Management, Organisational and Technological Change in Australian Workplaces: Evidence from the AWIRS Data Sets

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1 Introduction

Issues concerning the rate and nature of management, organisational and technological change are of key importance in understanding enterprise performance. This paper provides an analysis of workplace 'change' by using data from the two Australian Workplace Industrial Relations Survey (AWIRS). The AWIRS surveys contain a large number of questions concerning management, organisational and technological change and this paper's primary aim is to provide a broad analysis of these variables. The paper's secondary aim is to investigate the inter-relatedness of the various variables that concern workplace change. The paper does not include a survey of the previous empirical research carried out on the 1990 AWIRS data set, or the equivalent UK survey, and interested readers are referred to Drago and Wooden (1994), Nunes et al (1993), Machin and Wadhwani (1991) and Daniel (1987) for further discussion and references.

The main Australian Workplace Industrial Relations Surveys were conducted in 1990 and 1995, and covered workplaces with 20 or more employees. A total of 2004 workplaces were surveyed in 1990 and 2001 in 1995. Although the surveys are primarily concerned with industrial relations, there are a number of questions relating to organisational, management and technological change. Section 2 presents an overview of these variables by presenting frequencies of the responses to various 'change' questions, for both the 1990 and 1995 surveys. Special attention is given to comparing responses between the two years in order to investigate if the rate of change has increased or decreased. This comparison is hampered by the fact that the questions asked in 1995 differ from those asked in 1990. The paper highlights these changes and also recodes some variables to allow an approximate comparison over time.

The main AWIRS surveys comprise of a number of questionnaires. These include the 'General Management Questionnaire' (GMQ), the 'Employee Relations Management Questionnaire' (EMQ) and the 'Union Delegate Questionnaire' (UDQ). The AWIRS surveys also included a small work place questionnaire (for those workplaces with less than 20 employees) and, in 1995, an employee questionnaire. For the purposes of this paper, I focus entirely on the main AWIRS surveys which refer to workplaces with

more than 20 employees. Section 2 of this paper considers questions contained in the GMQ, EMQ and UDQ surveys. To simplify the presentation, each of the surveys is contained in a separate sub-section. Section 3 then undertakes an investigation into the inter-relatedness between the various types of change.

Since each of the AWIRS surveys has been designed to produce estimates for the entire population of Australian workplaces, there are some important issues surrounding sampling method. The 1995 survey splits workplaces into 18 industry sectors and 5 firm size bands (i.e. 90 categories) and, since the actual numbers of workplaces in each category varies, the numbers of workplaces interviewed in each category also varies (to achieve approximately equal standard sampling errors for each category). This in turn means that weights should be used if our interest is in the population of Australian workplaces. The AWIRS data sets are released with weights calculated for the various surveys and these are used to produce the population estimates shown in this paper. Most of the statistics presented below are population estimates, since these are the best indication of what is happening in all Australian workplaces. However, some of the tables also present 'survey' estimates, which are based on unweighted survey responses. Use of the unweighted survey responses is common in more advanced econometric work (e.g. Nunes et al, 1993), hence their inclusion here.

A further issue concerns the accuracy of the various population estimates presented below. The AWIRS Technical Report (1997) provides a brief explanation of the calculation of standard errors. The Report notes that the calculation of precise standard errors for any particular estimate requires detailed knowledge of the survey method and weighting procedures. As an approximation, the Report suggests the following formula is used

$$\text{standard error} = \left[\alpha p(1-p)/n\right]^{1/2}$$

where, α is the design effect, p the estimated proportion, and n is the number of responses. For the 1990 and 1995 main surveys the Report suggests an average design effect (α) value of 1.65. Given that the surveys have approximately 2000 observations, the table below shows the approximate standard errors for the proportions 0.1, 0.2, 0.3,

0.4 and 0.5. These, therefore, imply that the 95% confidence interval is plus or minus between 2% and 3% for most of the population estimates presented in the paper.

Table of standard errors (n = 2000, α = 1.65)

proportion	0.1	0.2	0.3	0.4	0.5
s.e.	0.9%	1.1%	1.3%	1.4%	1.4%

2 Overview of change variables in AWIRS 1990 and 1995

2.1 The General Management Questionnaire

The general management questionnaire has a series of questions relating to 'changes' (management, organisational and technological) carried out in the workplace. The survey is conducted with the most senior manager at the workplace. The questions, shown in Table 1 (from the 1990 survey) and Table 2 (from the 1995 survey), refer to changes made in the last two years. For example, in 1990 the most common types of change were 'restructuring of how work was done', the 'reorganisation of management structure', 'change in senior management' and 'introduction of new plant, machinery or office technology' – all with over 30% of the workplaces reporting such change in the last two years.

