INTERNATIONAL TELECOMMUNICATION UNION

Telecommunication Development Bureau

Telecommunication Statistics and Data Unit

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Document:	**WICT-28E**
Source:	**William K. McHenry** **University of Akron**
Title:	**Studying the Digital Divide with the MOSAIC Group Methodology (PowerPoint presentation)**

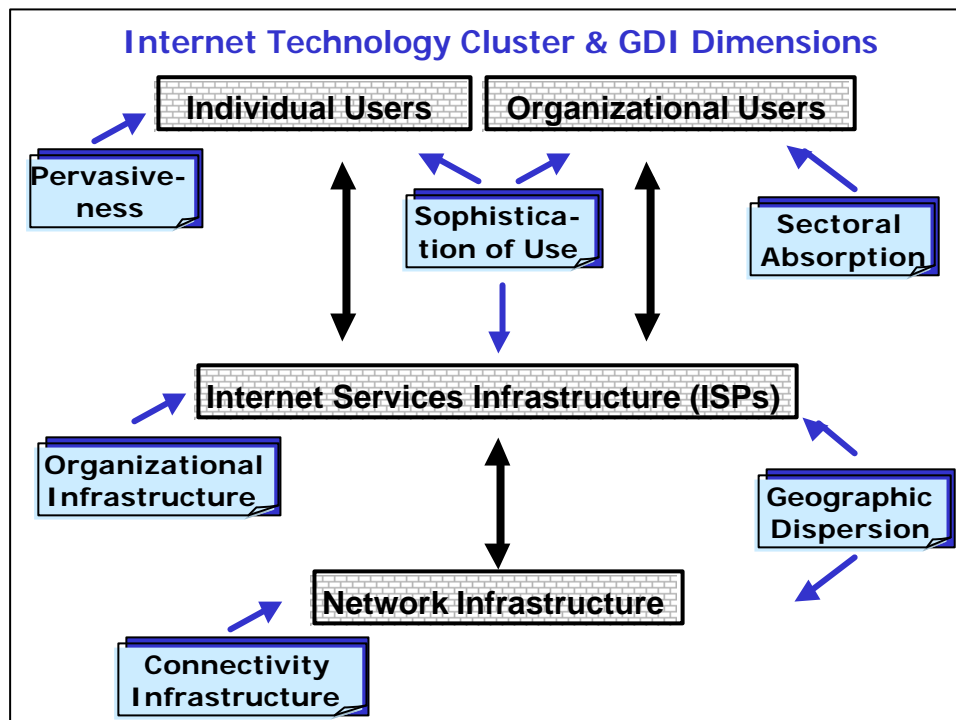# Studying the Digital Divide with the MOSAIC Group Methodology

William K. McHenry
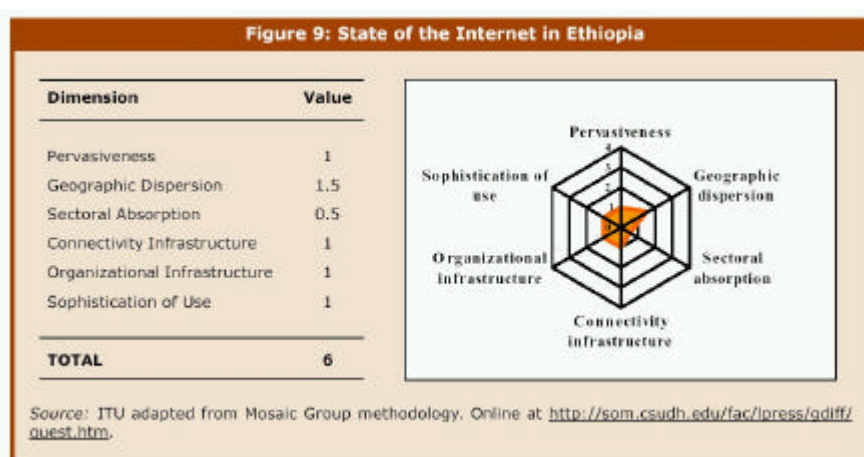
The University of Akron

Jan 17, 2003

Overview of GDI Methodology

- Each country characterized by six dimensions of Internet diffusion
- Dimensions capture infrastructure & access (availability), and use
- Ratings assigned qualitatively based on assessment of quantitative and qualitative data

