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Continuing Education (CE) Credit

Recertification Credit forms for CE credit can be collected from the Registration Desk on Thursday.

Housekeeping

The conference proceedings will be available approximately 8 weeks after the conference.

Factors that Influence the Adoption of GIS Technology in the Property Assessors Office

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Adoption

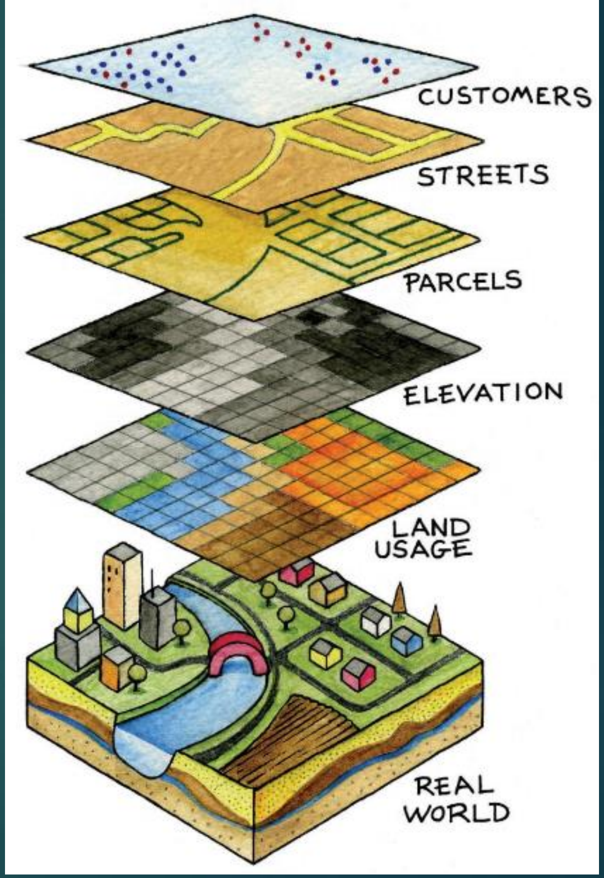
The instance of choosing to use a technology (Lee et al, 2003).

Use

The extent to which a technology is employed for a particular purpose (Lee et al, 2003).

Geographic Information System (GIS)

"…an integrated collection of computer software and data used to view and manage information about geographic places, analyze spatial relationships, and model spatial processes. A GIS provides a framework for gathering and organizing spatial data so that it can be displayed and organized (Wade & Sommer, 2006, p.90))."



Research Problem

- Adoption of GIS Technology is emerging in many professional work environments.
- Many uses of GIS Technology have been thoroughly documented in the literature.
  - Local Government, Environmental, Education, Mathematics, Engineering, Etc.
- Growing reliance and infusion of GIS into various work environments can be intimidating.
  - How do I use it? What is it used for? How Relevant is it to what I do?
  - Resistance and barriers to the use of GIS technology
- Not many studies address the factors or perceived factors that influence GIS adoption within many professional work environments.

Barriers for GIS Adoption in the Assessors Office

- Political resources, Cost, Time
- Education or skills (technical capacity)
- Lack of technical resources, system design
- Afraid of Change or close to retirement.
- Adoption and implementation is scary.
- Organizational and institutional factors may be a greater barrier than technical constraints (Ventura, 1995).

Research Purpose

- Assess factors that influence the adoption of GIS Technology in the Property Assessment profession.
- Explain causal effects of adoption or acceptance of GIS technology.
- This will help derive and inform best practices and approaches for organizations wishing to adopt or increase the usage of GIS technology.
  - Instructional Design of Courses
  - Professional Development and Training
  - Guidance on the adoption of simple and more advanced uses within Assessors Offices to streamline workflows.