Although the 1990 and 1995 questions are not identical, they do allow some comparisons across time. The questions that are most easily compared are: question 2 from the 1990 survey and question 4 from the 1995 survey (concerning 'major restructuring of how work is done'); as well as question 5 from 1990 and question 3 from 1995 (concerning 'reorganisation of management structure'). Unfortunately, the wording of the questions varies between the two surveys, so a strict comparison is not possible. With this problem in mind, the tables suggest that both 'major restructuring of how work is done' (34.1% in 1990, 42.7% in 1995) and 'reorganisation of management structure' (37.9% in 1990, 51.5% in 1995) have become more common over the five year period. The 1990 survey contains one question (7) about the 'introduction of new

plant, equipment or office technology'. In contrast, the 1995 survey has two questions covering these changes, question 1 in Table 2 concerns office technology and question 2 asks about investment in plant, machinery or equipment. Combining the responses to these two 1995 questions creates a new variable that is (approximately) comparable with the 1990 survey (the 1995 question does, however, include the word 'machinery', which is absent from the 1990 question, and it also refers to 'non-routine investment'). However, if this new variable is created we find that 57.7% of workplaces introduced 'new office, plant, machinery or equipment', as compared to 33.5% of workplaces in 1990 who invested in 'office technology, plant or equipment'. While this difference may be due to the different wording, it again appears that workplaces are experiencing faster rates of change over time.

Table 1 The 1990 general management questionnaire

Which, if any, of these changes have affected this workplace in the last two years		1990 % of workplaces (Population)	1990 % of workplaces (Sample)
1)	Major change in product or service	16.6	16.7
2)	Major restructuring of how work is done	34.1	37.3
3)	New ownership of workplace	15.3	15.0
4)	Change to a more commercial orientated operation	19.5	24.7
5)	Reorganisation of management structure	37.9	42.9
6)	Change in senior management personnel	39.1	43.3
7)	Introduction of major new plant, equipment or office technology	33.5	36.8

Table 2 The 1995 general management questionnaire

Which, if any, of the changes listed, happened at this workplace in the last two years	1995 % of workplaces (Population)	1995 % of workplaces (Sample)
1) Introduction of new office technology (not just routine replacement)	47.0	45.7
2) Introduction of major new plant, machinery or equipment (not just routine replacement)	27.9	29.7
3) Major reorganisation of workplace structure (e.g. changing the number of management levels, restructuring whole divisions/sections and so on)	51.5	58.8
4) Major changes to how non-managerial employees do their work (e.g. change in range of tasks done, changes in type of work done).	42.7	47.7
1) and 2) combined	57.7	57.6

It is also interesting to calculate the extent to which the different types of changes occur in the same two year period. (Nunes et al, 1993, undertake a similar analysis by creating 'reform' indexes, these reflect how many different types of changes each workplace has undertaken). Three types of change are used to form the index, namely,

a) introduction of office technology, plant, equipment and machinery (q.1 and q.2 in 1995, q.7 in 1990),

b) change to how work is done (q.4 in 1995, q.2 in 1990),

c) reorganisation of workplace structure (q.3 in 1995, q.5 in 1990).

We then calculate, for each workplace, how many of these changes occurred over the same two year period. Table 3 shows the estimates for the entire population of workplaces.

Table 3 Relationship between three categories of change

Number of changes	1990	1995
	% of workplaces (population)	
No changes made	32.6	19.1
One change made	38.2	29.7
Two changes made	20.6	31.4
• (b) & (c)_____ 9.7 % (90) 10.3 % (95) • (b) & (a)_____ 6.1 % (90) 7.9 % (95) • (c) & (a)_____ 4.8 % (90) 13.2 % (95)		
All three changes made	8.6	19.8

Once again it is important to remember that the comparison between 1990 and 1995 is not precise since the questions asked vary between surveys. However, Table 3 suggests that far fewer workplaces are experiencing 'no changes' (only 19.1% in 1995, compared to 32.6% in 1990). The pattern of changes within a workplace also appears to be changing. Most dramatically, 19.8% of Australian workplaces in 1995 are estimated to have experienced all three categories of change in the last two years, whereas only 8.6% of workplaces in 1990 did so. This is in keeping with the fact that, in 1990, 38.2% of workplaces experienced only one category of change in the last two years as compared to 29.7% of workplaces in 1995. Another notable variation over time is that in 1990 only 4.8% of workplaces reported both a) and c) had occurred, whereas in 1995 the equivalent figure was 13.2%. This suggests that the introduction of new office technology, etc and the reorganisation of workplace structure may have became more interlinked.