Internet Technology Cluster & GDI Dimensions
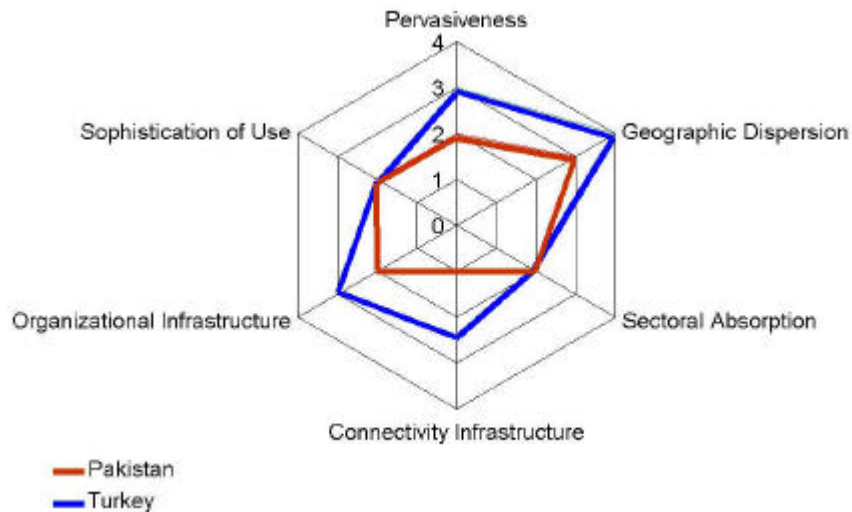
- Individual Users
- Organizational Users
- Pervasive-ness
- Sophistica-tion of Use
- Sectoral Absorption
- Internet Services Infrastructure (ISPs)
- Organizational Infrastructure
- Geographic Dispersion
- Network Infrastructure
- Connectivity Infrastructure

Representation Using Kiviat Diagrams

Figure 9: State of the Internet in Ethiopia

Dimension	Value
Pervasiveness	1
Geographic Dispersion	1.5
Sectoral Absorption	0.5
Connectivity Infrastructure	1
Organizational Infrastructure	1
Sophistication of Use	1
TOTAL	6

Source: ITU adapted from Mosaic Group methodology. Online at http://som.csudh.edu/fac/lpress/gdiff/guest.htm.

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Turkey vs. Pakistan, 1999

Country Ratings To Date

Number of Countries to which GDI framework has been applied as of December, 2002

• **84 countries, of which:**
- • **20 rated by more than one group**
- • **36 rated more than once**

• **183 ratings**

Distribution by Source, Including Overlaps

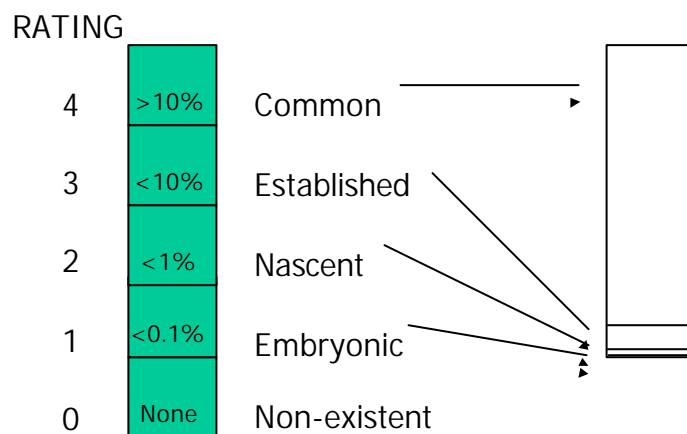| Source	Countries
Press	39
Francophone	26
MOSAIC	26
ITU	16
Thesis	2
TOTAL (Unique)	84

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Studying the Digital Divide

- Some scales skewed towards lower end, earlier stages of diffusion
  - Pervasiveness, Geographic Dispersion
- Attention of researchers on low and medium income countries

Countries Studied	Number	Percentage
Low Income	33	39.3%
Middle Income	38	45.2%
High Income	13	15.5%

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Scale: Pervasiveness

RATING

Rating	Value	Label
4	>10%	Common
3	<10%	Established
2	<1%	Nascent
1	<0.1%	Embryonic
0	None	Non-existent

"Number of Users"

