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The influence of industrial clusters and place on innovation and entrepreneurial behaviour

An empirical analysis of the Australian wine and tourism industries

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Abstract: *Responses from a questionnaire survey of wine and tourism businesses operating in regional clusters were analysed using factor analysis. These suggested three factor scores relating to entrepreneurial behaviour; four factor scores relating to cluster activities and attributes; and three factors relating to the respondents' personal characteristics. The three entrepreneurial behaviour factor scores were interpreted as: innovator, calculator and venturer. These were used as dependent variables in regression models. The independent variables were the cluster and personal characteristics factor scores, industry and place. The central result was that the cluster activity variables did not have a significant impact on the innovator behaviour variable, which contradicts the standard view. Cluster activities and attributes were found to attract entrepreneurs of the calculator kind, and to a lesser extent, of the venturer kind. Place did seem to offer an attraction to entrepreneurs beyond those offered by the intensities of the cluster activities and attributes.*

Keywords: *entrepreneurial behaviour; industrial clusters; tourism industry; wine industry; Australia*

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Clustering and the Australian wine and tourism industries

This paper investigates how innovation and entrepreneurial behaviour are influenced by cluster activities and attributes and by participation in a cluster. *A priori,* it might be expected that entrepreneurial behaviour both influences cluster formation and is enhanced by the existence of a cluster. The evidence of successful and mature clusters such as Silicon Valley in the USA, the belt of high-technology firms around Cambridge University in the UK and the many other agglomerations of new technology rapid-growth firms, suggests that entrepreneurship, new venture creation and clustering are closely related phenomena. In addition, the success of micro-clusters involving niche markets and tourism has recently been recognized (Michael, 2003).

A cluster is a geographic co-location of activities that

are linked horizontally and/or vertically along the value chain. Co-location facilitates knowledge and information transfer, either formally or through spillovers. It is argued that the competitive pressure on cluster participants can improve their efficiency and effectiveness, and may act as a spur to innovation. A cluster is an attractant to buyers, new firms and suppliers, creating external economies for cluster participants. The concept of the micro-cluster involves additional diagonal links between activities in different value chains. Essentially, diagonal links result from complementarities in the demand and supply of products and services (Michael, 2003).

The wine and tourism industries within western Victoria share a number of common attributes including geographic co-location and economic, social and natural resource assets. In addition, the two industries have significant demand- and supply-side complementarities with each other, which vary considerably from one region to another. There is a drive from both industry and government to foster greater complementarity between the two industries by the promotion of a 'wine tourism' product (Dowling, 1998; Johnson, 1998; Sutton, 1998; Cambourne and Macionis, 2000; Macionis and Cambourne, 2000; Hall *et al*, 2000; Michael, 2006).

Entrepreneurial activity, place, industry and clustering

Studies that have investigated the relationship between entrepreneurial activity and micro-clusters include Hall and Rusher (2005) and Ateljevic and Doorne (2000). The latter deals with lifestyle entrepreneurship, something that is found in both the wine and tourism industries in Australia. Within the cluster literature, there is a strong interest in networks; O'Donnell *et al* (2001) suggest two forms of networks, namely: interorganizational (formal) networks and entrepreneurs' personal or social (informal) networks. Gibson *et al* (2005) add the category of semi-formal networks, which involve both social and business activities, but have identified aims. Gibson *et al* (2005) also discuss the Ayrshire Food Network, championed by its chairman Howard Wilkinson, a network entrepreneur who owns a micro-business producing vegetarian and vegan food, and who promotes the idea of 'thinking collaboratively'.

Wine and tourism are two very different industries along a number of dimensions. Specifically, the wine industry in Australia is technology-based, collaborates widely and trades extensively in international markets (Anderson, 2000). The tourism industry in Australia, however, is less well defined, involves a number of different industry sectors and is more reliant on small business start-ups that are unsupported by any real competitive advantage based on resources or strategic positions. The two industries also have some similarities. They both benefit from external economies, have a significant lifestyle segment, are often co-located, have seen major growth, are internationally traded, and have already provided classic examples of clustering elsewhere. In addition, they may be able to gain competitive advantage through diagonal linkages.

Research methodology

The study applied cluster theory to small rural/regional industry groups. The study thus required an alternative approach to that used in mainstream cluster studies. The essence was that the study would focus on the cluster process rather than on the cluster as an entity. In this context, the term *cluster* is '. . . simply used to represent concentrations of firms that are able to produce synergy because of their geographic proximity and interdependence, even though their scale of employment may not be pronounced or prominent' (Rosenfeld, 1997, p 4).

The fieldwork was undertaken in the wine-growing and tourism regions of western Victoria. There were international wine makers and tourism service providers in each of the locations studied. For the study, three locations were identified where there was a co-location of both the wine and tourism industries. Pilot interviews were carried out with industry members in each location.

