

## **Validating a Novel New Instrument for Measuring Firm Managers' Intellectual Property Management Practices: A study of biotechnology firms**

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### **Abstract**

**Purpose:** The purpose of this research project was to pilot and validate a new instrument to measure firm intellectual property (IP) management practices.

**Methodology/Approach:** A survey instrument was developed in consultation with a Perth-based firm of patent attorneys specialising in IP management services. The survey was piloted by random mail-out to 357 biotechnology firms, 68 of which returned a useable response. IP managers' responses to the following seven dimensions of extent of IP management practice were measured on a 5-point Likert-scale: 1) Record-keeping and management practices (22 items); 2) IP capture and protection mechanisms (10 items); 3) Use of IP management services or traditional patent attorney services (9 items); 4) Defensive measures (12 items); 5) Business Plan and strategic vision (9 items); 6) Knowledge of the IP landscape (9 items); and, 7) Promoting an IP culture (7 items). Factor Analysis and Principle Component Analysis extraction method with Varimax Rotation were used to identify factors measured by our instrument.

**Findings:** Between two and seven factors were extracted for each of the dimensions measuring IP management practices, explaining between 51% (IP Defensive Measures) to 74% (IP management services and traditional patent attorney services) of the cumulative variance on any one factors. Scrutiny of the Component Matrices for a common thread amongst large loadings indicated thirteen actual measures of IP management practices perceived by biotechnology firm IP managers; with high Cronbach's Alpha reliability.

**Research limitations/implications:** Factor analysis of this instrument revealed that IP managers' responses were loading on 13 factors instead of the original 7 anticipated dimensions to the measure. The spread of 78 item was reduced to a more relevant and economical measure with 56 items. As scrutiny of the factor analysis has revealed increasing heterogeneity to IP management practices in the biotechnology industry, it might be interesting to repeat the study for IP managers in another industry. A limitation of the study is its Australian biotechnology context and also that no concession was made in the measure for the effect of firm vertical disintegration.

**Originality/value:** To our knowledge this is a novel project. We have validated and streamlined a new IP management practices instrument with advice from a practicing firm of IP management consultants. The instrument should be useful to high-technology firms as a checklist of IP management practices for innovation management. It should also be a valuable measurement tool for academics, firms and industries wanting to characterise the nature of firm-level IP management practices.

## **Introduction**

Published research about Intellectual property (IP) can be categorized by subject matter as follows: 1) studies that examine the legal nature of patents and international patent law; 2) enforcement and disputes related studies, often focussed on the ramifications of infringement; 3) consideration of the microeconomic effects of IP protection, monopoly and effect of protectionist policy and regulatory framework; 4) studies that examine IP protection from different industry perspectives focussing on unique attributes of high-technology, research and development (R&D) focussed firms; 5) investigations of firm-related determinants of IP strategy such as size, training and IP personnel; 6) empirical studies that attempt to quantify the value of IP; and, 7) intellectual property management studies (summary from an excellent recent review by Hansel (2006)). The subject of the current research project is closest in subject matter to 4) and 7) above - an industry-specific investigation of IP management practices.

Intellectual capital is notoriously difficult to define (Roos et al., 2005; p. 19). Intellectual property (IP) as a subset of intangible firm value is often registered, with associated legal costs capitalized in financial reports, and considerable disclosure in the firm's annual report (patents and trademarks), and on the firm website. Less tangible IP is more often hidden from investors (trade secrets, copyright and design are less obvious examples of property that is IP). Traditionally registered IP rights are part of the 'Organisational Capital' classification of intellectual capital (Stewart, 1997).

In an interesting study of the networking and integration of IP into business process by Mouritsen and Koleva (2005) investigated the business environment setup around patented IP rights. Through case study analysis of Palm Computing Inc. and Polaroid, the authors discuss

patents as networked objects - as a driving-force responsible for integrated management. The authors theorise that:

“...the concreteness of managing patents play out many more dimensions, and that to make patents valuable requires a somewhat more complex management agenda”, and, “... the patent, when it works, develops surprising relations that can hardly be captured in a finite resource allocation mechanism” (p. 316)

The aim of this paper was to validate an instrument which, in future studies, can be used to empirically capture some of the relational determinants of IP property rights identified by Mouritsen and Koleva above. In considering IP management practices of active IP managers in the life sciences sector, our paper attempts to disaggregate the processes that accountants and IP management consultants perceive as important for establishment of sound and defensible IP rights; there are many important network players. The measures' individual items which loaded during Factor Analysis and survived scrutiny during critical evaluation of the component matrices of the pilot instrument clearly identify a complex array of people (IP managers (firm IP champions), consultants, researchers, patent attorneys, employees, financial report preparers, firm visitors, new market entrants, policy makers, external contractors), places (patent office, IP management committee, contractor firms) and things (third-party prior art, body of scientific knowledge, firm culture and strategic alliances) contributing to firms' IP networks.