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No. of Countries

Distribution of countries by Pervasiveness Metric, AFRICA, ITU Data

Pervasiveness Rating

Year

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No. of Countries

Distribution of countries by Pervasiveness Metric, EUROPE, ITU Data

Pervasiveness Rating

Year

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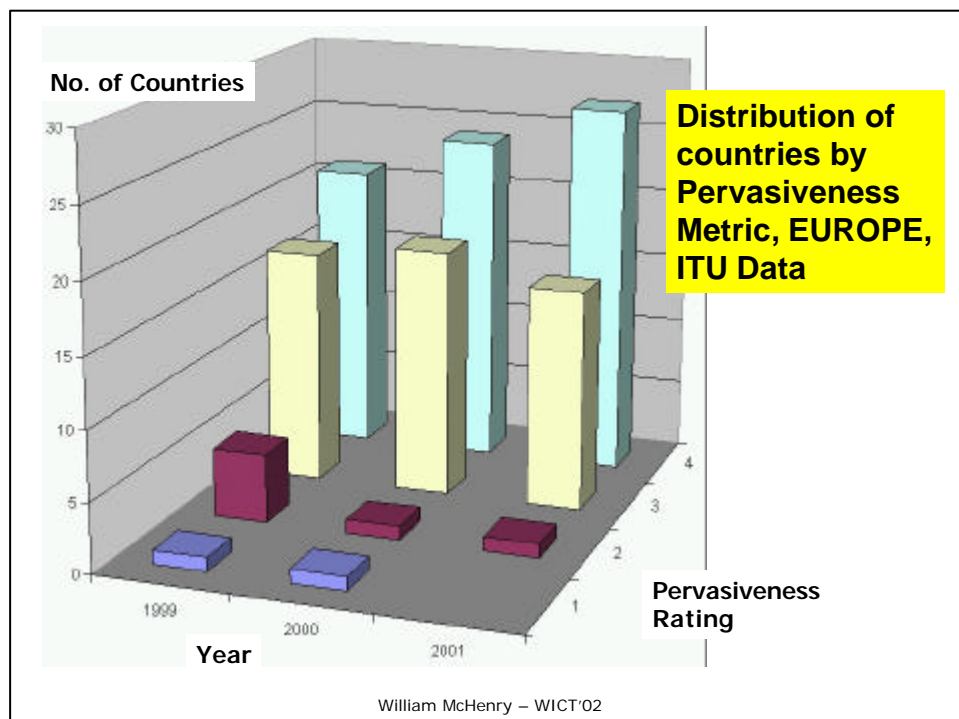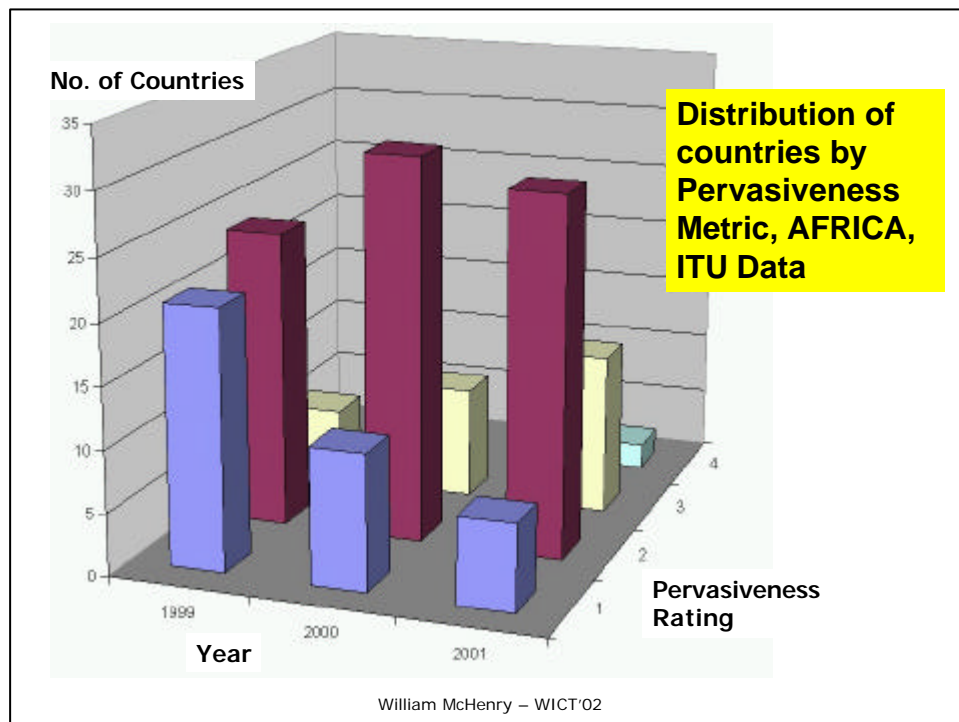
Scale: Geographic Dispersion