Case studies were undertaken to identify clustering activities and attributes, and the strength and structure of relationships. The cases showed that, in general, tourism clusters exhibited passive interaction. That is, most tourism enterprises did not seem to engage in joint activity or actively seek to grow their businesses through interaction with other related businesses within the cluster. On the other hand, wine clusters tended to demonstrate more active collaboration. In these clusters, most wine enterprises actively engaged in activities with other enterprises in order to grow their businesses.

A questionnaire was subsequently designed and administered. Targeted questionnaires were directed to all participants in the wine and tourism industries who had been identified through their involvement in industry associations and in the earlier stages of the study. The sample selection process was therefore judgmental, as participants were identified on the basis of their involvement in the phenomenon prior to the commencement of the survey.

The analysis of the interdependence between entrepreneurial behaviour and clustering activities and attributes was to be achieved through the construction and estimation regression models in which the explained

Table 1. Rotated factor weights for entrepreneurial factor score variables.

Factor	(i) INNOVATOR	(ii) CALCULATOR	(iii) VENTURER
Percentage of total variance explained	21%	17%	11%
Question relating to:			
Innovation strategy	0.910	0.012	–0.024
Growth strategy	–0.815	0.142	0.139
Developed own business	0.282	0.078	–0.266
Existence of local entrepreneurs	0.208	0.781	–0.032
Local skills and knowledge	–0.253	0.669	–0.239
Innovation important for growth	0.480	0.597	0.062
Iconic personality living in the region	–0.196	0.510	0.226
Local business opportunities	–0.057	0.026	0.853
Sole trader legal status	–0.033	–0.098	0.373
Respondent both owner and manager	–0.035	0.171	0.366

variables were to be different types of entrepreneurial behaviour. Factor analysis was to be used to obtain factor scores that represented entrepreneurial and cluster constructs that could be used as variables in the regression models.

Quantification of the components of entrepreneurship and cluster activities

The questionnaires contained several series of questions asking each respondent to express his or her degree of agreement with a set of statements, each measured on a five-point Likert scale, and various yes/no nominal questions. Groups of questions related to the respondent's business, roles, activities, attitudes and personal characteristics. One set of questions related to entrepreneurial factors, another to clustering concepts and a third to the personal characteristics of the respondent. Factor analysis was applied separately to each of these three groups of questions for three reasons: first, to reduce the number of questions to a few variables to enable tests of statistical significance to be undertaken using the underlying conceptual information contained within the explicit questions; second, to combine questions for which the responses were correlated and so create separate orthogonal factor scores for testing each of the independent underlying concepts; third and most importantly, to ascertain whether the factors derived corresponded to theoretical constructs relating to entrepreneurial behavioural characteristics and cluster activities and attributes.

Factor analysis was applied to the 10 questions relating to different aspects of entrepreneurial behaviour. It revealed three underlying factors with eigenvalues greater than one, which accounted for 21%, 17% and 11% of the total variation in the data. The strongest factor was positively related to the respondent pursuing an innovation strategy, negatively related to pursuing a growth strategy, and positively related to wanting to develop his or her own business. In Table 1, the values of the weights for the questions relating to these issues in factor (i) are shown to be 0.910, –0.815 and 0.282 respectively. This seemed to indicate the behaviour of an INNOVATOR. It can also be seen that there is a weight of 0.480 for the question regarding the view that innovation was important to growth. It is interesting to see that the existence of local entrepreneurs was positively associated with the INNOVATOR factor (0.208), while the existence of local skills and knowledge was negatively associated (–0.253). The former would suggest that there are external economies of scale for innovation, as cluster theory would suggest. The latter could support an interpretation of innovation *per se* being an independent process.

The second factor can be seen to be related to the existence of other entrepreneurs and innovators in the region (0.781) as a factor in the growth of the respondent's business, and to the availability of skill and knowledge (0.669). It was also positively related to the view that innovation was important for growth (0.597) and to the existence of an iconic personality living in the region (0.510). This latter question was included in the questionnaire as there is a view that such personalities have an effect on place, making it more attractive to live in and to visit – the latter being especially important as regards tourism.

It may be argued that the set of weights in factor (ii) are also related to innovation to a considerable extent. However, the weight for the item about pursuing an innovation strategy is only 0.012, while the weight is 0.142 for a growth strategy. Finally, the weights for the item 'developed own business' for factors (i) and (ii) suggest that factor (i) captures innovation behaviour more than factor (ii). Taken together, the factor weights

for factor (ii) suggest that the behaviour and characteristics are those of a rational decision maker, an imitator, a cautious risk-averse person, and so the factor was named CALCULATOR.

The third factor was strongly related to the question about business opportunities being important in the decision of where to locate (0.853). This suggested that the essence of this factor was opportunist behaviour, in the sense that business opportunities were a strong incentive. The idea that the respondent wished to appropriate all of the benefits of his or her efforts is supported by the weight of 0.373 for the question about being a sole trader, and by a weight of 0.366 for the question about whether the respondent was an owner-manager/owner-operator rather than being either an owner or a manager/operator. This factor was named VENTURER, although not in any derogatory sense.