The most common studies examine the nature of IP rights and are typified by the work of Levin et. al. (1987), who discovered from experts working in US manufacturing companies that they typically trust alternative strategies such as secrecy, managed lead time and

complementary sales and services more than formal intellectual property rights as a way of protecting their property. For an excellent recent review of issues related to IP management (Hansel, 2006).

Scientific research papers have clearly identified specific problems that may exist within the biotechnology sector in terms of the granting and enforcement of intellectual property rights protecting biotechnology-related products and processes (Adler, 1984; Caulfield et al., 2006). The latter paper by Caulfield and co-authors sought to summarise some of the concerns raised within the community regarding the use of patents to protect rights associated with the discovery of particular genetic sequences, so-called ‘gene patents’, the resulting policy decisions and legislative changes resulting from these concerns, and whether the concerns raised have manifested in fact. Specifically, Caulfield et al discuss whether the existence of a large number of patents for gene-related inventions, in combination with the myriad of owners of these patents, makes it difficult to acquire all necessary rights to carry out further research, thereby resulting in the underuse of valuable technologies – the so-called “tragedy of anticommons”. Furthermore, Caulfield et al identified the risk that owners of patents protecting fundamental inventions in the sphere of genetics may assert their rights to exclude others, thereby preventing further development or access to the technologies.

These concerns – as discussed by Caulfield - have been raised by a number of ‘controversies’ such as the Myriad Genetics’ decision to enforce patents related to the breast cancer genes BRCA1 and BRCA2, and has led to significant discussions between policy makers as to the impact of intellectual property rights on the inhibition, or otherwise, of research and development. As an example, the Australian Advisory Council on Intellectual Property (ACIP) published a Report (2005, ACIP) on “Patents and Experimental Use” after a lengthy

consultation, and recommended that an exception to experimental use be included in the legislation to help alleviate concerns that patents provided a barrier to research. However, to date, no legislative changes have been made in response to this recommendation. Despite these concerns, Caulfield et al found little evidence that these concerns had manifested as real problems – except possibly where patents protected inventions relating to diagnostic testing. They conclude a number of factors may be present which mitigate against the “tragedy of anticommons” and lack of access. Caulfield et al identified processes such as licencing, ‘inventing around’ protected inventions, challenging the validity of patents, and exploiting the invention in jurisdictions where there is no patent protection as examples of such processes. All of these are avenues regularly used by researchers and organisations in other technology arenas. In Australia, in December 2002, the Attorney General requested that the Australian Law Reform Commission investigate the practices governing IP rights over genetic materials and related products with a particular focus on human health issues. The reader is referred to the executive summary of the final report tabled in Australia’s parliament on 31 August 2004; it makes fascinating reading (Genes and Ingenuity: Gene Patenting and Human Health (ALRC 99)).

The need for models of biotechnology intellectual property management has been clearly identified in the scientific literature as recently as 2002 (Gold et al., 2002).

Intellectual property and its management by an organization falls within this previously defined ‘Organizational Capital’ category of intellectual capital, and organizational capital defines firm-value captured in systems, processes, and proprietary databases. It is these systems, processes and property databases which are critical for correct capturing of data necessary for IP registration and protection. What is unclear, however, is the critical path an

organization may take in achieving protection and property rights for its intangible assets. In high-technology firms like the biotechnology industry, allocation of scarce resources is very critical since most firms would juggle management and protection of a suite of IP rights with a view to commercialisation or early licensing. Royalties from early licensing versus full commercialisation of a discovery is often a choice imposed on the company by the growing pressure of dwindling cash reserves. More importantly full firm-value will not be realised, regardless of the actual legal protection offered by establishment of IP rights, without deeper knowledge of IP management practices and the measures which contribute to them.

The remainder of this paper is structured as follows: 1) Instrument Development; 2) Results and Discussion; 3) Limitations; 4) Future Research; 5) References; and, 6) Appendices.