RATING

4	>50%	Nationwide
3	<50%	Highly Dispersed
2	>1, few	Moderately Dispersed
1	1	Single Location
0	None	Non-existent
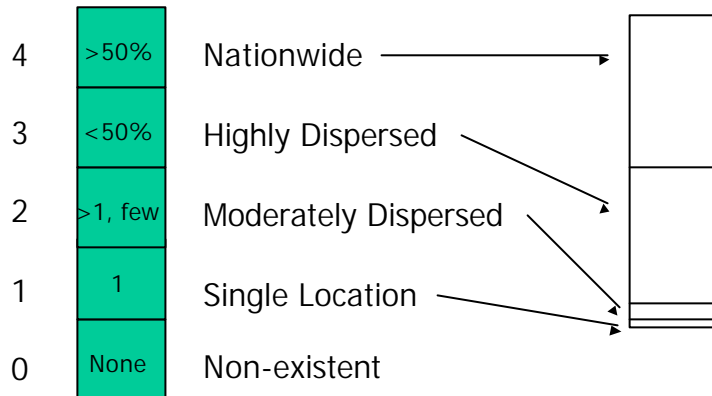
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Scale: Sectoral Absorption

Points

3

Academic

2

<10%   1

Points

3

Commercial

2

1 <10%

Sectoral point total	Sectoral Absorption dimension rating	
0	Level 0	*Non-existent*
1-3	Level 1	*Rare*
4-6	Level 2	*Moderate*
7-9	Level 3	*Common*
10-12	Level 4	*Widely used*

Points

3

Public

2

<10%   1

Points

3

Health

2

1 <10%
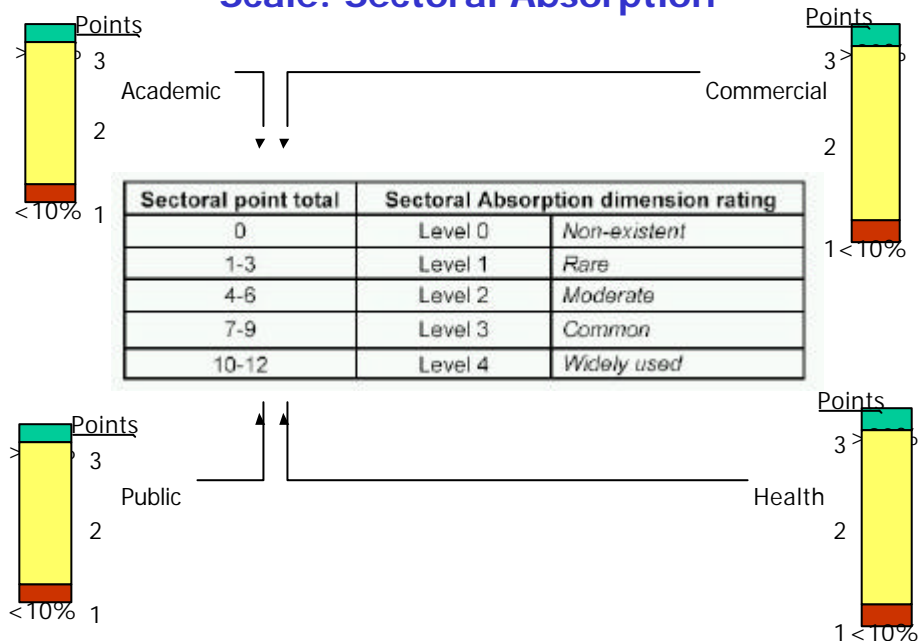
Scale: Connectivity Infrastructure

		Domestic backbone	International Links	Internet Exchanges	Access Methods
Level 0	*Non-existent*	None	None	None	None
Level 1	*Thin*	= 2 Mbps	= 128 Kbps	None	Modem
Level 2	*Expanded*	>2 -- 200 Mbps	>128 Mbps -- 45 Mbps	1	Modem, 64 Kbps leased lines
Level 3	*Broad*	>200 Mbps -- 100 Gbps	>45 Mbps - 10 Gbps	More than 1; Bilateral or Open	Modem, > 64 Kbps leased lines
Level 4	*Extensive*	> 100 Gbps	> 10 Gbps	Many; Both Bilateral and Open	< 90% modem, > 64 KBps leased lines

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Remaining Two Dimensions Are Qualitative

- Organizational Infrastructure
  - None, Single, Controlled, Competitive, Robust
- Sophistication of Use
  - None, Minimal, Conventional, Transforming, Innovating

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Statistics Generated Using MOSAIC Methodology

