MONASH University
Information Technology

David Arnott

ACIS 2007 Design Science Panel:
The Nature of DSS Design Science

Centre for Decision Support and Enterprise Systems Research

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Project on Foundations of DSS

- Arnott, D, & Pervan, G. (2005). A critical analysis of decision support systems research. *Journal of Information Technology*.
- Arnott, D, & Pervan, G. (2007). Eight key issues for the decision support systems discipline. *Decision Support Systems*.

The Article Sample

Journal	Origin	Ranking (ISI Impact Factor)	Journal Orientation	No of DSS Articles Published	DSS Design Science Articles Published	DSS Design Science Articles as a Percentage of Published DSS Articles
Decision Sciences (*DS*)	US	A (1.055)	Multi-discipline	67	19	28.4
Decision Support Systems (*DSS*)	US	A (0.954)	General IS	500	247	49.4
European Journal of Information Systems (*EJIS*)	Europe	A (1.093)	General IS	25	5	20.0
Group Decision and Negotiation (*GD&N*)	US	Other (0.696)	Specialist IS	139	24	17.3
Information and Management (*I&M*)	US	Other (1.524)	General IS	104	13	12.5
Information and Organization (*I&O*)	Europe	Other (not abstracted)	General IS	16	1	6.3
Information Systems Journal (*ISJ*)	Europe	A (0.559)	General IS	16	1	6.3
Information Systems Research (*ISR*)	US	A (2.054)	General IS	34	5	14.7
Journal of Information Technology (*JIT*)	Europe	Other (1.543)	General IS	25	2	8.0
Journal of Management Information Systems (*JMIS*)	US	A (1.406)	General IS	84	18	21.4
Journal of Organizational Computing and Electronic Commerce (*JOC&EC*)	US	Other (not abstracted)	Specialist IS	73	12	16.4
Journal of Strategic Information Systems (*JSIS*)	Europe	Other (0.579)	General IS	8	1	12.5
Management Science (*MS*)	US	A (1.669)	Multi-discipline	41	13	31.7
MIS Quarterly (*MISQ*)	US	A (4.978)	General IS	35	1	2.9
Total				1,167	362	31.0

Assessing Design Science Reseach

- Hevner, A.R., March, S. T., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS Quarterly,* 28 (1), 75-106.

- Seven “clear guidelines for understanding, executing, and evaluating the research”
- “Each of theses guidelines should be addressed in some manner for design-science research to be complete.”

Guideline 1: Primary Artifact

“Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.”

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Design Artifact	1990 - 1993		1994 - 1997		1998 - 2001		2002 - 2005		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Construct	0	0.0	0	0.0	1	1.3	1	1.0	2	0.6
Model	7	9.7	9	7.8	5	6.5	7	7.1	28	7.7
Method	12	16.7	34	29.6	18	23.4	39	39.8	103	28.5
Instantiation	56	77.8	83	72.2	61	79.2	63	64.3	263	72.7
Total	*72*		*115*		*77*		*98*		*362*	

Guideline 2: Problem Relevance

“The objective of design-science research is to develop technology-based solutions to important and relevant business problems.”

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Importance of Business Problems

	1990 - 1993		1994 - 1997		1998 - 2001		2002 - 2005		Total	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Strategic	3	4.2	12	10.4	14	18.2	9	9.2	38	10.5
Tactical	14	19.4	15	13.0	10	13.0	11	11.2	50	13.8
Operational	55	76.4	88	76.5	53	68.8	78	79.6	274	75.7
Total	72		115		77		98		362	

Guideline 2: Problem Relevance Part 2

Relevance to IS Practitioners

	1990 - 1993		1994 - 1997		1998 - 2001		2002 - 2005		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
High	3	4.2	5	4.3	2	2.6	5	5.1	15	4.1
Medium	19	26.4	29	25.2	28	36.4	26	26.5	102	28.2
Low	50	69.4	81	70.4	47	61.0	67	68.4	245	67.7
Total	72		115		77		98		362	

Relevance to Managerial Users

	1990 - 1993		1994 - 1997		1998 - 2001		2002 - 2005		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
High	14	19.4	28	24.3	21	27.3	23	23.5	86	23.8
Medium	24	33.3	33	28.7	30	39.0	39	39.8	126	34.8
Low	34	47.2	54	47.0	26	33.8	36	36.7	150	41.4
Total	72		115		77		98		362	

Guideline 3: Design Evaluation

“The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.”