In addition, the question about the importance of developing his or her own business was negatively associated with the third factor (–0.266), which would suggest that the appropriation of wealth *per se* was more important than the process of creating wealth. At first it is surprising that the availability of local skills and knowledge was negatively associated (–0.239), but this could reinforce the fact that this type of behaviour was not about calculating. Factor (ii) was about calculating. The negative association could have been due to a belief that labour could be easily trained on the job. This would be the attitude of someone who was not risk-averse. Note that this argument can also be applied to the INNOVATOR factor, for which the weight is approximately the same. The interpretation of both factors (i) and (ii) involves risk, while factor (ii) avoids risk. March (1991) suggests that entrepreneurial activities are determined by explorer behaviour and exploiter behaviour. In the current study, the INNOVATOR factor could thus be interpreted as being equivalent to explorer behaviour, and the VENTURER factor as exploiter behaviour.

It must be remembered that each respondent embodied all three types of behaviour, but in varying proportions. In truth, these types of behaviour are likely to be correlated, but the use of orthogonal factor analysis enabled the types of behaviour to be distinguished more clearly and provided sharper factor scores for the analysis of relationships in the subsequent regression analyses.

There was also a series of questions about clustering activities and attributes. These requested respondents to score the extent of their relationships with other similar businesses in the same region, their relationships with the businesses and agencies, and their sources of skill and knowledge transfer. Together these statements were designed to capture information about the respondent's attitudes and behaviour as regards collaboration and competition. Factor analysis of the responses to these questions could thus reveal underlying factors that would relate to concepts and theoretical constructs concerned with the determinants of clustering. There were 16 measures of clustering, competitive and collaborative activities. Factor analysis revealed four underlying factors with eigenvalues greater than one, which accounted for 30%, 14%, 9% and 7% of the total variation in the data.

The first factor was related to the extent to which the respondent's business worked closely with public sector agencies, trade associations, other external bodies and individuals that were local, as well as with other businesses. The emphasis was on sources of skills, knowledge and information. This factor may be seen to indicate network activity. This factor was thus labelled NETWORKING.

The second factor was related to the respondent's awareness of the activities of other similar firms and of wanting to have higher standards than such firms. It was also related to working closely with local suppliers. This factor indicated the necessity of keeping abreast of the competitive environment, similar to the sort of behaviour exhibited in the imitation, copying and adoption of successful operational and management practices (Porter, 1998). The second factor was therefore labelled COMPETITIVE RESPONSIVENESS as it indicated responding to changes in the competitive environment. In what is usually thought of as being at the opposite end of the spectrum, the third factor was related to cooperative interdependence between businesses in terms of working together, sources of skills and performance. This factor was labelled COOPERATIVE ACTIVITIES. Thus competitive and cooperative activities were found to be different dimensions rather than being located at opposite ends of a single dimension.

The final factor was related to the sources of skill and knowledge from businesses in the same industry, both locally and from outside of the region, and to being influenced by what other businesses were doing. In addition, it indicated that, although respondents did not see all businesses that were similar to themselves as direct competitors, they did not work with such businesses. This factor was labelled SPILLOVER EFFECTS as it indicated that spillover effects and non-collusive interdependence were recognized.

In addition to deriving factors that captured measurements for the conceptual variables, factor analysis was used to reduce the number of personal characteristic variables. Initially, four factors were indicated. However, two of these related to time, one being essentially age, and the other, the amount of time spent in the industry. Conceptually, these both seemed to indicate experience.

A subsequent factor analysis was constrained to derive three factors, which brought these two time variables together, and produced weights that were clearer to interpret for the other two factors. The final three factors were FAMILY matters and issues, including lifestyle, EXPERIENCE, and finally CHANCE EVENTS, which included chance events, gender and, again, lifestyle. The naming of the latter factor may be debatable, but the pattern of weights seemed to indicate matters that were not primarily a consequence of the respondent's own actions.

The factor scores for each of the three sets of factors were derived for each respondent. The scores in each set were orthogonal to each other, which meant that a respondent's score for one factor was no indication of their scores on any other factor in the same set.

Formulation of the regression models

The purpose of the study was to analyse the determinants of entrepreneurial activities using regression analysis. The factor scores for the three types of entrepreneurial behaviour: INNOVATOR, CALCULATOR and VENTURER, were used as the dependent variables. The essence of the models was that each type of entrepreneurial behaviour was determined by four sets of independent variables, namely: the cluster activities and attributes, the personal characteristics of the respondents, industry, and place.