- Should we use the six dimension sum?
- Are there common patterns of diffusion?
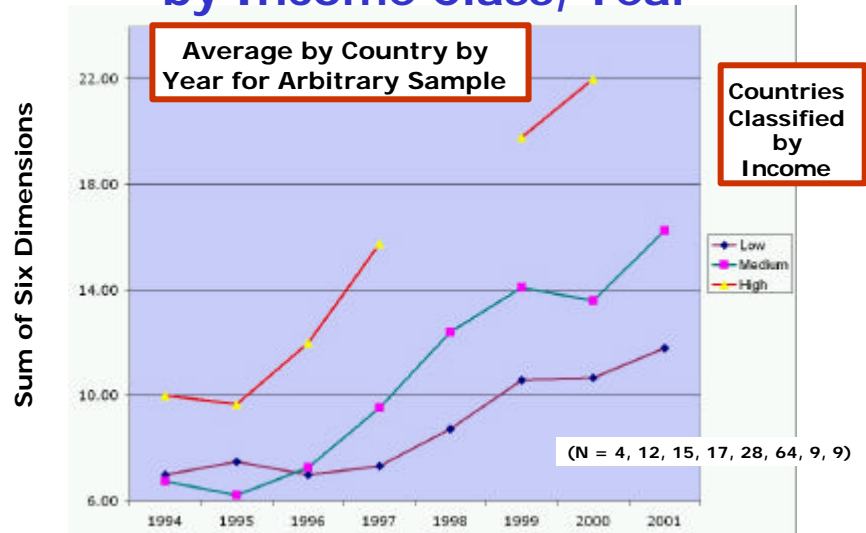- What can we learn from longitudinal studies?

Adding MOSAIC Dimensions Together

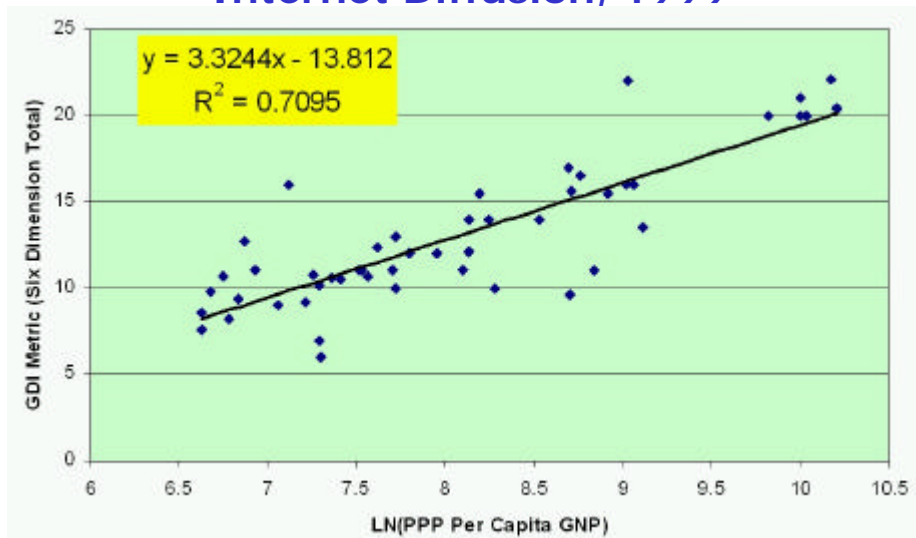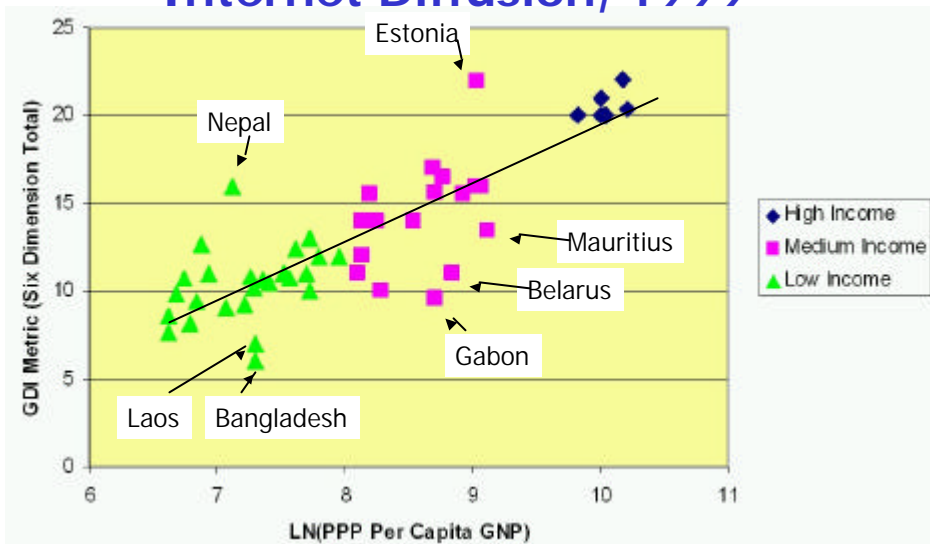|	Covers universe of possibilities	Other configurations possible
• Pervasiveness	☑	
• Geographic Dispersion	☑	☑
• Sectoral Absorption	☑	
• Connectivity Infrastructure		☑
• Organizational Infrastructure	☑	☑
• Sophistication of Use	☑	☑