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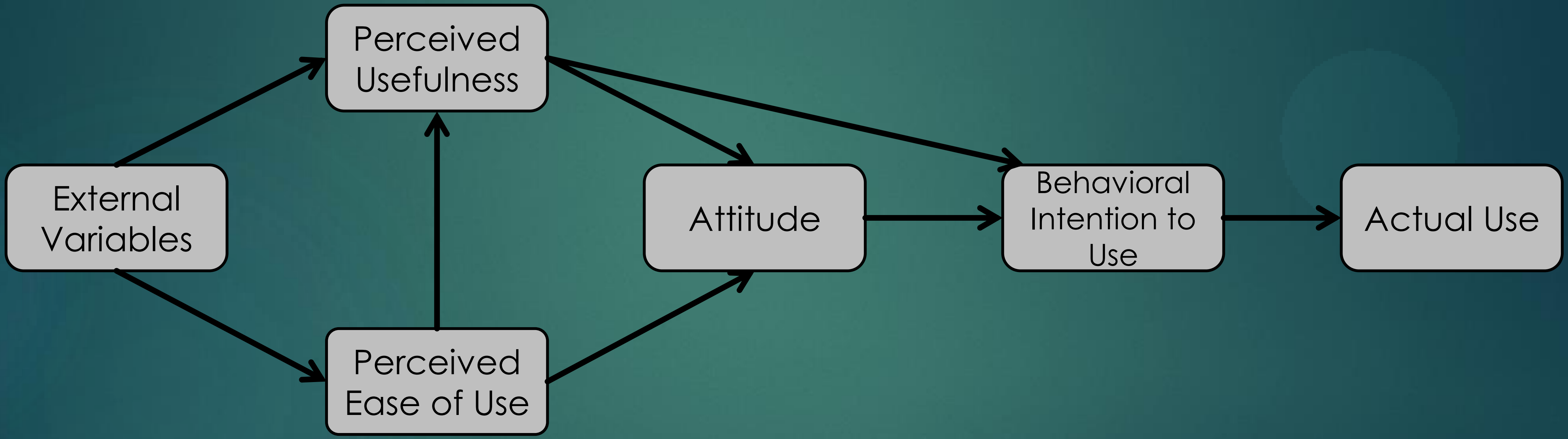
Research Questions

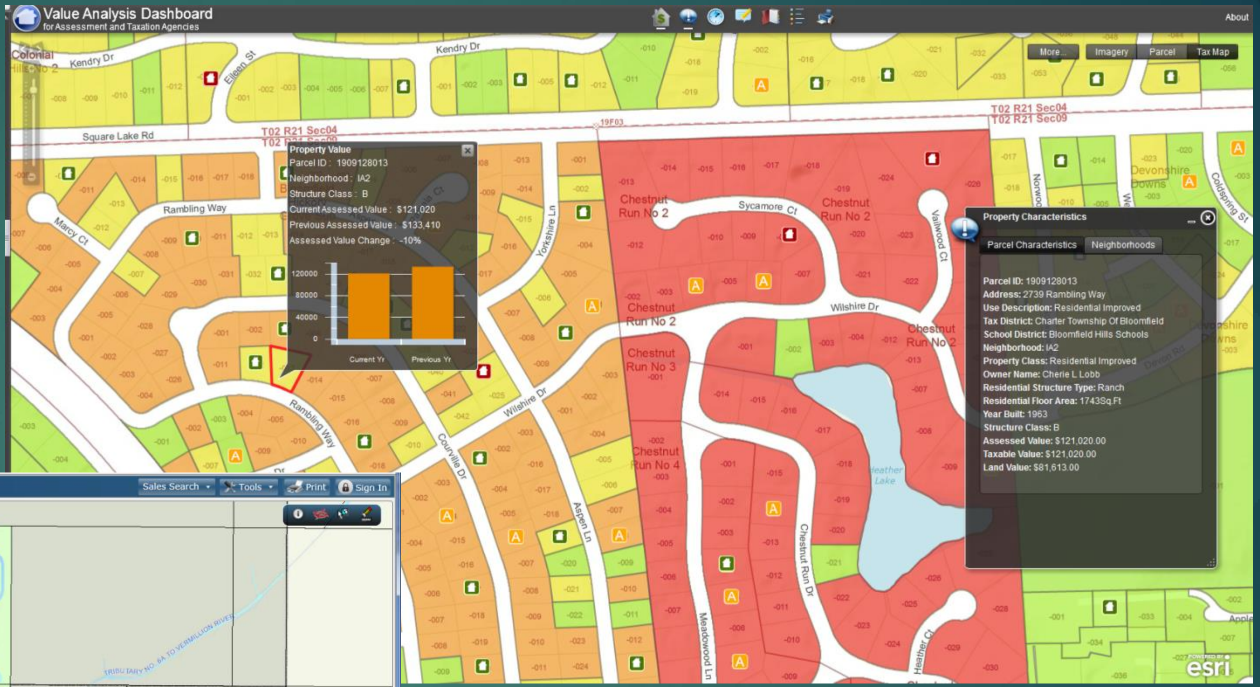
- What is the overall level of support on each potential construct for evaluating individual user adoption of GIS technology in the property assessment profession?
- Does the proposed extended TAM structural model provide an adequate framework for explaining GIS technology adoption within the property assessment profession?
- What effect does perceived quality of training with regard to the use and functionality of GIS technology have on factors of adoption?