The AWIRS 1995 set of surveys also includes data from a follow up survey on 698 of the original 1990 participants (called the 1995 panel survey). Thus, a two period panel can be constructed to analyse how workplaces have changed over time. The 1995 panel survey asked the same set of questions as listed in Table 1. Table 4 shows the 1990 and

1995 frequencies for these questions for the 698 workplaces (these are unweighted, or sample, frequencies). Table 4, therefore, allows us to see which types of change have become more or less common among the 698 workplaces.

Table 4 presents a rather mixed story. Of the seven categories, the reported rates of change for four have risen over time, while three have fallen. For example, the reported rate of 'introduction of major new plant, equipment or office technology' has fallen for the workplaces in the panel (by -8.4%). This is opposite to the trend suggested by the main survey results. The difference may be due to the changes in wording or the division of one question into two (between the 1990 and 1995 surveys). Alternatively, it could be that the 698 firm sample has different characteristics to the main sample and this may underlie the differences.[1] In contrast, the rate of reported 'restructuring of how work is done' has increased for the panel (by 8.3%) and this is in agreement with the results from the main 1990 and 1995 surveys.

[1] The construction of the panel sample is as follows. Workplaces in 1990 were asked whether they would participate in a follow-up survey and, in turn, a sample of these workplaces was selected. The sample will be non-representative of all Australian workplaces to the extent that a) workplaces who elected not to participate in a follow-up survey, and b) workplaces that stopped trading, or who could not be contacted, differ from the population.

Table 4 Panel data (1990 and 1995)

Which, if any, of these changes have affected this workplace in the last two years (n = 698)		1990 % of workplaces (Sample)	1995 % of workplaces (Sample)	Diff-erence
1)	Major change in product or service	18.3	17.0	-1.3
2)	Major restructuring of how work is done	40.1	48.4	8.3
3)	New ownership of workplace	13.0	9.9	-3.1
4)	Change to a more commercial orientated operation	27.8	28.7	0.9
5)	Reorganisation of management structure	46.7	51.9	5.2
6)	Change in senior management personnel	45.1	46.1	1.0
7)	Introduction of major new plant, equipment or office technology	41.5	33.1	-8.4
8)	None of the above changes in the last 2 years	9.0	12.8	3.8

The panel survey also allow us to investigate whether it is the same workplaces experience change in both 1990 and 1995 or if change affects more than just a subset of workplaces. For example, Table 4 states that around 17-18% of workplaces undertook a major change in product or service in a two year period. This could mean either that the same set of workplaces are undergoing a continuous process of change or, alternatively, that a constant fraction of all workplaces change their major product or service in any given year. In both cases, a single "snap shot" survey will report that around 17-18% of workplaces are experiencing changes to products or services. However, the underlying nature of change throughout the entire population of workplaces is very different. Table 5 presents one method of analysing this issue. The Table shows the workplaces who answered 'yes' in 1990 (first column after questions) and then the percentage *of these workplaces* that also answered 'yes' in 1995 (second column). If experiencing change pre-1990 has no connection with experiencing change pre-1995, then this subset of workplaces should experience change at approximately the same rate as all workplaces. Comparing column 2 with the data in Table 4, we can see that in all cases workplaces that reported a change in 1990 are *more likely* to report the same type of change in 1995 (i.e. there is some persistence in the propensity to undergo change). Table 5 does not consider whether these differences are statistically significant. One method of testing

this is to run a cross-tab with the 1990 response and the 1995 response. The results test the null hypotheses that there is no relationship between the questions (i.e. reporting change in 1990 has no relationship with whether the same workplace reports change in 1995). The results show that the null hypothesis of no relationship is rejected, at the 5% significance level, for questions 1, 2, 4, and 5. The far right column of Table 5 shows another way to investigate these issues. The percentages shown represent the proportions of workplaces that answered 'no' to the same question in both 1990 and 1995 (i.e. this proportion reported no change in either the two years prior to 1990 or 1995). The percentages shown suggest that it is not simply a dynamic subset of firms that are undergoing change. A further insight into this is to calculate the proportion of workplaces that answered 'no' to all the questions listed in Table 4 and 5, in both 1990 and 1995. There are only 2.2% of workplaces that reported undertook no changes in the 2 years before both 1990 and 1995.

