responsiveness measures.

17
 19 7.10. *GIT developments for P-GIS*

21 GIS, or P-GIS, is not a magic bullet for improved PSP, but it is by no means only a technical
 fix. There are real needs and opportunities for progressive developments in P-GIS and mapping.

23 Spatial visualisations (maps, GIS) can reinforce empowerment through scenario development—
 “GIS-based decision tools need to be exploratory rather than definitive”. (Carver, 2001). Civil
 25 society groups can use P-GIS capabilities to explore decision spaces and play around with
 alternative futures, based on understanding of their own goals, constraints, preferences, as in the
 co-learning processes of joint development of GIS (e.g. Weiner & Harris, 2002; Gonzalez, 2000).

27 There are value-adding functionalities giving GIS strong advantages over paper mapping,
 salient of which is overlaying, along with spatial analysis capabilities, spatial scaling (scale
 29 comparisons, zooming-in), time series for temporal comparisons, and many visualisation options.

31 Significant technical innovations are entering more regular usage—GPS, already well-
 developed and more affordable, and Personal Digital Assistants (PDA), becoming cheaper,
 user-friendlier, and with sufficient functionalities to support mobile GIS, such as Compaq-iPaq
 33 featuring ArcPad. Innovative visualisation is being developed, more attuned to ISK
 characteristics—flexible and fuzzy in place of hard boundaries, multi-user transparent overlays,
 35 soft zoning, dynamic and interactive visualisations, using new mapping and presentation software
 such as FreeHand10 and Avenza MaPublisher4. Web mapping opens new potentials, with
 37 hyperlinks to information or other images, magnified maps or photos, interactive visualisation, or
 temporal animation.

39 The primary concern in PSP initiatives should remain the participatory planning per se and its
 implementation through good governance. The applications of P-GIS and P-mapping, and
 41 effective visualisation, are the tools to support and strengthen PSP. The potential for synergy in
 effective P-GIS remains, however—the proper process of making P-GIS products based on
 43 people’s ISK, itself promotes empowerment, and thus strengthens the respect, equity, and
 legitimacy dimensions of (good) governance.