Theoretical Framework

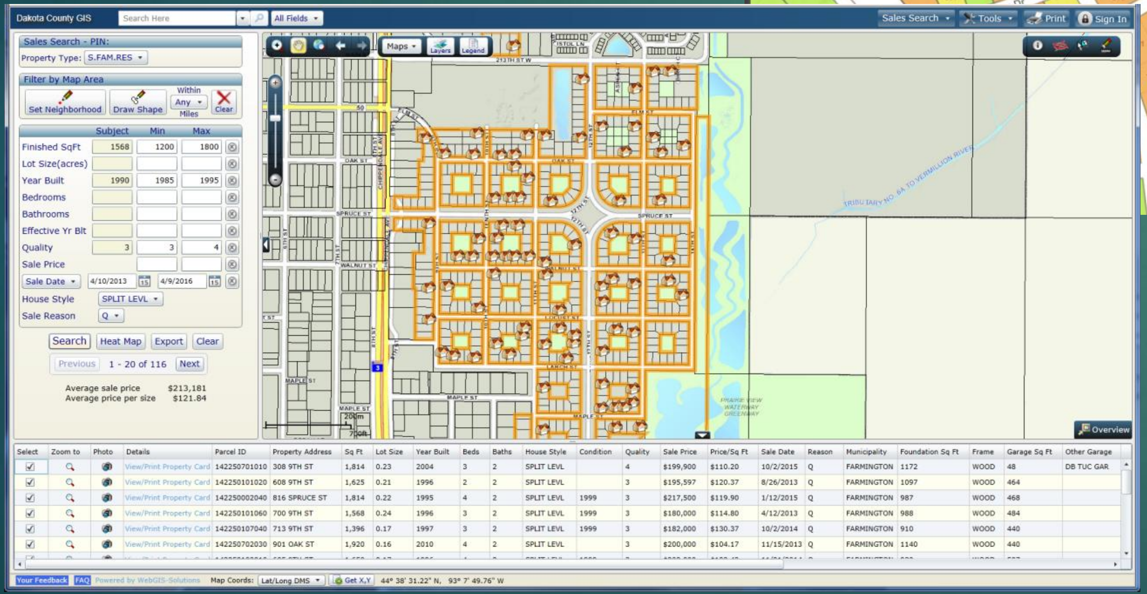
- Technology Acceptance Model (TAM)



GIS in the Assessors Office



CAMA
- Tabular data management
- Sales analysis
- Valuation approaches
- Equity analysis
- Administrative