Table 5 Workplaces that experience change in both 1990 and 1995

Which , if any, of these changes have affected this workplace in the last two years (n = 698)		No. of workplaces in 1990 who answered yes	% of these workplaces that answered yes in 1995	% of workplaces who answered no in both 1990 and 1995
1)	Major change in product or service	128	24.2	69.1
2)	Major restructuring of how work is done	280	53.2	32.8
3)	New ownership of workplace	91	14.3	78.9
4)	Change to a more commercial orientated operation	194	44.3	55.9
5)	Reorganisation of management structure	326	56.7	27.9
6)	Change in senior management personnel	315	49.2	30.9
7)	Introduction of major new plant, equipment or office technology	290	36.6	40.5

2.2 The Employee Relations Management Questionnaire

The employee relations management questionnaire also contains a number of questions relating to change in 1990 and 1995. This survey was carried out with the manager who had day-to-day responsibility for employee relations. Again, although the surveys in 1990 and 1995 are similar, there are important differences that make direct comparisons between the two surveys problematic. Table 6 lists all the questions that were asked about management methods introduced in workplaces in both 1990 and 1995.

Table 6 Questions concerning the introduction of management methods

Important note: The 1990 survey asked about last five years, the 1995 survey asked about last two years.

Types of management method	1990 % of workplaces (Population)	1995 % of workplaces (Population)
Over the last five (two) years, which, if any, of these has management implemented at this workplace		
1) Formal training scheme	61.1	38.2
2) Job re-design	48.9	n/a
3) Incentive/bonus scheme	24.3	24.0
4) Semi-autonomous work group	16.8	17.9
5) Skills audit	25.1	22.6
6) Staff appraisal/evaluation	59.4	42.9
7) Quality circles/team building (not in 1995)	32.3	9.5
8) Team building	n/a	37.8
9) Total quality control	30.5	29.4
10) Computer integrated management (CIM)	26.1	13.4
11) Just in time	11.8	5.3
12) In the last year has management conducted any work study, time study or job re-design programs here?	39.0	47.3

The only question that allows a direct comparison between 1990 and 1995 is the last one in Table 6 ('in the last year has management conducted any work study, time study or job re-design programs here'). The responses to this question indicate the proportion of workplaces who carried out such studies has risen from 39.0% to 47.3%. Unfortunately, the rest of the questions in Table 6 are not directly comparable since

the 1990 survey asked about methods introduced in the last 5 years, whereas the 1995 survey asked about methods introduced over the last two years. However, even if the questions had both referred to the same time period (i.e. either two or five years), interpreting the results would not be straightforward.[2] This is because the questions relate to specific management methods which might be expected to be introduced only once. This means that, at some point in time, the rate of introduction of a specific method would fall to low levels (once almost all workplaces had adopted it), hence, when comparing the rate of introduction between 1990 and 1995, a fall in adoption rate may not indicate a fall in the rate of 'change' *per se*. With these comments in mind, a simplistic way of comparing the 1990 and 1995 results is to assume that the 1995 percentages should be 2/5ths of the 1990 percentage.[3] A quick look at the percentages in Table 6 suggests that the percentages in 1995 are higher than 2/5ths of the 1990 percentages, hence workplaces may have been adopting new methods more rapidly, and, moreover, that these methods are still not approaching a 100% usage level.

The 1995 survey also asks the employee relations manager whether their workplace had any of the management methods currently in place (i.e. even if they were not introduced in the last 2 years). Table 7 shows the percentages of workplaces that use different management methods. This table shows that many methods are used by a relatively small percentage of workplaces (implying further scope for adoption). Formal training schemes and staff appraisal/evaluation are the only methods to have more than 50% of workplaces who have adopted these methods.

[2] For some reason the 1995 panel survey, which is designed to follow the 1990 survey, did not ask these questions, hence we cannot use the panel survey to investigate these issues further.

[3] Assuming that 1995's figures should be 2/5ths of 1990's effectively assumes that the diffusion path is linear (i.e. x% of workplaces introduce the method in any period t) and also that there are still sufficient workplaces in 1995 left to adopt the new methods at this rate. This is a crude assumption as most empirical studies suggest a non-linear (S-shaped) adoption path.

Table 7 Use of specific management methods in 1995

Which, if any, of these has management methods are currently in use at this workplace		1995 % of workplaces (Population)
1)	Formal training scheme	60.5
2)	Incentive/bonus scheme	35.9
3)	Semi-autonomous work group	38.7
4)	Skills audit	28.1
5)	Staff appraisal/evaluation	60.7
6)	Quality circles	13.2
7)	Team building	47.2
8)	Total quality management (TQM)	36.6
9)	Computer integrated management (CIM)	17.5
10)	Just in time (JIT)	8.7

The above table prompts use to consider what proportion of workplaces use relatively few management methods. To investigate this, the management methods are grouped into four categories

- formal training,
- staff appraisal, skills audit and incentive/bonus scheme,
- quality circles and team building,
- TQM, CIM and JIT.