1 **8. Uncited references**

3 Harris and Weiner (1998); Weiner, Harris, and Craig (2002, Chapter 1)

5 **References**

- 7 Abbott, J., Chambers, R., Dunn, C., Harris, T., Merode, E. de., Porter, G., Townsend, J., & Weiner, D. (1998). Participatory GIS: Opportunity or oxymoron? *Participatory Learning and Action (PLA) Notes*, 33, 27–34.
- 9 Aberley, D. (Ed.), (1993). *Boundaries of home: Mapping for local empowerment*. Gabriola Island, BC: New Society/New Catalyst.
- 11 Aitken, S. (2002). In: W. J. Craig, T. M. Harris, & D. Weiner (Eds.), *Public participation, technological discourses and the scale of GIS* (pp. 357–366).
- 13 AMN. (2002a). A Survey of GIS in the aboriginal mapping community. Aboriginal Mapping Network (AMN) website, www.nativemaps.org/news/GIS.
- 15 AMN. (2002b). Insight and advice on implementing a GIS. Aboriginal Mapping Network (AMN) website, www.nativemaps.org/news/GIS/.
- 17 Bartolo, R. E., & Hill, G. J. E. (2001). Remote sensing and GIS technologies as a decision-making tool for indigenous land management. *Indigenous Knowledge and Development Monitor*, 9(1), 8–11.
- 19 Bitter, P., & Mathias, M. (Eds.), (1998). *Mapping for planning. A source book*. Zurich: University of Zurich, Department of Geography, 55pp.
- 21 Brodnig, G., & Mayer-Schonberger, V. (2000). Bridging the gap: The role of spatial information technologies in the integration of traditional environmental knowledge and western science. *Electronic J. on Information Systems in Developing Countries*, Vol. 1. www.unimas.my/fit/roger/EJISDC/EJISDC.
- 23 Carver, S. (2001). Participation and geographical information: A position paper. *ESF-NSF Workshop on access to geographic information and participatory approaches using geographic information*, Spoleto, December 2001. <http://www.shef.ac.uk/~scgisa/spoleto/workshop.htm>.
- 25 Carver, S., Evans, A., Kingston, R., & Turton, I. (1999). Virtual Slaithwaite: A web-based public participation ‘Planning for Real’[®] system. Leeds: University of Leeds, School of Geography, Case Study Report, 14pp. <http://www.geog.leeds.ac.uk/papers/99-8/>.
- 27 Casey, L., & Pederson, T. (2000). Mapping urban neighbourhood environments. <http://www.ncgia.ucsb.edu/varenius/ppgis/papers/casey.html>.
- 29 Chattopadhyay, S., Mathai, J., Varma, A. K., Sukumar, B., Sankar, G., Machado, T., Shrivankumar, V., Samad, A., Edison, S., Narayanan, N. C., Gangadharan, T., & Sinha, S. (1996). Micro/village-level resources survey with people’s participation for sustainable development. In R. B. Singh (Ed.), *Research in geography: Land use change and sustainable development*, Vol. 1. (pp. 47–77). New Delhi: A.P.H.
- 31 Craig, W. J., & Elwood, S. A. (1998). How and why community groups use maps and geographic information. *Cartography and Geographic Information Systems*, 25(2), 95–104.
- 33 Craig, W. J., Harris, T. M., & Weiner, D. (Eds.), (2002). *Community participation and geographic information systems*. London: Taylor & Francis.
- 35 Drew, C. H. (2002). Transparency—considerations for PPGIS research and development. *Urban and Regional Information Association Journal* (Currently under peer review) version 02/28/02. http://www.urisa.org/Journal/Under_Review/consideration_for_ppgis_research.htm.
- 37 Duerden, F., & Kuhn, R. (1996). Indigenous land-use information project. Ryerson School of Applied Geography. www.ryerson.ca/geog/wwwsag/html/indigen.
- 39 Egenhofer, M. J., & Mark, D. M. (1995). Naïve geography. In A. U. Frank, & W. Kuhn (Eds.), *Spatial information theory. A theoretical basis for GIS lecture notes in computer sciences*, Vol. 988. (pp. 1–15). Berlin: Springer.
- 41 Elwood, S. (2002). In: W. J. Craig, T. M. Harris, & D. Weiner (Eds.), *The impacts of GIS use for neighbourhood revitalization in Minneapolis* (pp. 77–88).
- 43 ESRI. (1997). *ESRI conservation program resources: International groups, global organizations, world regions. ESRI conservation program resources: Native American, first nation and indigenous*. Environmental Systems Research