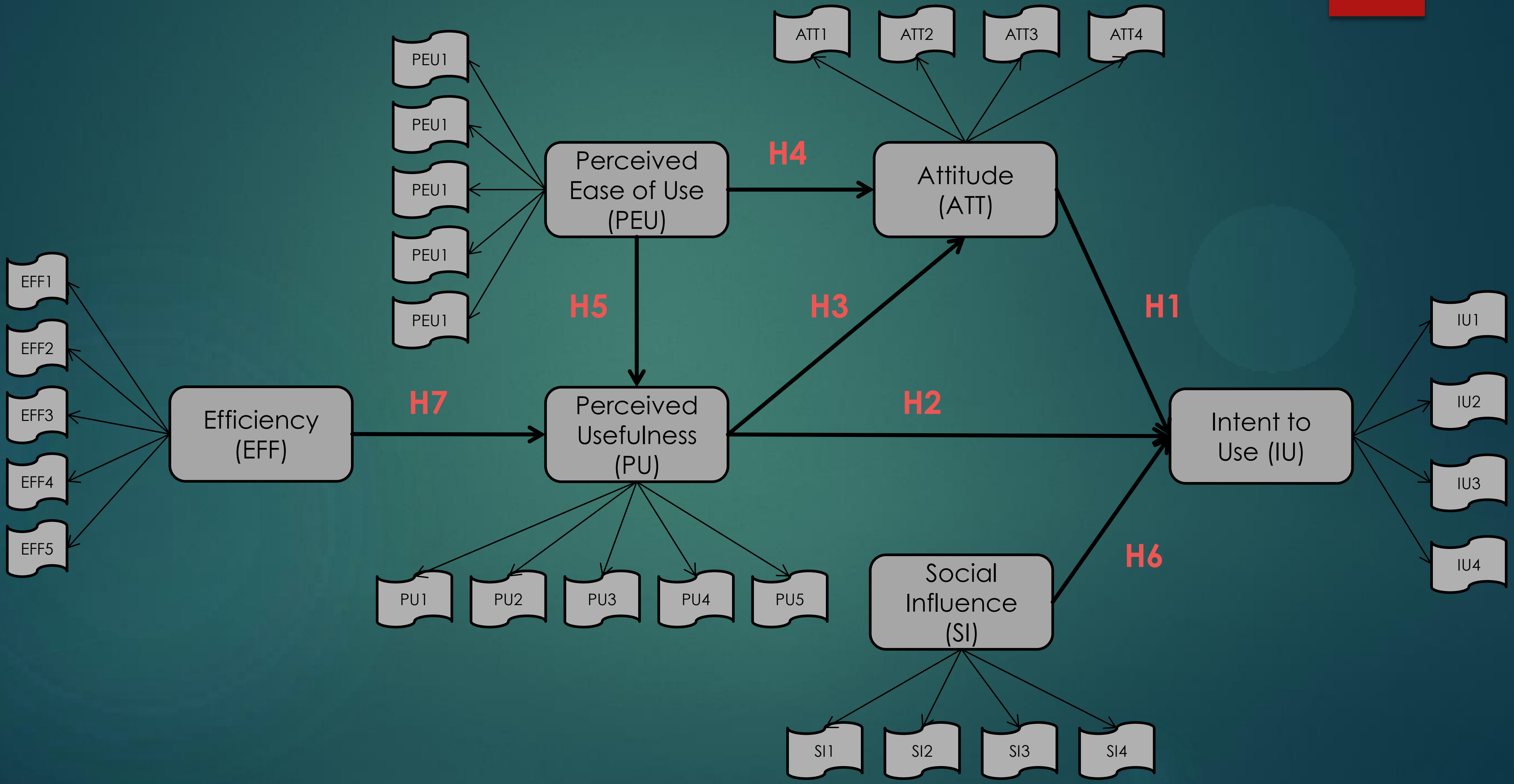


GIS
- Spatial data management
- Visualization of property characteristics
- Spatial Analysis and modeling of Sales
- Clustering of sales, permits, other
- Spatial equity analysis
    - Ratios, PRD, PRB, COD, etc

Methodology

- Online Survey instrument of 10 total questions sent to 12,000 e-mail addresses through online newsletter called IAAO Assessing Info (May 18th – June 10th, 2016)
  - Eight demographic questions
    - Education level, age, years of professional experience, years of GIS experience, location and size of jurisdiction, years of professional experience.
  - Most Frequent uses of GIS
  - 28 Likert-type scale statements on level of agreement.
- Research Questions
  - Analyze the factors level of support - Construct mean comparisons
    - Hypothesized that attitude and efficiency to have the highest mean scores.
  - Test the predictive model – CFA and SEM analysis
    - Hypothesized that the model will work!
  - Analyze training - T-test on each construct
    - Hypothesized that SI and PU are have the highest influence on perceived quality of training.

Conceptual Model



Results - Demographic Information

- 377 total responses (≈3%)
- Age

  Mean = 48.4, Median = 50, SD = 11.3
- Years of assessment experience

  Mean = 16, Median = 14, SD = 11.4
- Years of GIS technology experience

  Mean = 10, Median = 10, SD = 6.4

Results – Demographic Information

- Number of hours per week using GIS technology

Attributes	Frequency	%	Cumulative %
Less than 2	50	13.3	13.3
Between 2 and 5	90	23.9	37.1
Between 5 and 7	63	16.7	53.8
Between 8 and 10	57	15.1	69.0
More than 10	115	30.5	99.5
Do not use GIS	2	0.5	100.0
	377	100.0	

- Level of agreement on receiving quality training on the use and functionality of GIS

	Frequency	Percent	M	SD
Some Form of Agreement	258	68.4		
Some From of Disagreement	119	31.6		
Totals	377	100.0	5.04	0.917