Average Six Dimension Ratings by Income Class, Year

PPP Per Capita GNP Related to Internet Diffusion, 1999

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PPP Per Capita GNP Related to Internet Diffusion, 1999

Estonia

Nepal

Mauritius

Belarus

Gabon

Laos   Bangladesh

GDI Metric (Six Dimension Total)

LN(PPP Per Capita GNP)

- High Income
- Medium Income
- Low Income

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Patterns by Country Income

Country Income	Unique Patterns	Percent Total	Mean Value for Six Dimension Total
LOW	39	35.5%	10.5
MEDIUM	45	40.9%	13.4
HIGH	19	17.3%	17.2

Only 6.4% of patterns showed up in more than one income class

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The Supply/Demand Division: Which Sum (Area) is Bigger?

Is bigger than
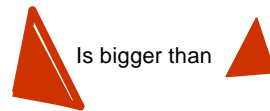
This country has an emphasis on or orientation towards the SUPPLY side rather than the DEMAND side

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Country Income vs. Supply-Demand Orientation

	Supply-Demand Orientation		
Country Income	demand	even	supply
Low	23.1%	17.9%	59.0%
Medium	35.6%	11.1%	53.3%
High	36.8%	31.6%	31.6%
Other	28.6%	42.9%	28.6%

- Patterns in low and middle classes only tend to be "supply"
- Patterns in high class only tend to be evenly distributed between supply, even, and demand
- Patterns that show up in more than one class tend to be "even"
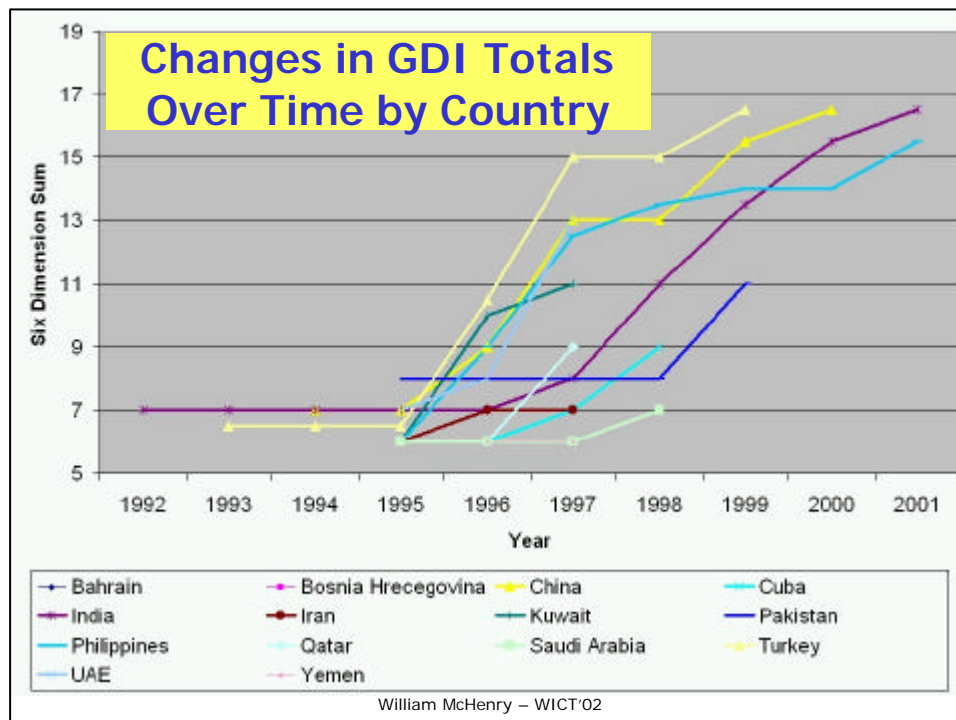
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Examples of Repeating Patterns