Once the nature of the entrepreneurial behaviour had been ascertained, it was possible to establish general hypotheses. However, it was not always possible to give unique signs to all the coefficients. Hence it was not possible to say much about the expected effects of the place or industry dummy variables. Relationships relating to personal circumstances could be specified more concretely. The FAMILY variable was expected to be positively related to CALCULATOR behaviour and negatively to VENTURER behaviour. The EXPERIENCE variable was expected to be negatively related to VENTURER behaviour, and possibly to INNOVATOR behaviour.

Although the effects of the personal variables on entrepreneurial behaviour were causal in the direct sense, the relationships between the cluster variables (and place and industry) and entrepreneurial behaviour were not causal in the direct sense. Instead, they were the result of a matching or selection process. That is, entrepreneurs would participate in particular cluster activities, or set up in places that had particular cluster activities and attributes, depending on their own personal mix of entrepreneurial behavioural characteristics. Thus, although the relationships were not causal in the deterministic sense, they were in the statistical sense: that is, respondents with particular entrepreneurial behavioural characteristics would be found where conditions were such (or perceived to be such) that those characteristics could best be used in entrepreneurial activities.

It was expected that INNOVATOR behaviour would be positively related to all the cluster activities and attributes, but especially to NETWORKING. Similarly, CALCULATOR behaviour would be positively related to all the cluster activities and attributes, but most especially to NETWORKING and COOPERATIVE ACTIVITIES. The relationships were expected to be statistically stronger in the CALCULATOR equation. Finally, as regards VENTURER behaviour, the expected relationships were much less clear as this behavioural characteristic has certain short-term opportunism and less risk aversion about it. However, it was unlikely to be negatively related to SPILLOVER EFFECTS.

Different industries offer different opportunities for innovation and hence it would be expected that entrepreneurial behaviour would be different in different industries. Possibly, the wine industry would be more attractive to people who exhibited CALCULATOR behaviour. Although it may be argued that entrepreneurial behaviour is not directly dependent on place *per se*, the influences of place being indirect through cluster effects, there remains the question of whether cluster influences embody all of the effects of place. Agglomeration effects may be seen as supply-side influences, while location effects may include demand-side influences, especially as regards an intangible service industry such as tourism, in which customers are, by definition, not located within the cluster. However, no systematic relationship could be hypothesized *a priori*.

The four measures of cluster activity that had been derived using factor analysis were uncorrelated with each other (ie orthogonal) and so they could all be used as independent variables in a regression equation without creating the problem of multicollinearity. The same applied to the three measures of personal characteristics. As discussed earlier, orthogonality may appear to be rather too sharp a property relative to the truth, but it is likely to enable the analyst to distinguish relationships more clearly. In addition, as the three measures of entrepreneurial behaviour were also orthogonal, it meant that the regression equations were similarly independent of each other.

Four industry '0,1' dummy variables were created, indicating whether the respondent worked in TOURISM, HOSPITALITY, WINE production or WINE-TOURISM respectively. The category of 'other industries' was used as the base. As there were three regions, the region effects were captured using two '0,1'

dummy variables with Ballarat as the base region. Instead of using Bendigo and North Grampian as the two regional dummy variables, one dummy variable was used for the two NOT BALLARAT regions and the other, N.GRAMPIAN, was used to distinguish whether there were any differences between the two 'not Ballarat' regions. This arrangement was based on *a priori* expectations about likely differences between the regions. In the same vein, any likely interaction between wine production and place was captured by a dummy variable, NOT BALLARAT WINE, as Bendigo and North Grampian both had larger wine industries than Ballarat.

The dependent variable in each of the equations was one of the three measures of entrepreneurial behaviour. In each equation, one set of independent variables constituted the four clustering activity variables. However, there was a strong possibility that the entrepreneurial variables and the cluster variables were simultaneously determined. A Hausman test was used to see whether any simultaneity causes statistical problems that would bias the estimated coefficients (see Gujarati, 2003, pp 754–756). The results of Hausman tests indicated that the problem of simultaneity was present only in the VENTURER equation, and so only this equation was estimated using both ordinary least squares (ols) and two-stage least squares (tsls) regression methods. The tsls equation was therefore a structural equation and did not include the place variables because in the simultaneous model, place effects would be expected to have an indirect impact through the cluster variables. However, it was possible to include them in the ols equations, which thus became augmented structural equations. See Taylor *et al* (2007) for the estimation of cluster variable structural equations.

Results of the regression models

The approach adopted was first to estimate each of the equations in full, and then without the group of cluster variables, and finally, without the group of variables that related to place and place–industry interactions. These restricted models thus enabled the overall effects of clustering behaviour and place to be ascertained. The results of the full equations are presented in Table 2 and are discussed in the text. The effects of deleting cluster and place variables are discussed subsequently in the text, and the results of the F-tests used to ascertain the net effects on entrepreneurial behaviour are shown in Table 3.

Note that the estimated values of the regression slope coefficients in Table 2 are standardized and so comparison of their relative magnitudes directly reflects their relative influences. The figures in brackets beneath the estimated coefficients in Table 2 are the probability levels at which the estimated coefficients are significantly different from zero.