These four 'M-groups' represent one way of categorising similar methods. This is done to avoid the assumption that workplaces have to use similar methods (e.g. staff appraisal and skills audit are likely to involve similar management procedures and may be substitutes for one another). Table 8 shows the percentages of workplaces that have one or more of these M-groups currently in use. From the table it can be seen that 7.5% of workplaces do not use a single management method from any of the M-groups. In contrast, there are an estimated 21.5% of workplaces that use a method from each of the four M-groups.

Table 8 Multiple use of management methods in 1995

Number of M-groups currently in use	1995 % of workplaces (population)
No M-groups in use	7.5
One M-group in use	18.8
Two M-groups in use	26.9
Three M-groups in use	25.4
All M-groups in use	21.5

The 1995 employee relations survey asks a further question concerning whether work groups, quality circles, committees or productivity groups are in use. These are considered as 'communication and participation' methods and the proportions of workplaces that use such methods are shown in Table 9. Table 9 is of interest since a subsequent question asks the date of introduction of such methods.[4]

[4] Note that some of Table 9's questions are similar to those in Table 6. For those familiar with the AWIRS surveys, the questions that provide Table 6's results are contained in section A of the ERQ (see question A17). Those in Table 9 are from section D (question D7). Comparing the responses of the common question (use of quality circles) we note that the two proportions are very close (13% and 13.2%). The question concerning work groups is slightly different. Question A17 asks about semi-autonomous, while questions D7 asks for semi or fully autonomous. Presumably this wider definition accounts for the higher proportion (43% as compared to 38.7%).

Table 9 Use of communication and participation methods in 1995

Are the following in place	1995 % of workplaces (population)
Semi or fully autonomous work groups	43.0
Quality circles	13.0
Joint consultative committee	33.4
Task forces or ad hoc committee	38.5

For each of the methods listed in Table 9 the 1995 survey asks the year in which the workplace introduced the method. This, in theory, allows us to calculate the percentage of workplaces who have adopted each method in any given year (i.e. a diffusion path). In practice, the response to this question is not complete and a significant proportion of workplaces did not know when the method was introduced.[5] With these reservations in mind, Figures 1 and 2 plot the rate of adoption of the two most commonly used methods. These are for use of 'semi or fully autonomous work groups' and 'task forces or ad hoc committees' (the figures show the cumulative percentages based on survey responses, not population estimates). In both cases the diffusion path appears in keeping with the initial section of the commonly found S-shaped diffusion path (see, for example, Lissoni and Metcalfe, 1994, for a review).

[5] In fact, the responses appear inconsistent in that the total number of workplaces reporting either a date of adoption, or the answer 'don't know' to the year of introduction, exceeds the number who claimed to be currently use the method.