### **Instrument Development and Survey Research Methods**

The design and construction of our measurement instrument was a combined effort from: 1) Lee, a management accounting academic with extensive survey research methods experience; 2) White, a chartered accountant, business academic and former NH&MRC Senior Research Officer with extensive biotechnology experience; and, 3) Slater, a practicing IP management consultant with significant international experience. We designed the original instrument with the following considerations. It was hypothesized that firm IP managers needed to consider both sound accounting internal controls and management of the legal protection mechanisms. Seven important measures of IP management practice were proposed: 1) record-keeping and management practice; 2) capture and protection mechanisms; 3) the use of management services or traditional patent attorney services; 4) defensive measures; 5) business plan and strategic vision; 6) knowledge of the IP landscape; and, 7) promotion of IP culture in the firm.

Survey research methods consistent with Dilman (2000) and de Vaus (1991) were employed to mail the survey with an introductory letter and information sheet to 357 companies. The company names were obtained from two sources: 1) the AusBiotech (industry lobby group) Australian Biotechnology 2005, Directory of Australian Biotech; and, 2) the Australian Stock Exchange (ASX) biotechnology investor website<sup>1</sup>. Of the 357 potential respondents, 125 were listed biotechnology companies, which represented nearly the entire population of publicly-listed biotechnology companies in Australia in July 2006. The response rate was only 19% with 68 completed surveys returned. The relatively low response rate can probably be attributed to the send-out time coinciding with the financial reporting period; some three months after financial year end in 2006.

The IP manager's responses to the seven measured dimensions of IP management practice were measured on a 5-point Likert-scale of extent of use, from (1) 'not at all' to (5) 'to a great extent'. In developing individual items under each measure a comprehensive approach was taken, in other words we did not choose the most important IP management practices to question, but instead tried to ask about every IP management practice pertinent to that measure. This was done in anticipation of the Factor Analysis undertaken here identifying important measurement items. The number of individual items in each dimension of the measure was: 1) Record-keeping and management practices (22 items); 2) IP capture and protection mechanisms (10 items); 3) IP management services or traditional patent attorney services (9 items); 4) Defensive measures (12 items); 5) Business Plan and strategic vision (9 items); 6) Knowledge of the IP landscape (9 items); and, 7) Promote an IP culture (7 items).

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<sup>1</sup> <http://www.asx.com.au/investor/industry/biotech/index.htm>

The individual Likert-scale scores for each of the 78 items were recorded in an SPSS database for each of the 68 respondent firms. Two of the responses had to be removed from the database because they were largely incomplete, resulting in the use of 66 questionnaires in the analyses. SPSS statistical analysis was done to measure: 1) factor loadings; and 2) Cronbach's Alpha reliability measure of item loading. Factor Analysis and Principle Component Analysis extraction method with Varimax and Kaiser Normalisation rotation method were used to identify the loading of factors measured by our instrument. The next section is combined results and discussion.

## **Results and Discussion**

The responses from 66 surveys were entered into an SPSS database for statistical analysis. The coding master identified the item questions measured for each dimension of IP management practice as follows: 1) Record-keeping and management practice (RK1 to RK22); 2) IP Capture and protection mechanisms (C&P1 to C&P10); 3) IP Management services or traditional patent attorney services (MS/PA1 to MS/PA9); 4) Defensive measures (DM1 to DM12); 5) Business plan and strategic vision (BPSV1 to BPSV9); 6) Knowledge of the IP landscape (KNOW1 to KNOW9); and, 7) Promote IP culture (CULT1 to CULT7) (refer Appendix A – Measurement Instrument).

Two tests were done of the data's suitability for further factor analysis (FA). First, the Kaiser-Meyer-Olkin measure of sample adequacy (KMO) informs the proportion of variance which is common variance, which might be caused by underlying factors. A reported high value close to 1 indicates that factor analysis may be useful with the data. Generally a reported result of less than 0.5 would indicate that FA would not be useful. Second, a Bartlett's test of sphericity (BTS) is a measure of whether the variables are unrelated, and very small

probability levels indicate a significant relationship probably does exist. Table 1 reports these test results for each of the seven measured dimensions of IP management practice.

INSERT TABLE 1 HERE

A factor analysis was conducted on each of the seven dimensions separately. In addition to the eigenvalue criterion (Kaiser, 1960), two other criteria were used to decide how many components to retain. They were the scree plot, which also retained the same number of components (Catell, 1966) and total explained variance of the components (Stevens, 1986). The eigenvalue, the percentage of explained variance, and the cumulative percentage for each component are reported in Table 2.

