e-Logistics Tracking Systems Success

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E-Logistics

- Tracking items ensures the smooth operation of fulfilling customers' orders.
- Application of e-commerce technologies to logistics, e-logistics, provides opportunities for further cost reduction and differentiation.

The problem

- Little guidance is available for evaluating the success of tracking system investments.
- Until validated e-logistics tracking systems success measures are established, managers must continue to use rules-of-thumb.

Our Model's Basis

- We present an empirically validated measurement model developed from DeLone and McLean's (D&M) (2003) Information Systems Success Model.
- E-commerce systems span a range of business processes, e-commerce systems' success needs to be evaluated from broader perspectives (Martinsons et al, 1999; Molla & Licker, 2001).

DeLone & McLean, 2003, JMIS.

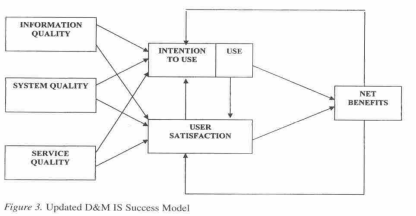


Figure 3. Updated D&M IS Success Model

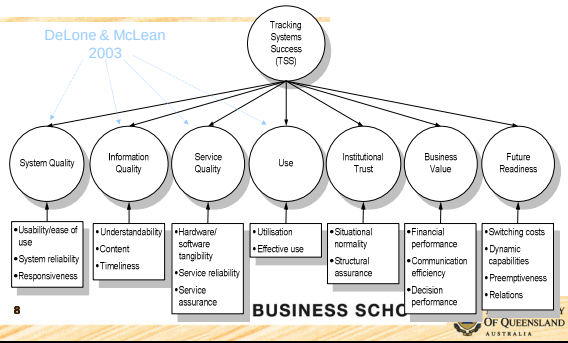
The D&M model: Extensions?

- IS are regarded as resource or capability that may affect a firm's long term competitiveness, i.e., Strategic attributes are important success dimensions.
- For e-logistics tracking systems, managers are the main users. Consequently, *user satisfaction* contains criteria that managers consider important and would, therefore, be analogous with TSS itself, i.e., an aggregate construct.

Model development

- We posit that *TSS* is a second-order latent construct consisting of seven first-order latent constructs:
  - *system quality*
  - *information quality*
  - *service quality*
  - *use*
  - *institutional trust*
  - *business value (net benefits)* and,
  - *future readiness.*

Our initial model



Constructs, characteristics, and items

Construct	Characteristic	Number of items	Source
System quality	Usability/ease of use	2	Goodhue & Thompson (1995)
	System reliability	2	Goodhue & Thompson (1995)
	Responsiveness	2	Goodhue & Thompson (1995)
Information quality	Understandability	2	Goodhue & Thompson (1995); Etezadi-Amoli & Farhoomand (1996)
	Content	4	Goodhue & Thompson (1995); Etezadi-Amoli & Farhoomand (1996); ISWorld Net (2004)
	Timeliness	2	Etezadi-Amoli & Farhoomand (1996)
Service quality	Tangibility of hardware/software	2	Pitt et al. (1995)
	Service reliability	2	Pitt et al. (1995)
	Service assurance	2	Pitt et al. (1995)
Use	Utilisation	2	Goodhue & Thompson (1995)
	Effective use	2	Torkzadeh & Doll (1999)
Institutional trust	Situational normality	3	McKnight et al. (2002); McKnight & Chervany (2001)
	Structural assurance	3	McKnight et al. (2002); McKnight & Chervany (2001)
Business value	Financial performance	3	Zhu & Kraemer (2002); Lederer et al. (2001); SCOR (SCC, 2005)
	Communication efficiency	2	Lederer et al. (2001)
	Decision performance	2	Swink (1995)
Future readiness	Switching costs	2	Sethi & King (1994)
	Dynamic capabilities	5	Sethi & King (1994); Lederer et al. (2001)
	Preemptiveness	3	Sethi & King (1994)
	Relations	3	Lederer et al. (2001); SCOR (SCC, 2005)

Method

- Web-based survey with members of LAA and APICS - 47 final, valid response cases
- 80% of respondents were in middle or upper management roles!
- Most respondents rely on either manual systems (39%) or barcode systems (38%) when tracking their logistics items – RFID tags (7%).
- Intranets are the most utilised technology (44.7%) followed by manual technology (fax, snail mail, printouts) (21.3%).
- Post-hoc: interviewed two supply-chain experts.