Figure 1 Adoption of semi or fully autonomous work groups

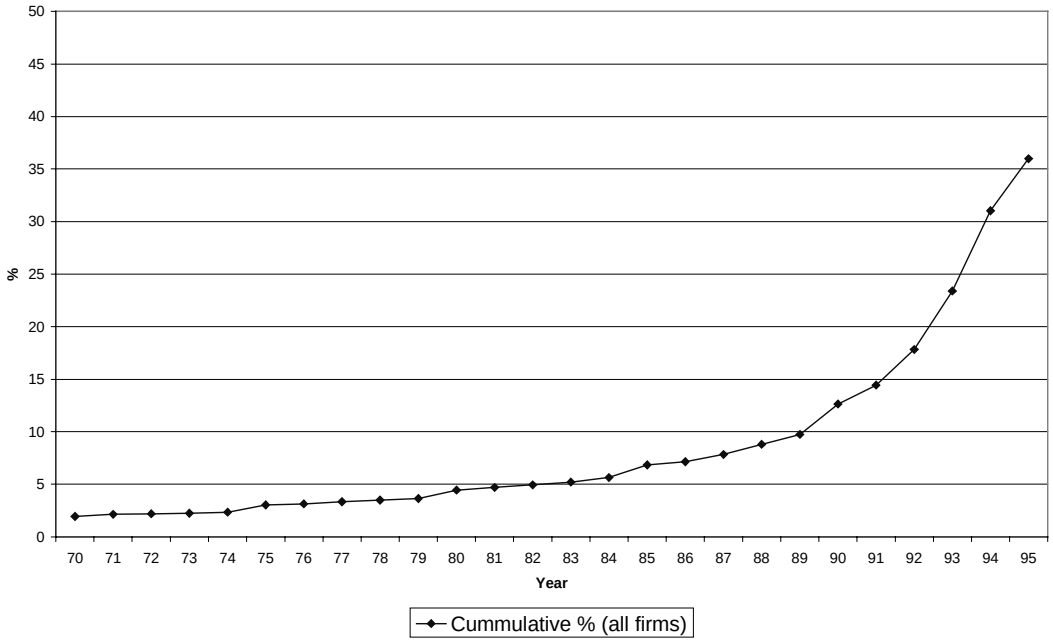

Figure 2 Adoption of task forces or ad hoc committees

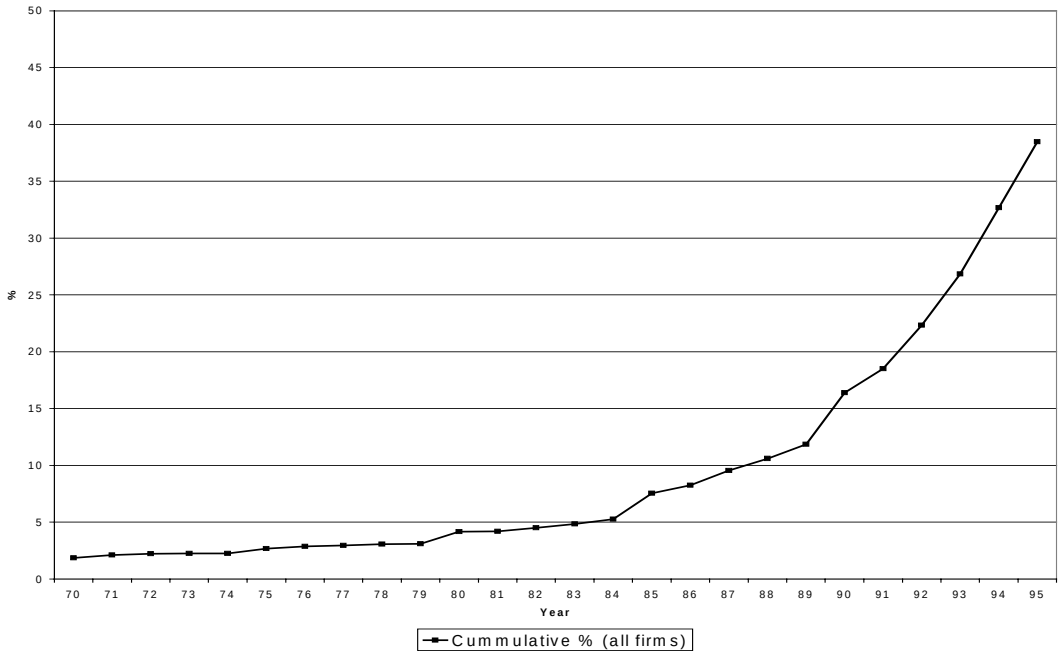

Table 10 shows a further set of questions contained in the 1995 ERM questionnaire concerning management-employee communication. The table has two columns of figures, the left most column gives the estimated proportion of workplaces currently

using the method, while the far right column gives the percentage who adopted the method in the last two years. Comparisons with the 1990 survey are problematic for the same reasons discussed above and are therefore not shown. Table 10 shows that the two most commonly used methods of communication are a 'daily walk around' as well as 'regular formal meetings between managers/supervisors and employees'. Both of these methods are used in over 80% of workplaces, although they were still being adopted at relatively rapid rates.

Table 10 Management - employee communication in 1995

Types of management – employee communication		1995 % of workplaces (population) (a)	1995 % of workplaces (population) (b)
Which of these methods (a) currently in use (b) introduced over last 2 years (1995)			
1)	Daily 'walk around' by senior management	86.2	11.8
2)	Suggestion scheme for employees	29.2	6.6
3)	Regular staff newsletters/ bulletins	55.9	14.0
4)	Surveys or ballets of employees' views or opinions	23.0	6.9
5)	Electronic mail	19.8	10.8
6)	Regular formal meetings between managers and/or supervisors and employees	82.0	18.4
7)	Regular social functions	45.1	5.5
8)	None of above	1.0	53.6

The employee relations managers were also asked questions about training. Table 11 shows the percentages of workplaces that provided a formal training program in the year before the survey was taken (for both the 1990 and 1995 surveys). The table shows there was a slight fall in the percentage of workplaces providing training between 1990 and 1995. The table indicates that there were changes in who received this training, with managers becoming more likely to receive training, while professionals and papa-professionals were less likely.