Equation I in Table 2 provides the regression model estimates of the model in which the dependent variable INNOVATOR is a function of all the variables discussed above. Its explanatory power is 22% ($R^2 = 0.2230$). It would be surprising if this simple cross-section relationship had high explanatory power. As regards interdependence with clustering activity variables, only the SPILLOVER EFFECTS variable shows any degree of influence (significant at the 8.5% level). The EXPERIENCE personal characteristic is significant only at the 11.4% level. The significance levels of the industry dummy variables indicate that innovative behaviour differed between industries. Although it may at first seem surprising that the estimated WINE coefficient is the lowest of all, and is statistically significantly lower than the TOURISM coefficient, the scope for innovation in wine production, as opposed to adoption of the latest technology as a competitive response, is probably lower than in the amorphous tourism category. As regards the region effects, respondents with businesses in Ballarat seem to have higher innovation scores, as the NOT BALLARAT estimated coefficient is negative and highly significant. There is only very weak evidence of a place–industry interaction effect, as NOT BALLARAT WINE has a positive coefficient that is only significant at the 13.4% level.

The explanatory power of equation II is 50% ($R^2 = 0.4966$), which is the highest of all the equations and is extremely high for this type of analysis. The high explanatory power of this equation is what we would expect because CALCULATOR behaviour is less likely to be affected by random influences. All four cluster variables have a significant positive impact on the CALCULATOR measure of entrepreneurial activity. It can therefore be concluded that cluster attributes are likely to attract entrepreneurs who are more inclined to make calculated and rational decisions, are of a technocratic nature, and, as a consequence, are likely to be imitators and followers. Higher scores on the FAMILY personal variable are also likely to lead to CALCULATOR behaviour. Again, we would expect this as family responsibilities are likely to affect behaviour. However, unlike the INNOVATOR measure in equation I, the CALCULATOR measure is not much affected by the industry within which the respondent works, as only the WINE dummy variable is significant and most of its effect is offset by the NOT BALLARAT WINE interaction dummy variable. Re-estimation of the model without the interaction variable showed this to be the case, that is, there is no net wine effect on CALCULATOR. The CALCULATOR type of behaviour does not seem to be affected by region either.

Table 2. Impact of cluster factors, personal attributes, industry and region on entrepreneurial behaviour.

Model	**I**	**II**	**III**	**IV**
Dependent variable	**INNOVATOR**	**CALCULATOR**	**VENTURER**	**VENTURER**
Regression method	ols	ols	ols	tsls
Cluster variables				
NETWORKING	–0.0222	0.4878	–0.0736	–0.5615
	(0.783)	(0.000)	(0.311)	(0.077)
COMPETITIVE RESPONSIVENESS	0.0538	0.1321	0.2340	0.9789
	(0.510)	(0.046)	(0.002)	(0.008)
COOPERATIVE ACTIVITIES	0.0092	0.3317	0.0087	–0.7445
	(0.909)	(0.000)	(0.904)	(0.037)
SPILLOVER EFFECTS	0.1366	0.2372	–0.1817	0.8388
	(0.085)	(0.000)	(0.012)	(0.003)
Personal variables				
FAMILY	–0.0445	0.2020	0.1203	–0.2118
	(0.569)	(0.002)	(0.089)	(0.113)
EXPERIENCE	0.1291	–0.0243	–0.0830	–0.8781
	(0.114)	(0.710)	(0.259)	(0.004)
CHANCE EVENTS	0.0120	0.0467	0.2512	0.5004
	(0.881)	(0.472)	(0.001)	(0.000)
Industry variables				
TOURISM	–0.0367	0.0765	–0.0301	–0.1670
	(0.803)	(0.518)	(0.820)	(0.317)
HOSPITALITY	–0.2565	–0.0563	0.2308	–0.3090
	(0.134)	(0.640)	(0.089)	(0.209)
WINE	–0.4065	–0.2309	–0.3075	0.0487
	(0.007)	(0.056)	(0.023)	(0.835)
WINE-TOURISM	–0.2905	–0.1500	–0.3639	–0.2174
	(0.046)	(0.199)	(0.006)	(0.390)
Regional effects				
NOT BALLARAT	–0.3496	–0.0933	–0.0888	–
	(0.001)	(0.267)	(0.346)	
N. GRAMPIAN	0.0345	0.1012	0.2819	–
	(0.697)	(0.157)	(0.001)	
NOT BALLARAT WINE	0.2116	0.1942	0.2407	–
	(0.134)	(0.088)	(0.059)	
R^2	0.2230	0.4966	0.3676	0.2770
Number of observations	153	153	153	153
Sig F-ratio	0.0009	0.0000	0.0000	0.0000

Notes: Values are standardized estimated slope coefficients.
Values in brackets are probability levels of significance of the t-ratios.