Table 7 First Order Factors

Panel A Eigenvalues and variance explained of first-order factors

Component	Extraction Sums of Squared Loadings		
	Eigenvalues	% of Variance	Cumulative %
1	8.695	43.474	43.474
2	2.452	12.260	55.764
3	1.548	8.742	64.506
4	1.379	6.896	71.402

Panel B Final first-order factor solution

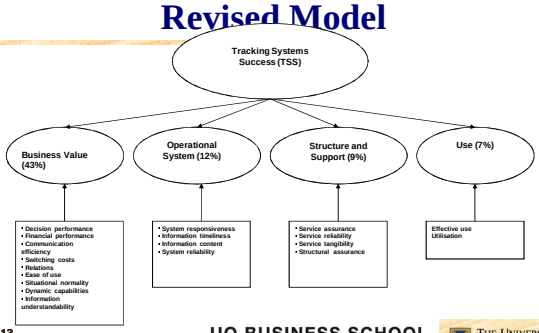
	Component			
	Business Value	Operational System	Structure and Support	Use
business value (decision performance)	.867			
business value (financial performance)	.838			
future readiness (switching costs)	.820			
business value (communication efficiency)	.805			
future readiness (relations)	.732			
system (ease of use)	.725			
trust (situational normality)	.622			
future readiness (dynamic capabilities)	.621			
information quality (understandability)	.566			
system quality (system responsiveness)		.766		
information quality (timeliness)		.735		
information quality (content)		.710		
system quality (system reliability)		.696		
service quality (service assurance)			.812	
service quality (service reliability)			.740	
service quality (tangibility)			.717	
trust (structural assurance)			.698	
use (effective use)				.871
use (utilisation)				.837

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization (converged in 7 iterations)

Revised model

- Resulting from the two-step factor analyses between the factors and the higher-order TSS, we respecified our TSS model.
- The revised TSS model is reflected by:
  - *business value*
  - *operational system*
  - *structure* and *support* and,
  - *use*.
- Each factor was measured or operationalized by the corresponding set of characteristics. Several characteristics were renamed to better fit the construct that they represented.

Revised Model



Business value

- Explaining 43 percent of the variance in the characteristics, business value is the primary driver of TSS. Analysis also confirms that characteristics identified in prior research load on this factor;
  - business value (*financial performance*),
  - business value (*communication efficiency*), and
  - business value (*decision performance*)

Business value

- Other characteristics of *future readiness* also loaded onto the same factor. These were:
  - *switching costs*,
  - *dynamic capabilities*,
  - *preemptiveness*
  - *information quality*, and
  - *relations*
- For the logistics tracking system context, *future readiness* and *business value* may not be distinctive constructs.

Operational system

- Operational system is the second factor extracted. It explains 12 percent of total variance.
- Comprised the characteristics used to measure system quality
  - system responsiveness and system reliability
- and information quality
  - information timeliness and content.

Operational system (cont.)

- The convergence of *system quality* and *information quality* possibly indicates that in TS contexts, users do not view system and information as two separate factors.
- When asked an open-ended question about the aspects that made up TSS, aside from business value, operational system was the only factor the experts mentioned.

Structure and support

- Explains nearly 9 percent of total variance, structure and support is the third factor extracted comprising six success measures.
- Formed predominantly by characteristics of *service quality*.
  - *Service reliability*, *service assurance*, and *hardware/software tangibility*.
- Structure and support is broader than *service quality* as it also consists of trust
  - *Structural assurance*
- Measures the environment in which the tracking system operates
  - *E.g., technical, legal, and security support.*

Use

- *Use* is an IS success factor championed by D&M.
- Formed of two characteristics only: use (*effective use) and utilisation*, use explains almost 7 percent of total variance.

