

Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation

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The Outline of the Study

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- 2. The Perceived Characteristics of Using an Innovation
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1. Introduction

- **The Goal of the Study:**
- Development of an instrument to measure the potential adopters' perceptions of the technology



1. Introduction Cont'd

- The designed instrument is intended to be a tool for the study of *initial adoption* and *diffusion of innovations*.
- 25-item, version of the instrument is suggested.



1. Introduction Cont'd

- Information Tech. Adoption → Information Systems Implementation
- Inadequate Measurement of Adoption → Poor Implementation



1. Introduction Cont'd

- Researchers consider the theories of the innovation diffusion to study *implementation problems* (Alexander 1989; Brancheau and Wetherbe 1990; Moore 1987; Johnson and Rice 1987).
- The major focus was users' perceptions of the tech.
- The authors have proposed an instrument to measure users' perceptions of tech. Innovations.



1. Introduction Cont'd

- Rogers (1983) identified 5 perceived characteristics of innovation which affect the rate of the diffusion of an innovation.
- The authors proposed to test this set of characteristics in the context of the adoption of Personal Work Stations (PWS) by individuals.



1. Introduction Cont'd

- The study has focused on *developing scales* to measure the various perceptions of using the PWS in particular.
- However, the items applicable only to using PWS can be excluded from the scales. Hence, the resulting instrument is general, with slight modifications.



2. Perceived Characteristics of Using an Innovation

- The main constructs of the interest in this research were the ***perceived characteristics*** of using an innovation(Rogers,1983).
- He defined them as follows:
 - Relative Advantage
 - Compatibility
 - Complexity
 - Observability
 - Trialability



2. Perceived Characteristics of Using an Innovation

- In addition to perceived characteristics, two further *constructs* were identified which were thought important in the decision to adopt an innovation.
 - **1. Image (Social Approval)**
 - «the degree to which use of an innovation is perceived to enhance one's image or status in one's social system»
 - **2. Voluntariness of Use**
 - «the degree to which use of innovation is perceived as being voluntary, or of free will»



3. Existing Measurement Instruments

- Prior to developing measurement instruments for the *seven PCI*, the literature was searched for tests or scales that were already developed, which then were then evaluated in terms of their validity and reliability.



3. Existing Measurement Instruments

- Ostlund's Instrument (1969)
- Holloway (1977)
- Bolton (1981)
- Davis (1986)
 - Perceived Usefulness
 - Perceived Ease of Use



4. Instrument Development Process

- Development of the instrument was carried out in 3 stages:
 - **1. Item Creation**
 - Objective: to ensure content validity
 - **2. Scale Development**
 - Objective: to assess the construct validity
 - **3. Instrument Testing**
 - Objective: to test overall instrument



Stage 1: Item Creation

- All items identified in the existing instruments were categorized to various PCI.
- New items were created for those PCI categories with fewer than 10 items
- 7-point Likert Scale ranging from «extremely disagree» to «extremely agree»

Compatibility:

I really need a tool like the PWS.

Using a PWS would help me a lot with my work.

Stage 1: Item Creation

Voluntariness

1. My superiors expect me to use a PWS.
2. My use of a PWS is voluntary (as opposed to required by my superiors or job description).
- 3.* My boss does not require me to use a PWS.
- 4.* Although it might be helpful, using a PWS is certainly not compulsory in my job.

Relative Advantage

- 1.* Using a PWS enables me to accomplish tasks more quickly.
- 2.* Using a PWS improves the quality of work I do.
- 3.* Using a PWS makes it easier to do my job.
4. The *disadvantages* of my using a PWS far outweigh the advantages. (See Note a.)

Stage 1: Item Creation

- In Total, 94 items were defined.

Voluntariness:	6	Ease of Use:	18
Image:	8	Observability:	14
Relative Advantage:	18	Trialability:	14
Compatibility:	16		



Stage 2: Scale Development

- To assess the **construct validity**, items were sorted at first.
- Then, **convergent validity** and **discriminant validity** were demonstrated.



Stage 2: Scale Development

- Sorting Procedures:
 - Each items was printed on one 3x5 inches index card.
 - The cards were shuffled into random order for the presentation to the judges.
 - Each judge sorted the cards into categories and labelled independently from the other judges.
 - Each set of judges included a secretary, administrative clerk, student and professor.



