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Abstract

This study investigated how Information Systems researchers accounted for time in the research design of their studies, as an indication of changing trends in the rigor of IS research. The time period of studies was determined from an analysis of papers published in ten outlets between 1980 and 1996. Of 336 papers found, the 173 empirical papers were classified using a scheme derived from a study by Orlikowski and Baroudi (1991). The papers were classified as 'one-shot', 'multiple snapshot', 'longitudinal' or 'process trace', where one-shot papers were regarded as being of low rigor. There were indications that the rigor of the research had generally improved between 1980 and 1996. However, more than a third of empirical papers published between 1992 and 1996 did not account for time in their research design.

Introduction and Background

When Information Systems (IS) emerged in the 1960s, it soon became apparent that it needed to establish itself as a field of research to prosper (Benbasat 1995). Because the IS community first focussed on developing curricula (Benbasat 1995) and then on topic-based research (Keen 1991), there was concern from both inside and outside the discipline about the quality of its research. Despite the general shift to methodological-based research in the late 1980s (Keen 1991) the relationship between IS and other disciplines was problematic, partly because of negative perceptions about the rigor of IS research.

IS was vulnerable as it was new, small, uncertain of its own nature and lacked status in the 'academic pecking order' (King 1993). As '… other disciplines … [set] the criteria for assessing IS research' (Keen 1991), its lack of credibility (Benbasat & Weber 1996) limited its resource allocation. IS instruments and research procedures were criticised for their quality (Straub & Carlson 1989; Grover 1997). There was a need to gain the respect of researchers from outside IS (Avison & Fitzgerald 1991). One way to do so was to increase the rigor of IS research.

The design of an empirical study needs to account for time order (Denzin 1989; Haga & Zviran 1994). In one IS study, only 30% of the investigations accounted for time (Haga & Zviran 1994) so that claims of causal inference could not be substantiated for the others.

A one-shot study takes a discrete snapshot of the data at one point in time while a cross-sectional study takes snapshots on a minimum of two occasions. Where two snapshots of the data are taken, the design is considered superior to a one-shot study (Haga & Zviran 1994). If more data points are taken in a cross-sectional study, the experimental design becomes a 'time series'. Time series is a strong experimental design as 'repeated measurements, before or after an experimental variable shield a study from internal validity threats' (Haga & Zbviran 1994). Consequently, a one-shot study is of lesser quality than cross sectional designs or those accounting for time in a more rigorous manner, such as longitudinal or process trace investigations. Longitudinal studies collect data continuously over a long period of time such as months or years (Orlikowski & Baroudi 1991). Process trace investigations also use continuous data collection but focus on a discrete event over a short period.

It can be seen that there are compelling reasons to monitor the quality of IS research. One way to do so is to consider the time period of empirical studies.

Methodology

The aim of the study was to investigate the time period used in mainstream empirical studies published by the Australian IS academic community between 1980 and 1996. The findings will contribute to a better understanding of trends in the design and rigor of IS research.

The Australian context was chosen as the findings of a recent study suggest that it echoes major methodological trends set in North America (Ridley & Keen 1998). Furthermore, the short history of IS academic mainstream research in Australia means that nearly its entire development to 1996 can be captured, while the small number of Australian publications means that almost all IS publications in the leading mainstream publication outlets (Ridley *et al.* 1998) can be analyzed. Such characteristics of Australian IS research allow close to the entire population of relevant studies to be investigated, rather than a sample.

A descriptive, positivist approach was taken (Orlikowski & Baroudi 1991). Analysis was undertaken of all refereed, empirical papers with at least one Australian author published between 1980 and 1996 in *MIS Quarterly*, *IS Research*, *Management Science*, *Academy of Management Review*, *Communications of the ACM*, *ACM Computing Surveys*, *European Journal of IS*

and *The Australian Journal of IS*, and in the proceedings of the International Conference of IS and the Australasian Conference on IS. Three IS researchers classified the papers, first determining which of the 336 papers found were empirical. Intercoder reliability was calculated to be in excess of 70%, which was considered acceptable. The empirical papers were categorized by the time period reported, using a scheme based on a study by Orlikowski and Baroudi (1991). In their analysis of 155 IS papers published from 1983 to 1988, Orlikowski and Baroudi (1991) found 90.3% were one-shot, 4.5% were longitudinal, 3.9% were multiple snapshot and 1.3% were process trace.

Results

The time periods reported in the IS papers analyzed are displayed in Table 1.

Time Period	No. of Papers	% of Empirical Papers
One-shot	75	43.35
Multiple snapshot	46	26.59
Longitudinal	45	26.01
Process trace	7	4.05
Total empirical papers	**173**	**100.00**

Table 1 Time Period of Refereed Empirical IS Papers Published 1980–1996 by Australian Academic Researchers

As can be seen from Table 1, between 1980 and 1996 one-shot investigations dominated with over 43% of the total Australian empirical papers. More than 26% of all empirical studies analyzed employed a multiple snapshot approach, 26% were longitudinal and 4% used process trace approaches. As one-shot studies are not often associated with rigorous research, the findings comment clearly on the quality of Australian IS research. However, it is encouraging that close to 57% of the Australian empirical research published between 1980 and 1996 in the outlets did account for time.