Results – Overall Level of Agreement

Construct	Mean	SD	Variance
Perceived Ease of Use (PEU)	4.2	.88	.77
Efficiency (EFF)	4.8	.92	.85
Intention to Use (IU)	5.1	.72	.52
Attitude (ATT)	5.2	.77	.61
Social Influence (SI)	5.2	.77	.59
Perceived Usefulness (PU)	5.4	.70	.49

Correlations and measures of internal consistency between all constructs

Construct	PU	PEU	SI	EFF	ATT	Cronbach a
Perceived Usefulness (PU)						.92
Perceived Ease of Use (PEU)	.37					.88
Social Influence (SI)	.50	.36				.88
Efficiency (EFF)	.73	.47	.47			.93
Attitude (ATT)	.72	.45	.39	.70		.89
Intention to Use (IU)	.69	.40	.41	.69	.77	.80

Results – Overall Level of Agreement

Construct	Indicator	Question	Some Form of Agreement (%)	Some Form of Disagreement (%)	M	SD
Perceived Usefulness	PU1	Using GIS applications improves my job performance.	98.7	1.3	5.5	.75
	PU1	Using GIS improves my quality of work.	97.9	2.1	5.4	.76
	PU3	Using GIS gives me greater control over my work.	97.3	2.7	5.2	.87
	PU4	Using GIS in my position increases my task capacity.	96.8	3.2	5.2	.91
	PU5	Overall, I find GIS applications to be useful in my position.	98.9	1.1	5.5	.72
Perceived Ease of Use	PEU1	My understanding of GIS technology is clear.	88.6	11.4	4.5	1.0
	PEU2	Using a GIS application does not require a lot of skill.	62.1	37.9	3.8	1.2
	PEU3	Using a GIS application does not require a lot of mental effort.	56.5	43.5	3.6	1.2
	PEU4	Learning to operate a GIS application is easy for me.	85.1	14.9	4.5	1.1
	PEU5	I find GIS applications flexible to interact with.	79.8	20.2	4.3	1.1
	PEU6	Overall, I believe that GIS applications are easy to use.	81.7	18.3	4.3	1.1
Social Influence	SI1	My supervisors and managers think that I should use GIS.	93.4	6.6	5.1	1.0
	SI2	My colleagues think that I should use GIS.	97.1	2.9	5.1	.87
	SI3	The senior management of my department supports the use of GIS technology.	96.6	3.4	5.3	.87
	SI4	In general, the organization supports the use of GIS technology.	97.1	2.9	5.3	.82
Efficiency	EFF1	Using GIS reduces the time I spend on completing other job-related tasks.	88.9	11.1	4.7	2.0
	EFF2	Using GIS saves me time.	93.9	6.1	5.0	.98
	EFF3	Using GIS allows me to complete my tasks in much less time.	91.0	9.0	4.8	1.0
	EFF4	GIS allows me to accomplish tasks using less staff.	79.6	20.4	4.4	1.2
	EFF5	Overall, using GIS increases task efficiency.	94.4	5.6	5.0	.95
Attitude	ATT1	I like working with GIS technology.	97.1	2.9	5.2	.85
	ATT2	GIS makes work more interesting.	95.8	4.2	5.1	.96
	ATT3	Working with GIS is enjoyable.	95.0	5.0	5.0	.97
	ATT4	In property assessment, using GIS is a good idea.	97.9	2.1	5.5	.79
Intention to Use	IU1	When I have access to GIS, I intend to use it in my job.	98.9	1.1	5.5	.74
	IU2	Whenever possible, I would use GIS for my tasks.	97.3	2.7	5.2	.85
	IU3	Even outside of my job I would use GIS applications to do different things.	85.8	14.1	4.6	1.2
	IU4	I intend to increase my use of GIS applications for work in the future.	96.0	4.0	5.0	.97

Results – Causal Model

- Confirmatory Factor Analysis (CFA) Conducted on the measurement model to test the latent structure for proper fit.
- Based on Wan (2002) three stage analysis
- Same process was used for the structural model
  1. Developed models based on theory
  2. Assessed Model Fit

Index	Adequate Fit	Excellent Fit
Chi-square (χ^2)	Low	Low
Degrees of Freedom (df)	≥ 0	≥ 0
Likelihood Ratio (χ^2/df)	< 4.0	< 4.0
Standardized Root Mean Square Residual (SRMR)	< .10	< .05
Comparative Fit Index (CFI)	≥ .90	≥ .95
Root Mean Square Error of Approximation (RMSEA)	≤ .08	≤ .06