Table 11 Training programs undertaken in previous year

	1990 % of workplaces (population)	1995 % of workplaces (population)
In the last year has your organisation provided any formal program of instruction for employees here that is designed to develop their skills? Please exclude any on-the-job training or attendance at conferences, or any apprentice training.	72.7	68.0
Which groups received this training?		
• Managers	56.0	68.9
• Professionals	55.2	47.8
• Para-professionals	54.4	41.4
• Tradepersons	33.4	29.5
• Clerks	63.5	63.5
• Sales and personal service workers	32.0	35.9
• Plant and machinery operators and drivers	23.4	21.0
• Labourers and unskilled workers	28.5	27.5

2.3 The Union Delegate Questionnaire (UDQ)

The UDQ was conducted with the most senior representative of the largest union represented at the workplace. If no such delegate was present then no interview was conducted, even though other union delegates may have been present. For example, in 1995, a total of 1086 delegates were interviewed out of the 2003 workplaces. Most of the UDQ concerns the role and structure of the union, however, there is a section concerning organisational change. In brief, this section asks the union delegate similar questions to those discussed above. To illustrate, Table 12 contains the 1995 population estimates derived from the delegate's answers to the questions contained in Table 2. Comparing the percentages between Tables 12 and 2 shows, for the first three questions, that the senior management and delegate responses are similar. However, the union delegates' responses to the last question – concerning change in how employees do

their work – yield a higher percentage (49.5% as compared to 42.7% calculated from the senior manager response).

Table 12 Union delegate responses on change in workplace

Which , if any, of the changes listed, happened at this workplace in the last two years		1995 % of workplaces (Population)
1)	Introduction of new office technology (not just routine replacement)	44.0
2)	Introduction of major new plant, machinery or equipment (not just routine replacement)	28.0
3)	Major reorganisation of workplace structure (e.g. changing the number of management levels, restructuring whole divisions/sections and so on)	51.2
4)	Major changes to how non-managerial employees do their work (e.g. change in range of tasks done, changes in type of work done).	49.5

The UDQ then asks the delegates to choose the change that had the 'most significant effect on employees' (if only one change had occurred this is considered the 'most significant'). The delegates were then asked to consider how involved unions and employees were in the decision to introduce the change. Table 13 summarises the responses to this question. It is interesting to note the relatively small proportion that reported the involvement of employees in the introduction of new office technology. This is in contrast to the relatively high involvement of employees in introduction of new plant, machinery or equipment. For the latter, 53.2% of workplaces had significant input from, or consultation with, their employees, while the equivalent figure is only 32.9% for the introduction of new office technology.

Table 13 Employee involvement in major change to organisation

Change (as in Table 12)	Proportion of workplaces whose employees had (%)				
	Made the decision	Had significant input	Were consulted	Were informed	Were not informed
1) New office ..	0.8	8.9	23.4	48.4	18.5
2) New plant ..	0	19.3	33.9	34.9	11.9
3) Workplace structure ..	3.1	16.6	19.9	45.0	15.3
4) How work is done	4.3	21.3	23.6	38.8	12.0

Notes: All percentages are unweighted, sample proportions.

3 Inter-relationships

The above sections have described the extent of change in Australian workplaces. This section investigates how these changes are related to one another. A basic method of summarising the relationships between the change variables described above is to use correlation coefficients. A commonly used correlation coefficient for such dichotomous variables is Kendall's tau-b (see, for example, Weisberg and Bowen, 1977). Table 14 shows the tau-b correlation for the summary measures of change contained in the general management questionnaire. This table shows that all of the various types of change are positively correlated with one another. The highest level of correlation is between 'reorganisation of workplace structure' and 'change to how employees do their work' (0.344). The introduction of new office technology and the introduction of new plant, machinery and equipment are also positively correlated (0.185).

Table 14 Correlation coefficients between types of workplace change in last two years (1995)

	Introduction of new office technology	Introduction of major new plant, etc	Major reorganisation of workplace structure	Major changes to how employees do their work
Introduction of new office technology	1			
Introduction of major new plant, etc	0.185	1		
Major reorganisation of workplace structure	0.138	0.046	1	
Major changes to how employees do their work	0.141	0.091	0.344	1

Notes: Full questions as stated in Table 2. Correlations (Kendall's tau-b) based on unweighted sample. All correlations are significant at the 5% (two tailed) level.

Table 15 shows similar correlation coefficients between the different types of management methods implemented in workplaces in the last two years (from responses in the employee relations questionnaire). As before, the management methods have been reduced into four groups. The correlation coefficients between these groups are all positive and between 0.21 and 0.31 in value, indicating that workplaces have a tendency to introduce more that one change in a two year period.

Table 15 Correlation coefficients between management methods introduced in last two years (1995)

	Formal training scheme	Quality circle or team building	Staff appraisal or skills audit or incentive bonus	TQM, CIM or JIT
Formal training scheme	1			
Quality circle or team building	0.233	1		
Staff appraisal or skills audit or incentive bonus	0.288	0.288	1	
TQM, CIM or JIT	0.210	0.313	0.235	1

Notes: Full questions as stated in Table 5. Correlations (Kendall's tau-b) based on unweighted sample. All correlations are significant at the 1% (two tailed) level.