Six-Dimension Total	Times Pattern Repeated	P	GD	SA	CI	OI	SU	Countries
6.5	3	1	1.5	1	1	1	1	Turkey 1993-1995
7	10	1	2	1	1	1	1	India 1989-1996, Iran 1996-1997
7	7	1	1	1	1	2	1	Benin 1998, Bosnia Hrecegovina 1997, China 1994-1995, Laos 1999, Saudi Arabia 1998
8	4	1	2	1	1	2	1	Pakistan 1995-1998
8	2	2	2	1	1	1	1	Rwanda 1999, UAE 1996

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Regressions for Each Country Series

Country	SLOPE	N	Adjusted R-Squared	P	Significance	Country Type
India	0.88	14	0.73	0.00007	Significant at alpha=.01	Supply
Saudi Arabia	1.40	5	0.48	0.11761	Not Significant	Supply
Pakistan	1.57	6	0.53	0.06020	Siginificant at alpha=.10	Supply
Cuba	1.90	5	0.73	0.04094	Significant at alpha=0.05	Supply
Philippines	1.96	8	0.80	0.00180	Significant at alpha=.01	Even-->Supply
Bosnia Hrecegovina	2.10	4	0.58	0.15320	Not Significant	Even-->Supply
China	2.14	8	0.91	0.00016	Significant at alpha=.01	Supply-->Demand
Iran	2.20	4	0.57	0.15634	Not Significant	Even-->Supply
Turkey	2.23	8	0.91	0.00017	Significant at alpha=.01	Supply
Yemen	3.00	3	0.50	0.33333	Not Significant	Even
Kuwait	3.70	4	0.87	0.04307	Significant at alpha=0.05	Even-->Demand
UAE	4.00	4	0.90	0.03551	Significant at alpha=0.05	Fluctuating (Even, Demand)
Bahrain	4.50	3	0.93	0.12104	Not Significant	Even-->Demand
Qatar	4.50	3	0.93	0.12104	Not Significant	Even-->Demand

Changes in GDI Totals Over Time by Country

Six Dimension Sum vs Year (1992–2001)

Legend: Bahrain, Bosnia Hrecegovina, China, Cuba, India, Iran, Kuwait, Pakistan, Philippines, Qatar, Saudi Arabia, Turkey, UAE, Yemen

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How Long to Move Up from One Level to the Next?

From Level to Level	Measure	CI	GD	OI	P	SA	SU	Grand Total
1-2	Avg Years	3.00	1.00	3.33	3.43	1.86	2.78	2.67
	STD of Years	3.03	0.00	2.88	3.10	0.90	2.64	2.45
	N	6	4	6	7	7	9	39
2-2.5	Avg Years	1.80	3.00	2.33	2.00	1.50	3.00	2.14
	STD of Years	1.10	2.83	2.31	n/a	0.71	n/a	1.46
	N	5	2	3	1	2	1	14
2.5-3	Avg Years	1.33	1.00	1.00	1.00	1.00		1.11
	STD of Years	0.58	n/a	0.00	n/a	0.00		0.33
	N	3	1	2	1	2		9
2-3 by sum of	Avg Years	3.13	4.00	3.33	3.00	2.50	3.00	3.25
2-3	Avg Years	1	4.33	1	2.25		1.50	2.60
	STD of Years	n/a	3.51	n/a	1.5		0.71	2.27
	N	1	3	1	4		2	11
Evaluation		HARDER?	HARDER	ABOUT THE SAME	EASIER	HARDER?	EASIER	ABOUT THE SAME

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Too Little Data for Studying Digital Divide & Transition Times

Average years for transition for all dimensions:

	Country Income		
From-To	High	Medium	Low
1-2	1.20	2.04	7.50 N = 6
2-2.5		2.78	

Too little data to disaggregate further, or make any meaningful statements about other transitions

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Questions for Discussion

- Should we incorporate "proximate cause" metrics into the diffusion rating?
- Should we persist with ratings that are qualitative in nature and require consistent value judgments based on a strong body of evidence?
  - Can we make the latter routine with a "check-off" rating system?
- Has the methodology "aged" well and is it suitable for future use?