Stage 2: Scale Development

- Items Placement Score
- Row C shows that all 40-item placement for *Construct C* were successful, but that in Row B, only 60% (24/40) were within the target.

CONSTRUCTS		ACTUAL					
		A	B	C	N/A	Total	% Hits
THEORETICAL	A	36	2	1	1	40	90
	B	12	24	4	0	40	60
	C	0	0	40	0	40	100

Item Placements: 120 Hits: 100 Overall "Hit Ratio": 83%

Stage 2: Scale Development

Appendix 1.
Item Placement Ratios

FIRST SORTING ROUND

TARGET CATEGORY	ACTUAL CATEGORIES								TOT	TGT %
	VOL	IMAGE	REL ADV	COMPAT	EOU	TRIAL	OBS	N/A		
VOL	20		1	3					24	83
IMAGE		29	3						32	91
REL ADV		1	71						72	99
COMPAT	5	1	3	42	4		1	8	64	66
EOU			2		64			1	72	96
TRIAL	17			1		38			56	68
OBSERV	1	1	23		6	2	24	2	56	43
Total Item Placements: 376			Hits: 293				Overall Hit Ratio: 78%			

Stage 2: Scale Development

- The table demonstrates construct validity, with high potential reliability coefficients.

FOURTH SORTING ROUND

TARGET CATEGORY	ACTUAL CATEGORIES									TOT	TGT %
	VOL	IMAGE	REL ADV	COMPAT	EOU	TRIAL	RES DEM	VISI-BILITY	N/A		
VOL	20									230	100
IMAGE		26	1						1	28	93
REL ADV			59	3		2	3		1	68	87
COMPAT				43		1				44	98
EOU				1	63	4				68	93
TRIAL	7					37				44	84
RES DEM			1		1		29		1	32	91
VISIBILITY							2	34		36	94
Total Item Placements: 340			Hits: 311			Overall Hit Ratio: 92%					

Appendix 2. Judges' Labels for Categories

First Sorting Round Individual Judge's Construct Labels

CONSTRUCTS	J U D G E S			
	A	B	C	D
VOLUNTARINESS	Access/ Barriers	Voluntariness	Personal Fit	Voluntariness
IMAGE	Image/ Visibility	Image	Image	Status
RELATIVE ADVANTAGE	Advantages	Benefits	General Usefulness	Value
COMPATABILITY	Fit with Personal Style	Experience	Fit with Job	Change in Work Patterns
EASE OF USE	Required Skills	Understanding	Ease of Use	Ease
TRIALABILITY		Trialability	Trialability	Availability
RESULT DEMONSTRABILITY	Explaining Results	Perception of Results	Measureability	

Stage 3: Instrument Testing

- Final step is to test overall instrument
- Questionnaire were distributed to the sample of 20 users
- The scales were analyzed by Cronbach's ALPHA



Stage 3: Instrument Testing

Scale	Original Length	Reduced Length
Voluntariness	5	4
Image	7	5
Relative Advantage	14	9
Compatibility	11	4
Ease of Use	10	8
Result Demonstrability	8	4
Trialability	11	5
Visibility	9	4
TOTAL	75	43

TABLE 2
Reliability Coefficients

	PILOT TESTS						FIELD TEST					
	FIRST (n = 20)			SECOND (n = 66)			SAMPLE #1 (n = 270)			SAMPLE #2 (n = 270)		
SCALE NAME	ITEMS	ALPHA	GLB	ITEMS	ALPHA	GLB	ITEMS	ALPHA	GLB	ITEMS	ALPHA	GLB
VOLUNTARINESS	5	0.93	0.96	4	0.87	0.88	4	0.82	0.83	4	0.87	0.86
IMAGE	7	0.71	0.89	5	0.84	0.88	5	0.79	0.80	4	0.80	0.83
RELATIVE ADVANTAGE	14	0.89	0.98	9	0.90	0.91	9	0.95	0.95	8	0.92	0.93
COMPATIBILITY	11	0.52	0.86	4	0.81	0.82	4	0.88	0.88	4	0.83	0.84
EASE OF USE	10	0.79	0.91	8	0.83	0.85	8	0.81	0.81	6	0.80	0.80
TRIALABILITY	11	0.77	0.94	5	0.72	0.73	5	0.73	0.74	5	0.71	0.72
RESULT DEMONSTRABILITY	8	0.20	0.64	4	0.72	0.74	4	0.81	0.81	3	0.77	0.78
VISIBILITY	9	0.83	0.96	4	0.37	0.46	5	0.72	0.75	4	0.73	0.81