Overall, it can be concluded that CALCULATOR behaviour is predominantly explained by the cluster variables; the implications may be that not only is cluster behaviour attractive to entrepreneurs with the CALCULATOR characteristic, but that it may even promote this aspect of entrepreneurial behaviour.

The dependent variable, VENTURER, represents behaviour that is driven by incentives and opportunities, and is likely to involve a greater degree of risk-taking. Equation III works well, explaining 37% of the total variation ($R^2 = 0.3676$). Equation IV is the same equation, but was estimated using two-stage least squares (tsls), as the Hausman test indicated that an ordinary least squares (ols) model (equation III) would be subject to simultaneous equation bias. The tsls equation (IV) therefore does not contain the region variables because in a simultaneous model, these would be expected to have an indirect effect through the cluster variables. The region variables are therefore used as instruments in the tsls estimation process. It can be seen that the tsls results differ significantly in terms of signs and significant variables from the original ols results.

In equation III, the COMPETITIVE RESPONSIVENESS variable is highly significant and has a positive sign, while the SPILLOVER EFFECTS variable is also highly significant but has a negative sign, unlike in equation IV. This could be due to simultaneous equation bias. The CHANCE EVENTS variable is positive and highly significant, and three of the industry effects variables are significant. FAMILY has a positive sign and is significant at the 8.9% level. The WINE and WINE-TOURISM industry variables have negative

signs and are highly significant, which was expected as wine production does involve longer-term commitment. As regards place, both the N.GRAMPIAN and the NOT BALLARAT WINE variables are significant, indicating that some places and some industries in certain places offer better opportunities for those with strong VENTURER behavioural characteristics.

In the other VENTURER equation (IV), all of the cluster variables are significant. The COMPETITIVE RESPONSIVENESS and SPILLOVER EFFECTS variables both have positive effects on VENTURER behaviour. The negative signs of the estimated NETWORKING and COOPERATIVE ACTIVITIES variables would appear to indicate that VENTURER behaviour is less likely in the presence of such activities. CHANCE EVENTS again have a positive estimated coefficient, while EXPERIENCE has a negative one, both being highly significant. FAMILY is negative and significant at the 11.3% level. All of these estimated coefficients have signs that have straightforward explanations. None of the industry variables in equation IV approaches reasonable levels of significance, but this may be because in a simultaneous model, the effects of industry are both direct and indirect as they have an impact through the cluster activity variables.

Do cluster variables influence entrepreneurial activities?

In order to investigate the marginal effects of the cluster variables as a whole on entrepreneurial behaviour, the four equations I–IV were re-estimated subject to zero restrictions on the four cluster variables, and the effect on the overall explanatory power of each equation evaluated. By imposing zero restrictions on their coefficients, the method of restricted least squares regression analysis can be used to test whether blocks of variables have a significant effect (Gujarati, 2003, pp 266–273). In the method of restricted least squares, an F-test is used to ascertain the significance of a reduction in the R^2 caused by the removal of a block of variables. If the removal of a block of variables from an equation produces a significant F-ratio, then it can be concluded that the block of variables, as a whole, is important in the equation. The original unrestricted R^2 values, the restricted R^2 values and the F-ratios and their significance are reported in the section of Table 3 relating to the cluster activity variables restriction.

The most interesting result is that the zero restrictions on the cluster variables in the INNOVATOR equation (I) have no significant effect on the explanatory power of the equation. This is especially surprising, as the general view is that clusters provide ideal incubators for innovation. It should be noted that the INNOVATOR equation (I) also had the lowest R^2 values of all four equations. The overall results thus support the view that innovation is very much a random process.

The effect of restricting the cluster variables in the CALCULATOR equation (II) was highly significant, the F-ratio being 26.08, which is statistically significant at a level very much more significant than 1%. This is not surprising as it would be expected that the existence of cluster activities and attributes would attract businessmen and women who embodied CALCULATOR behaviour. The CALCULATOR behavioural characteristics would seem to be essential in order to benefit from clustering activities and attributes. Such behaviour is also likely to be enhanced and developed by operating within a cluster.

However, the effects of cluster activities and attributes on the VENTURER equations (III and IV) are far less straightforward, although the restrictions are significant in both equations. There is a significant effect of two of the cluster variables on the equation estimated using ordinary least squares (III), but it suffers from simultaneous bias and so caution is required in drawing conclusions. For equation IV, the effects of all four cluster variables are significant. Thus it may reasonably be concluded that the cluster variables do have an influence on VENTURER behaviour. However, in both of the VENTURER equations, some of the cluster variables have significant negative estimated coefficients. The negative SPILLOVER EFFECTS coefficient in equation III is difficult to interpret convincingly, but may be due to the simultaneous bias in this equation. The negative significant coefficients for NETWORKING and COOPERATIVE ACTIVITIES in equation IV do correspond to what might be expected as regards VENTURER behaviour, while the attractiveness of SPILLOVER EFFECTS to a VENTURER is obvious.