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Mosaic Drawbacks
(Minges, INET 2002)

- Often maps back to Internet users, income
- Some items require subjective assessment
  - Base data not always available or unreliable
- Omits certain factors
  - Does not factor in universal access issues such as affordability or presence of Internet cafes
  - Does not factor in "soft" factors such as education or literacy

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Determinants of Internet
Diffusion in a Country

TECHNOLOGY QUALITIES

Perceived Value

Ease of Use of the Internet

Cost of Internet Access

TECHNOLOGY CLUSTER INTERACTIONS

Access to Constituent Technologies

Demand for Capacity, Multiplicity of ISPs, Services Provided
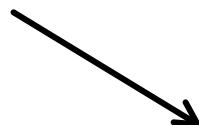
DIFFUSION & ABSORPTION

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Determinants of Internet Diffusion in a Country

EXTERNAL/SURROUNDING FORCES

Geography

Adequacy and Fluidity of Resources

Ability to Execute

Culture of Entrepreneurship

Regulatory/Legal Framework

Forces for Change

Enablers of Change

DIFFUSION & ABSORPTION

Data Collection Mandates: Two Choices

- **Collect data as part of regulatory regime, routine reports, with attempt at comprehensive reporting**
  - Additional cost: Probably bearable
  - Scope: Will miss many entities
  - Needed Persuasion to adopt: Moderate
- **Collect data as part of survey research across a number of topic areas**
  - Additional cost: May be too expensive for some countries
  - Scope: Will cover all entities of interest
  - Needed Persuasion to adopt: Significant

Data Collection Mandates: Pervasiveness

- Number of Internet Users – which definitions & methodology to use?
  - Subscribers (reported by ISPs)
  - Total Universe (total number with access)
    - Home, work
    - Internet café, educational institutions, other forms
  - Active Universe
    - going on line within given time period

Data Collection Mandates

- Geographic Dispersion
  - Existence and Number of Points of Presence in major geographic locations
  - Geographic structure of fixed and wireless access
  - Structure of Charges
    - Existence of toll-free dial-up (local and/or long distance) to Internet
    - Typical prices for various levels of access in various places

Data Collection Mandates

- Sectoral Absorption
  - Fraction of entities in each of four categories of education, commerce, public, and health that are under government regulation, support or control that have made commitment to Internet use as expressed by having their own servers, leased lines, or other evidence
  - Fraction of entities in each of three categories of education, commerce, and health that are not under government control that have made commitment to Internet use as expressed by having their own servers, leased lines, or other evidence

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Data Collection Mandates

- Connectivity Infrastructure
  - Backbone maps
  - International connectivity rates
  - Statistics on the traffic through exchange points
    - Public
    - Private
  - Nature, distribution of end-user access

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Data Collection Mandates

- Organizational Infrastructure
  - Level of competition for ISP services within cities
    - e.g., number cities with 1 ISP, 2-5 ISPs, > 5 ISPs
  - Brief summary of ISP and related regulations

Data Collection Mandates

- Sophistication of Use
  - Fraction of organizations of various sizes (e.g., SMEs vs. larger than SMEs) using the Internet for
    - electronic brochure/information dissemination only
    - conducting B2C transactions
    - conducting B2B transactions
  - End-user usage patterns
    - content (e.g. on-line shopping, e-mail, banking, entertainment)
    - technology (e.g. mobile Internet, SMS, voice over Internet, chat)
  - Indigenous development of Internet innovations

Use Check-Off for Survey About Personal Transforming Use

- "On-line communities proliferate around shared interests. These communities bring together people who otherwise would not have contact with each other. Interaction between members of such communities is substantive and often interactive."
- Examples for check off:
  - ❑ on-line clubs on various subjects
  - ❑ use of BBS, Web-cams, ICQ, instant messaging

Use Check-Off for Survey About Organizational Transforming Use

- "Business process re-engineering using Internet & Web. E-Commerce/E-business has taken hold. Significant percentage of Government & Business web sites interactive. Web sites becoming alternative distribution channel."
- Check off examples:
  - ❑ On-line ordering possible.
  - ❑ Customer service functions expand to permit customers to conduct transactions that formerly involved employees.
  - ❑ International companies use Internet as substitute for business trips, enabling round-the-clock collaborative product development.

Conclusions

- Statistical analyses suggest that gathering more comprehensive data would yield interesting results
  - Patterns, "supply" & "demand" orientation, transitions, etc.
- MOSAIC methodology has held up rather well, **but...**
- We must approach it is a qualitative methodology whose primary purpose is to uncover deeper relationships, causes, and recommendations

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References

- MOSAIC Group Studies/Publications
  - http://mosaic.unomaha.edu/Pages/GDI_Publications.html
- ITU Studies
  - http://www.itu.int/ITU-D/ict/cs/
- Press (ISOC) Surveys
  - http://som.csudh.edu/cis/lpress/gdiff/index.htm
- The Francophone Survey
  - http://www.cidif.org/diffusion/diffusion.pdf

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