Notes ITEMS: Number of items in each scale; ALPHA: Cronbach's Alpha reliability coefficient, GLB: Guttman's Lower Bound for reliability

Stage 3: Instrument Testing

- Factor Analysis was used as another assesment of construct validity.

Appendix 4. Rotated Factor Matrix

Numbers in brackets refer to respective item numbers for each scale in Appendix 3.

ITEM	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
RELATIVE ADV (3)	0.83014	-0.20739	0.09293	-0.05519
RELATIVE ADV (2)	0.80094	-0.17114	0.04037	0.08332
RELATIVE ADV (7)	0.78119	-0.01433	-0.05072	0.12049
RELATIVE ADV (9)	0.76953	-0.10946	0.10502	0.10199
RELATIVE ADV (6)	0.76644	-0.09817	0.12219	0.02485
RELATIVE ADV (5)	0.74996	-0.12779	0.11349	0.15115
COMPATIBILITY (4)	0.73611	-0.11529	0.23797	0.12184
COMPATIBILITY (3)	0.72881	-0.00200	0.18394	0.15350
RELATIVE ADV (1)	0.72514	-0.20658	0.12878	-0.03200
RELATIVE ADV (8)	0.72305	0.02852	0.08674	0.16745
COMPATIBILITY (2)	0.66501	-0.33841	0.15294	-0.00917

Stage 3: Instrument Testing

- **Adopters versus Nonadopters:**
- Diffusion Theory specifies that adopters should have more positive perceptions of using the PWS than nonadopters.
- Thus, final check on the validity of the instrument were done by comparing the sample of adopters and non-adopters.
- Adopters were determined by asking respondents to indicate whether they currently used a personal work station (PWS).



Stage 3: Instrument Testing

- **Adopters versus Nonadopters:**
- Mann-Whitney U-test were conducted.
- Significant difference between two groups were observed.



Stage 3: Instrument Testing

- Adopters versus Nonadopters:

TABLE 3
Variable Means for Adopters Versus Nonadopters

Perceived Characteristics	Adopters (n = 418)	Nonadopters (n = 122)	U-Test Z-Scores	Significance
Voluntariness	3.3	5.0	-10.01	0.0000
Image	4.3	3.9	3.08	0.0021
Relative Advantage	5.9	4.8	-9.39	0.0000
Compatibility	5.7	4.4	-9.68	0.0000
Ease of Use	5.1	4.5	-5.54	0.0000
Trialability	4.6	4.3	-2.23	0.0257
Result Demonstrability	5.8	4.9	7.81	0.0000
Visibility	5.9	5.3	5.13	0.0000

TABLE 4

*Discriminant Analysis**Standardized Canonical Discriminant Function Coefficients*

Constructs Included	Equation	
	1	2
Compatibility	0.59	N/A
Relative Advantage	0.27	0.70
Result Demonstrability	0.43	0.44
Visibility	0.35	0.39
Ease of Use	-0.29	-0.17
Trialability	-0.22	-0.20
Image	-0.08	-0.03

5. Summary and Conclusions

- The study offers several contributions.
- The most obvious is the creation of an overall instrument to measure various perceptions of using an information technology Innovation.
- The method of developing the scales provides a high degree of confidence in their content and construct validity.



5. Summary and Conclusions

- 34-item instrument, comprising 7 scales, all with acceptable levels of reliability.
 - Compatibility
 - Relative Advantage
 - Result Demonstrability
 - Visibility
 - Ease of Use
 - Trialability
 - Image



5. Summary and Conclusions

- The development process also helped to clarify and refine some definitions of the various PCI.
- **Observability** as originally defined by Rogers seemed to be tapping two distinctly different constructs, **Result Demonstrability** and **Visibility**.
- As a result, **two** distinct different scales were developed in additon to five PCI.



Question?