Second-order factor analysis

- The analysis suggests the formation of a single higher-order factor: *tracking systems success (TSS)* explaining around 55 percent of the first-order factor total variance.

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.227	55.682	55.682	2.227	55.682	55.682
2	.848	21.212	76.894			
3	.558	13.942	90.836			
4	.367	9.164	100.000			

Business value, operational system, structure and support, and use: Principal Component Analysis

	Component 1
Business Value	0.824
Operational System	0.814
Structure and Support	0.767
Use	0.547

Business value

- *Business value* proved to be the most important success factor indicated by the highest loading amongst other factors (43%)
- *Business value* was also the first factor that was mentioned by the experts.
- Consistent with DeLone and McLean's (2004) proposition that net *benefits* is the most important success measure as it captures the balance of both the positive and negative impacts of e-commerce on stakeholders.
- This analysis underscores the argument for the inappropriateness of solely relying on the Supply-Chain Operations Reference model and the Logistics Scoreboard to evaluate TSS, as they focus heavily on operational rather than strategic elements, and may not reflect *business value*.

Performance measures

- BSC
  - Financial perspective
  - Customer perspective
  - Internal business perspective
  - Innovation and learning perspective
- SCOR
  - Cycle time metrics
  - Cost metrics
  - Service/quality metrics
  - Asset metrics
- Logistics Scoreboard
  - Logistics financial performance
  - Logistics productivity performance
  - Logistics quality performance
  - Logistics cycle time performance

Structure and support

- *Operational system* (12%) (system quality and information quality) is widely regarded as an important success measure (D & M, 2003).
- While explaining 9% of total variance, *structure and support* is less important in representing *TSS* than *business value* and *operational system*.
- *Structure and support* likely explains why the system's environment and support have been overlooked in past IS success studies. The original D&M model does not include a measure of structure. The revised D&M model includes *service quality* to measure system's support, but still does not consider structural aspects.
- Structure and support's relative lack of importance as a factor in TSS may arise from the commoditisation of technology and confidence in its structure, particularly as systems become more robust and standards proliferate.
- *Use* (7%) as success measure is widely supported in the literature.

Was TSS actually measured?

- The composite measure of TSS was correlated with responses to the question: "Overall, the performance of the system is excellent".
- There was a positive and significant correlation between TSS and overall excellence (0.747, $p<0.001$).

Discussion

- Business value is an important measure of TSS, but using SCOR or Logistics Scoreboard only is not a sufficient measure of *business value*.
- To obtain a more complete picture of success consideration should also be given to:
  - operational system,
  - structure and support, and
  - system use.

Discussion

- New systems should be evaluated relative to:
  - the potential business value they could deliver,
  - the systems' operational aspects,
  - the structure and support for the systems, and
  - the systems' capability of effective and normal use.

"The Future of RFID"
Viehland & Wong (2007) *JTAECR*, **2(2)**, 74-81

- 3 rounds of Delphi study with 4 RFID specialists in retail (3 technical; 1 business manager) in NZ
- 7 factors impacting the success of RFID:
  - Standardisation (1.75)
  - System costs (2.25)
  - Business process re-engineering (2.75)
  - Integration (3.00)
  - Privacy (5.25)
  - Lack of RFID-skilled professionals (5.75)
  - Data warehousing (6.75)

Limitations

- The usual caveats associated with:
  - Questionnaire-based research
  - Small sample size
  - The requirement for screening and selection of characteristics that represent the constructs.

Where to from here?

- Require a more detailed examination of the *business value* factor using a larger proportion of managers who are focused on strategic decisions.
- Examine the applicability of the model to other areas, e.g., general IS and e-commerce systems success.
- Investigation of the causal relationships amongst success factors to better understand the interactions between factors and their effects on TSS

Thank you for your comments and suggestions!