- 1 Institute, Conservation Program. www.conservaiongis.org/links/international.html, www.conservaiongis.org/links/native.html.
- 3 Flavier, J. M., et al. (1995). The regional program for the promotion of indigenous knowledge in Asia. In D. M. Warren, L. J. Slikkerveer, & D. Brokensha (Eds.), *The cultural dimension of development: Indigenous knowledge systems* (pp. 479–487). London: Intermediate Technology.
- 5 Goetz, A. M., & Gaventa, J., et al. (2001). *Governance: Bringing citizen voice and client focus into service delivery*. Brighton: University of Sussex (IDS Working Paper No. 138).
- 7 Gonzalez, R. M. (2000). *Platforms and terraces: Bridging participation and GIS in joint-learning for watershed management with the Ifugaos of the Philippines*. Ph.D. thesis Wageningen University, Wageningen. Enschede: ITC.
- 9 Groten, S. (1997). Aerial photographs as means of communication in land use planning. *Agriculture and Rural Development*, 1197, 11–14.
- 11 Haklay, M. E., & Harrison, C. (2002). Public participation GIS in the UK and the USA: A cross cultural analysis. Paper given at: 98th Association of American Geographers Annual Meeting, Los Angeles, March 2002, 28pp. <http://www.casa.ucl.ac.uk/muki/pdf/HaklayandHarrison-PPGIS-AAG2002.pdf>.
- 13 Hall, C. (1997). Gender and GIS. Varenus Program, Initiative 19 Paper. <http://www.geo.wvu.edu/www/i19/hall.html>.
- 15 Harmsworth, G. (1997). Maori values for land use planning. *New Zealand Association of Resource Management (NZARM) Broadsheet*, 37–52.
- 17 Harris, T., & Weiner, D. (1998). Empowerment, marginalization, and community-integrated GIS. *Cartography and Geographic Information Systems*, 25(2), 67–76.
- 19 Harris, T. M., Weiner, D., Warner, T. A., & Levin, R. (1995). Pursuing social goals through participatory geographic information systems. Redressing South Africa's historical political ecology. In J. Pickles (Ed.), *Ground truth. The social implications of GIS* (pp. 196–222). New York, NY: Guilford.
- 21 Howard, D. (1999). Geographic information technologies and community planning: Spatial empowerment and public participation. <http://www.ncgia.ucsb.edu/varenus/ppgis/papers/howard.html>.
- 23 Hutchinson, C. F., & Toledano, J. (1993). Guidelines for demonstrating geographical information systems based on participatory development. *International Journal of Geographical Information Systems*, 7(5), 453–461.
- 25 Johnson, B. D. (1997). *The use of geographic information systems (GIS) by first nations*. North Vancouver: Aboriginal Mapping Network. www.nativemaps.org/abstracts/ben.html.
- 27 Jordan, G. H., & Shrestha, B. (1998). *Integrating geomatics and participatory techniques for community forestry management. Case studies from the Yarsha Khola watershed, Dolakha District, Nepal*. Kathmandu: ICIMOD, Mountain Natural Resources, *ICIMOD Discussion Paper* series MNR 98/2.
- 29 Kellogg, W. A. (1999). From the field; observations on using GIS to develop a neighborhood environmental information system for community-based organizations. *Urban and Regional Information Association Journal*, 11(1), 15–32.
- 31 Kersbergen, K. van., & Waarden, F. van. (2001). *Shifts in governance: Problems of legitimacy and accountability*. The Hague: MAGW (Social Science Research Council), for: NWO (Neth. Organization for Scientific Research) Strategic Plan 2002–2005, 77pp.
- 33 King, B. H. (2002). Towards a participatory GIS: Evaluating case studies of participatory rural appraisal and GIS in the developing world. *Cartography and Geographic Information Systems*, 29(1), 43–52.
- 35 Kingston, R. (2002). In: W. J. Craig, T. M. Harris, & D. Weiner (Eds.), *Web-based PPGIS in the United Kingdom* (pp. 101–112).
- 37 Kingston, R., Carver, S., Evans, A., & Turton, I. (2000). Web-based public participation GIS: An aid to local environmental decision-making. *Computers, Environment and Urban Systems*, 24(2), 109–125.
- 39 Kwan, M.-Po. (2000). Gender differences in space-time constraints. *Area*, 32(2), 145–156.
- 41 Kyem, P. A. K. (2002). In: Craig et al. (Eds.), *Promoting local community participation in forest management through a PPGIS application in Southern Ghana* (pp. 218–231).
- 43 Leitner, H., McMaster, R. B., Elwood, S., McMaster, S., & Sheppard, E. (2002). In: W. J. Craig, T. M. Harris, & D. Weiner, (Eds.), *Models for making GIS available to community organizations: dimensions of difference and appropriateness* (pp. 37–51).
- Madsen, W. (1995). Protecting indigenous peoples' privacy from "eyes in the sky". www.spatial.maine.edu/tempe/madsen.html.