  3. Revised model to improve fit if necessary

Results – Causal Model

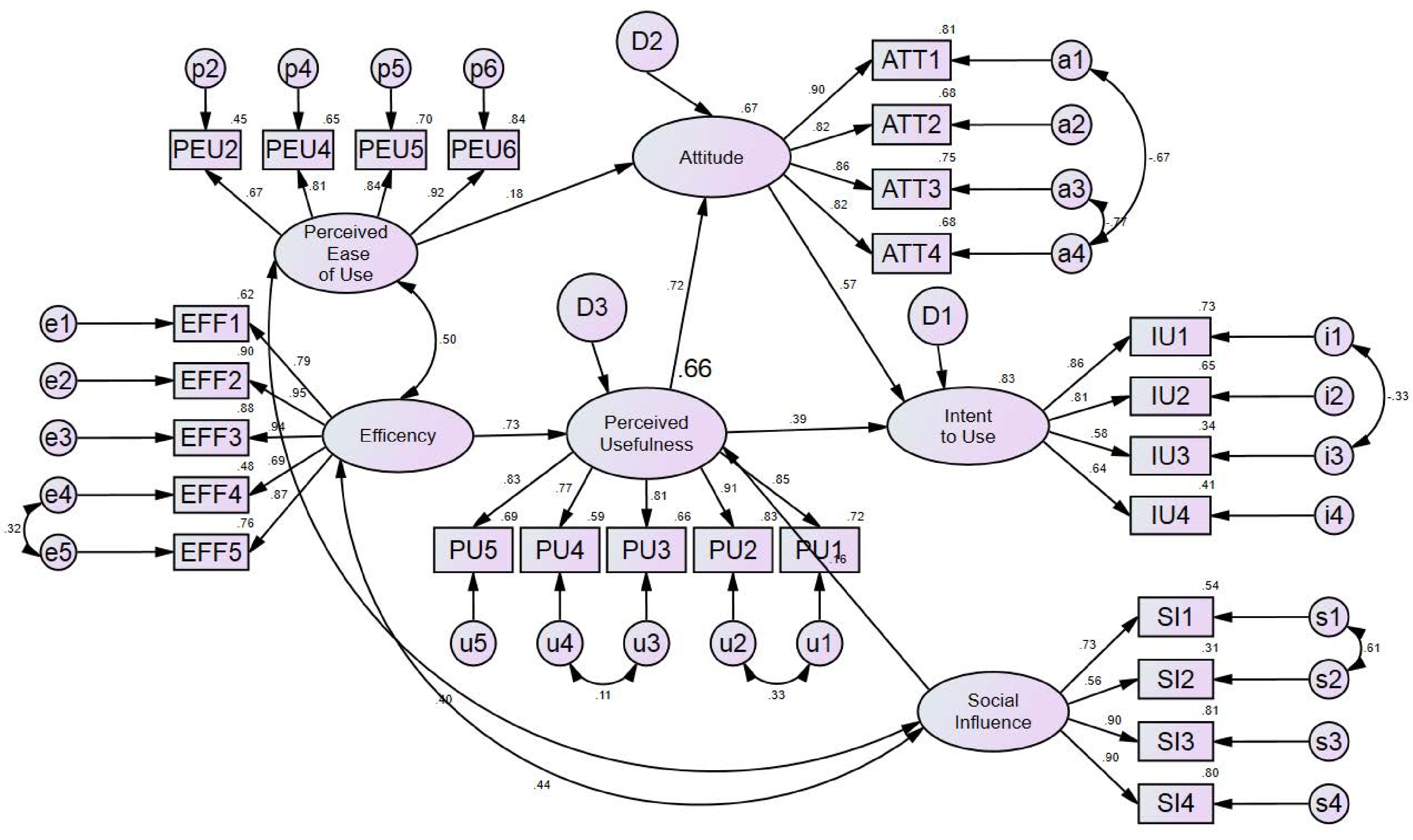
	Theoretical Model					Revised Model				
Indicator	URW	SRW	SE	CR	P	URW	SRW	SE	CR	P
PU←EFF	.624	.781	.042	14.90	***	.561	.730	.039	14.56	***
PU←SI						.132	.157	.035	3.74	***
PU←PEU	.004	.005	.038	.113	.910					
ATT←PEU	.233	.246	.041	5.69	***	.183	.185	.039	4.74	***
ATT←PU	.741	.665	.053	13.97	***	.873	.720	.058	15.09	***
IU←PU	.336	.357	.053	6.40	***	.388	.390	.059	6.54	***
IU←SI	.073	.089	.029	2.51	.012					
IU←ATT	.480	.567	.049	9.74	***	.468	.570	.050	9.42	***
PEU2←PEU	1.00	.671				1.00	.671			
PEU4←PEU	1.12	.809	.081	13.85	***	1.11	.807	.080	13.86	***
PEU5←PEU	1.14	.838	.080	14.26	***	1.31	.836	.079	14.26	***
PEU6←PEU	1.24	.916	.082	15.13	***	1.24	.919	.082	15.18	***
EFF5←EFF	1.00	.869				1.00	.869			
EFF4←EFF	.993	.693	.053	18.66	***	.994	.694	.053	18.66	***
EFF3←EFF	1.15	.938	.042	27.51	***	1.15	.939	.042	27.62	***
EFF2←EFF	1.13	.950	.040	28.32	***	1.12	.950	.040	28.31	***
EFF1←EFF	1.04	.786	.053	19.45	***	1.04	.786	.053	19.46	***
PU1←PU	1.00	.882				1.00	.849			
PU2←PU	1.07	.934	.0.38	27.83	***	1.08	.909	.037	28.86	***
PU3←PU	1.07	.811	.051	20.78	***	1.11	.812	.058	19.13	***
PU4←PU	1.03	.753	.057	18.23	***	1.10	.770	.062	17.64	***
PU5←PU	.900	.825	.042	21.47	***	.945	.833	.047	20.04	***
ATT1←ATT	1.00	.863				1.00	.902			
ATT2←ATT	1.12	.865	.050	22.56	***	1.02	.822	.047	21.75	***
ATT3←ATT	1.26	.885	.051	22.92	***	1.09	.864	.046	23.47	***
ATT4←ATT	.798	.742	.047	16.89	***	.855	.823	.051	16.92	***
IU1←IU	1.00	.846				1.00	.857			
IU2←IU	1.11	.809	.060	18.39	***	1.09	.808	.058	18.94	***
IU3←IU	1.08	.581	.102	10.57	***	1.06	.579	.099	10.68	***
IU4←IU	.946	.644	.070	13.49	***	.925	.639	.068	13.57	***
SI1←SI	1.00	.731				1.00	.731			
SI2←SI	.642	.556	.041	15.59	***	.644	.559	.041	15.65	***
SI3←SI	1.05	.903	.063	16.70	***	1.04	.898	.062	16.71	***
SI4←SI	.975	.891	.059	16.62	***	.978	.895	.059	16.69	***