Although the totals are of interest, they do not allow examination of trends over the period. Consequently, the annual totals for each time period were determined for the empirical papers between 1980–1996. They are presented in Table 2.

Year	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	Totals
One-shot	0	0	0	2	0	2	1	0	1	0	3	2	7	7	9	14	27	**75**
as % of total	0	0	0	67	0	100	100	0	33	0	43	29	37	35	38	38	57	**43**
Longitudinal	0	0	0	1	0	0	0	0	0	0	2	1	7	5	10	12	7	**45**
as % of total	0	0	0	33	0	0	0	0	0	0	29	14	37	25	42	32	15	**26**
Multiple snapshot	1	0	0	0	0	0	0	1	2	1	0	4	4	6	5	11	11	**46**
as % of total	100	0	0	0	0	0	0	100	67	100	0	57	21	30	21	30	23	**27**
Process trace	0	0	0	0	0	0	0	0	0	0	2	0	1	2	0	0	2	**7**
as % of total	0	0	0	0	0	0	0	0	0	0	29	0	5	10	0	0	4	**0**
Totals	**1**	**0**	**0**	**3**	**0**	**2**	**1**	**1**	**3**	**1**	**7**	**7**	**19**	**20**	**24**	**37**	**47**	**173**
as % of total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 2 Time Period Categories of Australian Mainstream Empirical Academic IS Papers Published During 1980–1996, Expressed Both as Raw Figures and Percentages of Annual Totals. (As percentages have been rounded to the nearest whole number, some totals exceed 100%.)

It will be noted that few papers were published before 1990. As it is difficult to determine trends from small data sets, this characteristic is a limitation of the study. However, as the full population of relevant papers for the period were analyzed, it remains a limitation that is difficult to overcome. To determine whether changes arose from variations in the time period used rather than from changes to the proportions of empirical and non-empirical papers, the number of papers using each time period was determined as a percentage of the annual total of empirical papers.

In the earlier years of IS research in Australia, one-shot papers formed a major to total influence on the published research in 1983, 1985 and 1986. In 1982 and 1984, no empirical papers were published. After 1986 the proportion of one-shot papers declined dramatically, and in general formed approximately 40% of the total empirical papers, except in 1987 and 1989 when no one-shot papers were found. The general decline in the proportion of one-shot papers suggests that a positive shift in the quality of the published research occurred between 1980 and 1996.

Except in 1983, there were no longitudinal papers found until 1990. After 1989 the longitudinal time period category became a major one in Australian IS research, contributing a minimum of 14% of the total

empirical papers in 1991, to a maximum of almost 42% in 1994.

In 1980 the only empirical Australian paper found was a multiple snapshot paper. Thereafter until 1987, no other papers from the category were found. Between 1987 and 1989 inclusive, and again in 1991, more multiple snapshot papers were published than any other empirical papers. Between 1992 and 1996 the proportion of multiple snapshot papers steadied, from a minimum of almost 21% of the total empirical papers in 1994 to a maximum of 30% in 1993.

No process trace papers were published before 1990. Apart from in that year when two process trace papers were published from a total of seven, this kind of investigation formed just a small proportion of the total empirical research. Only in 1992, 1993 and 1996 were other process trace papers found, so that the time period was more prevalent from 1992.

When comparison was made between the Australian results for 1983–1988 only, and those from Orlikowski and Baroudi (1991), a smaller proportion of Australian one-shot and process trace papers were found with a higher proportion of longitudinal and multiple snapshot papers. As the comparison was made on the basis of only ten Australian papers for the period, percentages have not been provided. However, the Australian study confirmed the very dominant role of one-shot studies noted by Orlikowski and Baroudi (1991) between 1983 and 1988.

Many reasons can be suggested for the changes to the use of time periods over the period. These include increased take-up of interpretive research in the 1990s with its increased emphasis on continuous data collection, greater exposure of Australian IS researchers to IS research methods courses since the introduction of IS PhD programs in the 1990s and the increased concern of leading IS publication outlets with the rigor of IS papers.

Conclusion

The investigation showed that since approximately 1990 there has been more variety in the time periods used in Australian mainstream IS empirical published research. A decline in the proportion of one-shot investigations and an increase in the proportion of multiple snapshot, longitudinal and process trace studies suggest that there was a favourable shift in the quality of Australian IS research examined over the period, particularly in the 1990s. Even so, there may be cause for concern in that over a third of the empirical studies investigated from 1992 took a single snapshot in time.

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