Only for the calculator equation (II) are all the signs of the estimated coefficients of the cluster variables positive, as well as all being highly significant. For the INNOVATOR equation (I), the coefficient with the negative sign is not statistically significant. Thus across all the equations, the variables that have estimated coefficients with negative signs, in general, do not contradict *a priori* expectations. The overall conclusions relating to the effects of cluster activities and attributes on entrepreneurial behaviour and activities are that they have little or no impact on INNOVATOR behaviour, but have very strong effects on the CALCULATOR aspect of entrepreneurial behaviour. Finally, they also have a strong effect as regards attracting entrepreneurs with VENTURER behaviour. However, it must be remembered that all respondents exhibited all three types of behaviour, but to different degrees.

Table 3. F-tests of zero restrictions on blocks of variables.

	Restricted R^2	Unrestricted R^2	F-ratio	Sig at
Cluster activity variables restriction:				
Model I	0.19937	0.22300	1.07962	Not 25%
Model II	0.12671	0.49655	26.07870	1%
Model III	0.30091	0.36763	3.74553	1%
Model IV	0.22313	0.27697	2.64349	5%
Regional variables restriction:				
Model I	0.15020	0.22300	3.32613	5%
Model II	0.47835	0.49655	1.28335	Not 25%
Model III	0.27909	0.36763	4.97046	1%

Critical values of the tabulated F-statistic

	D of F	1%	5%	10%	25%
Numerator	3	3.95	2.68	2.13	1.39
Numerator	4	3.48	2.45	1.99	1.37
Denominator	120				

Do cluster variables embody everything about place?

In order to address the issue of whether the cluster variables captured the essence of all the effects on entrepreneurial activities relating to a particular place, or alternatively, whether locational effects existed in addition to those from the cluster activities and attributes, equations I–III were re-estimated without the regional dummy variables. Again, the method of restricted least squares was used.

The resulting R^2 and F-values are also shown in Table 3 in the section relating to restriction of the regional variables. It can be seen that the R^2 values fell from about 0.22 to 0.15 for equation I, from 0.50 to 0.48 for equation II, and from 0.37 to 0.28 for equation III. This reduction is significant for the INNOVATOR equation at the 5% level, and for the VENTURER equation at the 1% level, although it is not at all significant for the CALCULATOR equation.

Therefore it can be concluded that INNOVATOR and VENTURER entrepreneurial behaviour are idiosyncratic to particular places. However, although this might be due to the cluster variables being imperfect measures of all the cluster effects, it may mean that there is more to place than simply the cluster effects. Indeed, cluster concepts do not include many of the traditional locational factors of economic geography.

Conclusions

Entrepreneurial activity occurs in several forms. Here, innovator, calculator and venturer types of entrepreneurial behaviour were identified using factor analysis. Regression models were then estimated to explain each of these types of behaviour. The models were formulated on the basis that entrepreneurs with particular types of behaviour would be attracted to establish and operate businesses in particular places and industries. The attractiveness of particular locations depended not only on industry and place *per se*, but also on the cluster activities and attributes. The process being modelled was therefore one of selection of entrepreneurial type and behavioural characteristics by different environments.

Innovator behaviour was the least influenced, if at all, by cluster activities and attributes. This was established by the insignificant reduction in explanatory power of the restriction of the innovator model in Table 3. Taken as a whole, the restricted model showed that the cluster activity variables were found to have no statistical relationship with innovator behaviour, even at the 25% level of significance. Of the regression results for the innovator equation, only the variable that was the factor score for spillover effects approached significance (8.5% level). This is rather surprising, as the expectation was that clusters would be incubators for innovation and that networking would be important in the innovation process. In addition, the family variable and chance events personal variable had no influence on innovator behaviour, although the experience variable had a positive influence at around the 10% level of significance. This last relationship had, on balance, been expected to have a weakly negative impact. The effects of industry and region and the interaction are difficult to interpret, although Ballarat was attractive to innovators at the 0.1% level. Ballarat is the most developed of the three regions. However, the further estimation of a restricted model showed that industry and region effects, taken as a whole, were significant at the 1% level. This

is likely to reflect the different opportunities for innovation in the different industries and places.

The calculator behaviour model provided the best explanatory power, which had been expected because of the intrinsic nature of this type of behaviour. All four cluster variables were found to have a highly significant positive effect on the calculator behaviour variable, again as expected. Although the estimated coefficient for wine was significant, it was negative, which had not been expected. However, when the three wine coefficients were considered together, there were no industry or industry and place effects. Of the personal variables, only family was significant, but highly so, again as might be expected.

Consideration of both sets of estimates for the venturer equation suggested that the cluster variables were found to be influential. As regards the personal variables, family and experience had negative significant coefficients, while the chance events variable had a positive coefficient and was extremely highly significant. The family coefficient was as expected. Although industry had no impact on the venturer variable, region did, but interpretation is difficult.