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Evaluation Methods

		1990-	1993	1994-	1997	1998-	2001	2002-	2005	Total	
										No.	%
Observational	Case study	6	8.3	10	8.7	13	16.9	13	13.3	42	11.6
	Field study	1	1.4	0	0.0	3	3.9	3	3.1	7	1.9
Analytical	Static	0	0.0	0	0.0	1	1.3	0	0.0	1	0.3
	Architecture	0	0.0	1	0.9	0	0.0	0	0.0	1	0.3
	Optimization	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Dynamic	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Experimental	Controlled experiment	1	1.4	4	3.5	5	6.5	5	5.1	15	4.1
	Simulation	14	19.4	17	14.8	17	22.1	26	26.5	74	20.4
Testing	Functional	0	0.0	2	1.7	0		2	2.0	4	1.1
	Structural	0	0.0	0	0.0	0		1	1.0	1	0.3
Descriptive	Informed argument	0	0.0	3	2.6	2	2.6	2	2.0	7	1.9
	Scenarios	13	18.1	21	18.3	8	10.4	15	15.3	57	15.7
None		37	51.4	57	49.6	28	36.4	31	31.6	153	42.3

Guideline 3: Design Evaluation Part 2

Choice of Evaluation Method

	1990 - 1993		1994 - 1997		1998 - 2001		2002 - 2005		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Highly Appropriate	16	22.2	25	21.7	36	46.8	38	38.8	115	31.8
Adequate	18	25.0	32	27.8	12	15.6	28	28.6	90	24.9
Poor	38	52.8	58	50.4	29	37.7	32	32.7	157	43.4
Total	72		115		77		98		362	

Quality of Evaluation Execution

	1990 - 1993		1994 - 1997		1998 - 2001		2002 - 2005		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
High	5	6.9	16	13.9	13	16.9	23	23.5	57	15.7
Medium	17	23.6	24	20.9	26	33.8	34	34.7	101	27.9
Low	50	69.4	75	65.2	38	49.4	41	41.8	204	56.4
Total	72		115		77		98		362	

Guideline 4: Research Contributions

"Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies."

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"Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies."

	No.	%
Design artifact	360	99.4
Foundations	1	0.3
Evaluation methodologies	1	0.3
Total	362	

Guideline 5: Research Rigor

"Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact."

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Rigor of the Theory Foundations

	1990 - 1993		1994 - 1997		1998 - 2001		2002 - 2005		Total	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Strong	20	27.8	41	35.7	26	33.8	38	38.8	125	34.5
Adequate	38	52.8	47	40.9	42	54.5	46	46.9	173	47.8
Weak	14	19.4	27	23.5	9	11.7	14	14.3	64	17.7
Total	72		115		77		98		362	

Rigor of Research Method

	1990 - 1993		1994 - 1997		1998 - 2001		2002 - 2005		Total	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Strong	0	0.0	6	5.2	2	2.6	4	4.1	12	3.3
Adequate	10	13.9	21	18.3	18	23.4	31	31.6	80	22.1
Weak	62	86.1	88	76.5	57	74.0	63	64.3	270	74.6
Total	72		115		77		98		362	

Guideline 6: Design as a Search Process

"The search for an effective artifact requires utilizing available means to reach desired ends wile satisfying laws in the problem environment."

Guideline 7: Communication of Research

“Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.”

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"Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences."

Effectiveness of Technology-Oriented Communication

	1990 - 1993		1994 - 1997		1998 - 2001		2002 - 2005		Total	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
High	17	23.6	29	25.2	28	36.4	41	41.8	115	31.8
Medium	43	59.7	61	53.0	41	53.2	48	49.0	193	53.3
Low	12	16.7	25	21.7	8	10.4	9	9.2	54	14.9
Total	72		115		77		98		362	

Effectiveness of Management-Oriented Communication

	1990 - 1993		1994 - 1997		1998 - 2001		2002 - 2005		Total	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
High	0	0.0	2	1.7	3	3.9	0	0.0	5	1.4
Medium	10	13.9	8	7.0	14	18.2	16	16.3	48	13.3
Low	62	86.1	105	91.3	60	77.9	82	83.7	309	85.4
Total	72		115		77		98		362	

DSS Design-Science Research

- **Artifact virtually the only contribution**
- **Instantiations (73%), methods (29%) the artifacts**
- **Major problem areas**
  - Evaluation
  - Research method rigor
  - Some improvement over time

Observations about the Hevner et al. Guidelines

- **Can use the guidelines to assess design-science research**
  - Clear view of what is needed for improvement
- **Some guidelines difficult to operationalize**
  - Guideline 6 (Search) the hardest
- **Difficult to apply to interpretive studies**

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