***$p < .05$

Index	Theoretical Model	Revised Model
Chi-square (χ^2)	962.87	894.57
Degrees of Freedom (df)	284	283
Lilkihood Ratio	3.39	3.16
Standardized Root Mean Square Residual (SRMR)	.082	.071
Comparative Fit Index (CFI)	.918	.926
Root Mean Square Error of Approximation (RMSEA)	.080	.076

***$p <$

Results – Causal Model (Revised)



Results – Causal Model Hypothesis Tests

- *H1: An assessor's attitude toward using GIS technology has a positive influence on their intention to use it to do their jobs.*
  - **Supported:** Stronger attitude does have a positive effect on IU ($\beta = .57$, $p < .05$).
- *H2: PU has a positive influence on the intention of property assessment valuation professionals using GIS technology.*
  - **Supported:** PU does have an positive influence on IU($\beta = .39$, $p < .05$).
- *H3: PU has a positive influence on the ATT of property assessment valuation professionals using GIS technology*
  - **Supported:** PU does have a positive influence on the ATT of valuation professionals ($\beta = .72$, $p < .05$).
- H4: *PEU has a positive influence on property valuation professional's attitudes using GIS technology.*
  - **Supported:** PEU does have a positive influence on ATT ($\beta = .18$, $p < .05$).
- H5: *PEU has a positive influence on the PU of property valuation professional's using GIS technology.*
  - **Not Supported:** Not a statistical significant relationship between PEU and PU.
- H6: *Social influence has a positive influence on intention of property assessment professionals use of GIS technology.*
  - **Could be supported:** Very low parameter estimates and modification indices suggested an alternative approach. Reexamined with SI on PU
- H7: *Efficiency has a positive influence on the PU of property assessment professionals using GIS technology.*
  - **Supported:** EFF does have a positive influence PU ($\beta = .73$, $p < .05$).