- 1 McCall, M. K. (1988). The implications of Eastern African rural social structure for local-level development: The case
for participatory development based on indigenous knowledge systems. *Regional Development Dialogue*, 9(2), 41–69.
- 3 McCall, M. K. (1995). *Indigenous technical knowledge in farming systems of Eastern Africa: A bibliography*. Ames, IO:
Iowa State University, Technology and Social Change Program, *Bibliographies in Technology and Social Change* No.
9, 167pp (revised ed.).
- 5 McCall, M. K. (2002). *Nexus of GeoData acquisition/analysis and indigenous knowledge Applications of GIS to ISK
issues: A literature review*. Enschede: ITC.
- 7 Monmonier, M. (1996). *How to lie with maps* (2nd ed.). Chicago: University of Chicago UP, 207pp.
- 9 Obermeyer, N. J. (1994). Spatial conflicts in the information age. *Urban and Regional Information Association
(URISA)*, 269–282.
- 11 Pickles, J. (1995). Representations in an electronic age: Geography, GIS, and democracy. In J. Pickles (Ed.), *Ground
truth. The social implications of GIS* (pp. 1–30). New York, NY: Guilford.
- 13 Poole, P. (1995). *Indigenous peoples, mapping and biodiversity conservation: An analysis of current activities and
opportunities for applying geomatics technologies*. Washington, DC: World Wildlife Fund, People and Forests
Program Discussion Paper. www.bsponline.org/publications/show.
- 15 Rambaldi, G., & Callosa-Tarr, J. (2000). *Manual on 3-dimensional participatory modelling for natural resource
management*. Quezon City: PAWB-DENR, Protected Areas and Wildlife Bureau, National Integrated Protected
Areas Programme (NIPAP), *Essentials of Protected Areas Management in the Philippines*, No. 7.
- 17 Riggs, F. W. (2000). Exporting governance? Paper given at: Association for law and administration in developing and
transitional countries (ALADIN) forum, Leiden, June 2000. <http://www2.hawaii.edu/~fredr/aladin>.
- 19 Rocheleau, D., Thomas-Slayter, B., & Edmunds, T. (1995). Gendered resource mapping. Focusing on women's spaces
in the landscape. *Cultural Survival Quarterly*, 18(4), 62–68.
- 21 Rundstrom, R. A. (1995). GIS, indigenous peoples and epistemological diversity. *Cartography and Geographic
Information Systems*, 22(1), 45–57.
- 23 Sawicki, D. S., & Burke, P. (2002). In: W. J. Craig, T. M. Harris, & D. Weiner, (Eds.), *The Atlanta project: Reflections
on PPGIS practice* (pp. 89–100).
- 25 Sawicki, D. S., & Peterman, D. R. (2002). In: W. J. Craig, T. M. Harris, & D. Weiner, (Eds.), *Surveying the extent of
PPGIS practice in the United States* (pp. 17–36).
- 27 Schulte, K. J. (1999). Utilizing GIS to facilitate public participation in access management issues: A case study. Paper
given at APA National Planning Conference, Seattle, 1999. [http://www.asu.edu/caed/proceedings99/SCHULTE/
SCHULTE.HTM](http://www.asu.edu/caed/proceedings99/SCHULTE/SCHULTE.HTM).
- 29 Scott, C. V. (1995). *Gender and development: Rethinking modernization and dependency theory*. Boulder, CO: Lynne
Reiner.
- 31 Shiffer, M. J. (1998). Multimedia GIS for planning support and public discourse. *Cartography and Geographic
Information Systems*, 25(2), 89–94.
- 33 Talen, E. (1999). Constructing neighbourhoods from the bottom up: The case for resident-generated GIS. *Environment
and Planning B*, 26, 533–554.
- 35 Towers, G. (1997). GIS versus the community: Siting power in southern West Virginia. *Applied Geography*, 17(2), 111–
125.
- 37 UNDP. (1997). *Defining core characteristics of good governance*. New York, NY: United Nations Development
Programme, Management Development and Governance Division.
- 39 Varanka, D. (1997). The social implications of how people, space, and environment are represented in GIS. GIS and
Society. *Initiative 19 Position Paper*. www.geo.wvu.edu/i19/papers/varanka.
- 41 Vegt, M. van der. (2001). *Evaluating GIS in local government in developing countries*. Enschede: ITC, Social Sciences
Division.
- 43 Ventura, S. J., Niemann, B. J., Sutphin, T. L., & Chenoweth, R. E. (2002). In: W. J. Craig, T. M. Harris, & D. Weiner
(Eds.), *GIS-enhanced land-use planning* (pp. 113–124).
- Weiner, D., & Harris, T. M. (2002). Community-integrated GIS for land reform in South Africa. *Urban and Regional
Information Association Journal* (Currently under peer review) version 02/28/02. [http://www.urisa.org/Journal/
Under_Review/weiner/community_integrated_gis_for_land_reform.htm](http://www.urisa.org/Journal/Under_Review/weiner/community_integrated_gis_for_land_reform.htm).

- 1 Weiner, D., Harris, T. M., & Craig, W. J. (2002). In: W. J. Craig, T. M. Harris, & D. Weiner (Eds.), *Community participation and geographic information systems* (pp. 3–16).
- 3 Weiner, D., Warner, T. A., Harris, T. M., & Levin, R. M. (1995). Apartheid representations in a digital landscape: GIS, remote sensing, and local knowledge in Kiepersol, South Africa. *Cartography and Geographic Information Systems*, 22(1), 30–44.
- 5 Yapa, L. (1991). Is GIS appropriate technology? *International Journal of Geographic Information Systems*, 5, 41–58.

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