Finally, looking across the three entrepreneurial types of behaviour, the results for the calculator variable provide very strong support for ideas relating to clusters and networking. If not the essence, one of the essential ingredients and outputs of clusters and networks is the sharing of information. It is the calculator type of entrepreneurial behaviour that is likely to be able to make most use of such information and reciprocate it in kind. A calculator is likely to see that reciprocation is necessary for the long-term success of a cluster or network. In informal networks especially, the lack of reciprocation by one member is likely to lead, in turn, to a lack of reciprocation by other members towards that member.

However, venturer type of behaviour would seem to be negatively related to networking and cooperative activities, although positively related to spillover effects and competitive responsiveness, as would be expected. For the venturer, it would appear that cluster activities are to be exploited and that little reciprocation is to be expected. Thus too much of the venturer behavioural characteristic could be detrimental to cluster development. As regards innovator behaviour, cluster activities and attributes would appear to be of little importance. This is the most surprising result of the study and pours doubt on claims relating to the importance of cluster activities and attributes for innovation *per se*.

The lack of an empirical relationship between innovator behaviour and cluster activities and attributes leads to the conclusion that the evidence from this study therefore does not provide support for the view that clusters act as incubators for innovation. This finding could be due to measurement problems, but as the rest of the results generally support and do not contradict any of the stronger relationships hypothesized *a priori*, the measurement problem would have to relate primarily to the innovator variable.

References

Anderson, K. (2000), *Export-Led Growth Lessons from Australia's Wine Industry,* Rural Industries Research and Development Corporation, Canberra.

Ateljevic, I., and Doorne, X. S. (2000), 'Staying within the fence: lifestyle entrepreneurship', *Journal of Sustainable Tourism*, Vol 8, No 5, pp 378–392.

Cambourne, B., and Macionis, N. (2000), 'Meeting the wine-maker: wine tourism product development in an emerging wine region', in Hall, C. M., *et al*, eds, *Wine Tourism Around the World: Development, Management and Markets*, Butterworth Heinemann, Oxford, pp 81–101.

Dowling, R. (1998), 'Wine tourism: perfect partners', *Wine Industry Journal,* Vol 13, No 3, pp 307–309.

Gibson, L., Lynch, P., and Morrison, A. (2005), 'The local destination tourism network: development issues', *Tourism and Hospitality Planning and Development*, Vol 2, No 2, pp 87–99.

Gujarati, D. N. (2003), *Basic Econometrics*, 4 ed, McGraw-Hill/Irwin, New York.

Hall, C. M., and Rusher, K. (2005), 'Entrepreneurial characteristics and issues in the small-scale accommodation sector in New Zealand', in Jones, E., and Haven, C., eds, *Tourism SMEs, Service Quality and Destination Competitiveness: International Perspectives*, CAB International, Wallingford, pp 143–154.

Hall, C. M., Sharples, L., and Macionis, N., eds (2000), *Wine Tourism Around the World: Development, Management and Markets*, Butterworth Heinemann, Oxford.

Johnson, G. (1998), 'Wine tourism in New Zealand: a national survey of wineries, 1997', unpublished postgraduate thesis, University of Otago, Otago, New Zealand.

Macionis, N., and Cambourne, B. (2000), 'Towards a national wine tourism plan: wine tourism organisations and development in Australia', in Hall, C. M., *et al*, eds, *Wine Tourism Around the World: Development, Management and Markets,* Butterworth Heinemann, Oxford, pp 226–252.

March (1991), 'Exploration and exploitation in organizational learning', *Organization Science,* Vol 2, No 1.

Michael, E. J. (2003), 'Tourism micro-clusters', *Tourism Economics,* Vol 9, No 2, pp 133–146.

Michael, E. J. (2006), *Micro-Clusters and Networks: The Growth of Tourism,* Elsevier, Oxford.

O'Donnell, A., Gilmore, A., Cummins, D., and Carson, D. (2001), 'The network construction in entrepreneurial research: a review and critique', *Management Decision*, Vol 39, No 9, pp 749–760.

Porter, M. (1998), 'Clusters and competition: new agendas for companies, governments, and institutions', in *On Competition,* Harvard Business School, Boston, MA, pp 197–287.

Rosenfeld, S. A. (1997), 'Bringing business clusters into the mainstream of economic development', *European Planning Studies,* Vol 5, No 1, pp 3–23.

Sutton, I. (1998), 'National wine tourism strategy: introduction and overview', *Wine Tourism – Perfect Partners, Proceedings of the First Australian Wine Tourism Conference*, Bureau of Tourism Research, Canberra.

Taylor, P., McRae-Williams, P., and Lowe, J. (2007), 'The determinance of cluster activities in the Australian wine and tourism industries', *Tourism Economics*, Vol 13, No 4, December (forthcoming).