Results – Quality of Training

- As a user understands a technology through experience or training the more likely they are to utilize it or adopt it more regularly.
- Hypothesis: Perceived usefulness and social influence have the greatest impact on training.
- There is a sig difference between those receiving quality training and not receiving quality training.
- Result - PU, SI, and ATT had the highest mean score.

Construct	Yes		No		t	p	Cohen's d
	M	SD	M	SD			
Perceived Usefulness (PU)	5.5	.66	5.2	.76	-3.8	.00*	.42
Perceived Ease of Use (PEU)	4.4	.77	3.6	.88	-8.6	.00*	.97
Social Influence (SI)	5.3	.71	5.0	.85	-4.0	.00*	.38
Efficiency (EFF)	4.9	.85	4.4	.96	-5.3	.00*	.55
Attitude (ATT)	5.3	.73	4.9	.81	-4.4	.00*	.52
Intention to Use (IU)	5.2	.67	4.8	.78	-4.5	.00*	.55

*$p < .05$ (2-tailed)

Conclusions

- PU (M = 5.4) & SI (M = 5.2) had the highest level of agreement
  - Hypothesis: Attitude and Efficiency
  - Lee et al. (2003) writes that PU is the most important construct when predicting adoption
  - Supported by Davis et al. (1989), Wallace & Sheetz (2014), Yousafzai et al. (2010)
- Overall the factors in the model supported 83% of the total variance in predicting an assessment professionals intention to use GIS!
  - Five of seven hypothesis were supported with the revised model.
  - Extensions were helpful, but further revisions needed
  - The Model was successful in predicting intent to use supporting the hypothesis and falling in line with other forms of technology!!

Conclusions cont…

- High satisfaction on each of the constructs significantly determined if professionals had received quality training in GIS.
  - Highest was on PU which was expected due to the importance of PU on use and adoption (Lee et al., 2003).
  - If professionals do not receive adequate and quality training in thinking spatially, they will be more likely to reject the use of GIS.
  - Was important to understand factors of influence before designing instruction.
  - Further investigation into these factors may provide the necessary guidance on how to design instruction for professionals in the adoption of GIS.

Limitations

- Response Rate
  - Catered more to assessment managers or supervisors who have been around forever.
  - Also may have catered to respondents with experience with GIS Technology
- Causality rationale is open to interpretation for the SEM.
  - Plan to run and publish with out the Extended TAM (Potentially better fit model)
- Preconceived notions on the usage of GIS may introduce bias.
- Generalizability – only a snapshot in time.
  - Sample collected through convenience and snowballing.

Implications for Practice and Future Study

- This is the fist known use of the TAM for GIS technology to understand adoption.
  - Future studies on GIS to take into account other extension variables on PU and PEU.
- How assessors approach adoption and use of GIS technology within their organizations.
  - IU is directly affected by ATT and PU it may be beneficial to provide:
    - Information before adoption on use and functionality, how it will help.
    - Direction and training, professional development on its use (despite type of GIS)
    - Inclusion of Assessment staff in the design of GIS technology to provide some ownership.
- Training is essential
  - Higher quality of training makes a difference on all adoption constructs especially PU.
  - Active Learning to solve actual assessment related problems.

Share your GIS innovations and success stories!

The editorial board of the *GIS for Assessment Professionals* book is looking for practitioners to share their GIS case studies. What do we mean by case studies?

We are looking for specific examples of how GIS was used to solve:

- an assessment or valuation problem,
- or made your office operations more efficient,
- or made information sharing easier for your jurisdiction,
- or improved the outcomes of your assessment duties.

Tell us your story and contribute to information sharing of the latest uses of GIS in the assessment industry.

Please send a brief description of 2 or 3 paragraphs and any exhibits or diagrams you wish to share of your GIS case study by March 1st to *cusack@iaao.org*. Your submission will be forwarded for consideration to the *GIS for Assessment Professionals* book editorial board.

If you have any questions, contact Margie Cusack, Research Manager at *cusack@iaao.org*.

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