It is also interesting to calculate the correlation coefficients between management methods *currently* in use and the other types of change. This is done in Table 16. Overall, although the coefficients are positive, their values are lower than in Tables 14 and 15. The highest values are for the correlation between 'major reorganisation of workplace structure' and 'formal program of instruction' (0.168), and also between 'changes to how employees do their work' and 'quality circles/team building' (0.146). Table 16 contains two questions that relate to training. The top row refers to the question concerning whether a formal training scheme is in place (which is answered 'yes' by an estimated 60.5% of workplaces, see Table 7). The last row refers to 'whether any formal program of instruction for employees' has been undertaken in the last year (an estimated 68% of workplaces have such a program, see Table 11).[6] Table 16 shows that the correlation coefficients for these two different measures of training vary, in

[6] The similarity of these questions might imply workplaces would answer yes to both. The full wording of the 'formal instruction in last year' question shown in Table 11 does, however, imply some differences. For reference, 421 workplaces claim to have carried out formal instruction in the last year but answer *no* to having a formal training scheme, and 220 workplaces with a 'formal training scheme' say *no* to having carried out formal instruction in the last year.

particular, workplaces that have a formal program of instruction have a positive correlation with having undergone a 'reorganisation of workplace structure' and 'changes to how work is done' in the last two years.

Table 16 Correlation coefficients between types of workplace change and current use of management methods

	Introduction of new office technology	Introduction of major new plant, etc	Major reorganisation of workplace structure	Major changes to how employees do their work
Formal training scheme	0.069	0.037 ^{ns}	0.045	0.054
Quality circle or team building	0.058	0.037 ^{ns}	0.132	0.146
Staff appraisal or skills audit or incentive bonus	0.056	0.009 ^{ns}	0.130	0.057
TQM, CIM or JIT	0.043 ^{ns}	0.050	0.084	0.123
Formal program of instruction for employees in last year	0.090	0.040^{ns}	0.168	0.129

Notes: Full questions as stated in Table 2, 5 and 11. Correlations (Kendall's tau-b) based on unweighted sample. All correlations are significant at the 5% (two tailed) level apart from those marked *ns*.

4 Conclusions

The AWIRS data bases provide a large amount of information on 'change' in Australian workplaces. This said, much of this information requires careful analysis since the questions refer to both general and specific changes, and there has been significant alterations to the questionnaires between 1990 and 1995. The paper's main results can be summarised as follows.

- In terms of general workplace change, population estimates suggest more workplaces are undergoing change in 1995 than 1990. In the two

years prior to 1990 between 35% and 44% of workplaces reported to have undergone certain changes (see Table 1). The comparable figures for 1995 are between 45% and 60% (see Table 2).

- Many workplaces carry out more than one substantial change over the same two year period. Moreover, using evidence from the main 1990 and 1995 surveys, it appears that workplaces are becoming more likely to implement more than one change. For example, in the two years prior to 1995 about 20% of workplaces implemented three major changes, whereas the comparable figure for 1990 was 8.6% (see Table 3).

- The results from the panel data set do not give such a clear picture of increasing rates of workplace change over time. For the panel data set, most of the reported rates of change have not varied greatly over time. Two exceptions are 'change to how work is done' (which has increased) and 'introduction of new plant, equipment or office technology' (which has fallen). This difference between the main and panel data sets warrants further investigation.

- Using the panel data set, it appears that workplaces that experienced change pre-1990 are more likely to experience change five years later (see Table 5). However, it does not appear that only a small sub-set of workplaces undergo change, with only 2.2% of workplaces reporting 'no' to each of a set of questions on change in both 1990 and 1995.

- Formal training schemes and staff appraisal/evaluation are the most popular 'management methods' with, in 1995, approximately 60% of workplaces using them (see Table 7).

- Although the extent of training in workplaces may have fallen slightly between 1990 and 1995, it appears as though more training is now directed at managers and less at professionals (see Table 11).

- The correlation between various types of change is always positive and usually statistically significant (i.e. workplaces are highly likely to undergo more than one type of change, see Tables 14 and 15).

- The major categories of change are also positively correlated with current use of management methods (see Table 16).

These conclusions, together with the statistics presented in the paper, provide an overview of the extent and nature of change in Australia workplaces over the 1990 to 1995 period. The aim of the paper is to stimulate interest and discussion on the issue of workplace change. Many questions are not considered above. For example, what are the driving forces of such change, how do workplace and firm characteristics affect the propensity to change, and how do market and institutional factors interact with change. These and other questions will be the subject of future research.

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