INSERT TABLE 2 HERE

The anti-image correlation matrix was examined next for values on the main diagonal less than 0.5 as this is a possible indicator that variables do not seem to fit with the structure of other variables. The items with an  $r < 0.5$  were excluded and a factor analysis was performed on the reduced items (presented in brackets for RK in Table 2 for the following analysis). The items excluded were RK2, RK3, RK4, RK5, RK6, RK7, RK8, RK13 and RK16 from the record keeping dimension after two rounds of factor analysis; each round excluding variables below 0.5 on the anti-image correlation matrix main diagonal. None of the variables in other dimensions were below the threshold level of 0.5. These results are presented in Table 3.

INSERT TABLE 3 HERE

### *Record keeping and management practices*

The results of the factor analysis on the 22 item record keeping measure indicated that there were seven factors. However, this was reduced to only four factors that were loading reliably (discussed in the preceeding paragraph). See Table 4 for the component matrix for the four factors. Cronbach alphas were calculated for the four factors to test their reliability. They are 0.782, 0.660, 0.547 and 0.552, respectively. The last two factors were removed from further analyses as the Cronbach's alphas were below the lower limits of acceptability of 0.6 (Hair, et al, 1998). This resulted in two factors that can be reliably and validly measured using the instrument developed in this study. The first factor was named 'physical records management' because the items loading on it were concerned with the physical security of electronic documents, electronic devices and archived documents. The second factor was named 'records of firm IP' as the three items loading on it are related to the maintenance of records such as the minutes of meeting where firm IP were discussed by management, regular database searches related to IP assets, and internal IP disclosure documents that employees use to record new knowledge.

INSERT TABLE 4 HERE

### *IP capture and protection mechanisms*

A factor analysis of this 10-item measure produced three factors. However, C&P9 and C&P5 were removed from the analysis because their factor loadings were low. A second factor analysis of the remaining eight items produced two factors (see Table 5 for component matrix). The results showed that IP managers in the firms separated the external and internal aspects of IP capture and protection mechanisms. The first factor captured the external aspects of IP capture and protection mechanisms, as the items loading on this factor are concerned with the lodgement of patent applications, records of provisional or granted IP status, and renewal reminders from firm patent attorneys. The second factor, comprising of C&P1,

C&P2, and C&P7, measured the internal aspects of the capture and protection of IP, and items such as logged access to firm IP and maintenance of confidentiality agreements with employees. Reliability tests for the two factors produced high Cronbach alphas of 0.876 and 0.753, respectively.

INSERT TABLE 5 HERE

*IP management services or traditional patent attorney services*

The factor analysis of the MS/PA showed loading with Eigenvalues greater than one (Table 2) for three factors. The first factor comprises of five of the nine items. All the items relate to the seeking of advice or opinion in relation to firm IP, therefore this factor is named IP management advisory services. The second factor has three items (MS/PA7, MS/PA8 and MS/PA9) (see Table 6) and is named IP management control as the three items relate to the implementation of control systems within the firm, such as records management, audit and the production of policies and procedures. The isolation of question MS/PA2 from the other two factors seems logical in retrospect as that item measures, “Advice on your firm’s organisational structure”. The original intention was to have an item measuring advice about firm structure as it affects IP ownership rights, clearly the wording of the question was not carefully structured and this was detected by the respondents. In the revised instrument the question will be re-worded to, “Advice on IP ownership and the effect of organisational structure”. Cronbach’s alphas for the two factors are 0.824 and 0.869, respectively.

INSERT TABLE 6 HERE

*Defensive measures*

Defensive measures were measured using a 12-item instrument. An exploratory factor analysis revealed two factors. However, three of the items were not clearly loading on either

of the factors (DM9, DM11, and DM12) and were removed from the analysis. Another factor analysis was run on the remaining nine items and also revealed two factors (see Table 7). All of the items making up the first factor relate to general defensive measures with respect to employees and contractors working with the firm. The second factor comprises of four items measures issues arising when staff join and leave the firm. Tests of reliability produced Cronbach alphas of 0.823 and 0.741 for the two factors, respectively.

INSERT TABLE 7 HERE

#### *Business plan and strategic vision*

The nine-item instrument capturing business plan and strategic vision was factor analysed and produced two factors (see Table 8). The first factor, comprising of six items, is named strategic planning. The strategic planning dimension is concerned with the place of IP in the strategic planning of the firm. The second factor, IP risk management, comprises of three factors and the three items relate to the procedures and committees in place to manage the risks associated with the firm IP. The two factors were found to meet the reliability requirements, with Cronbach's alphas of 0.860 and 0.743, respectively.

INSERT TABLE 8 HERE

#### *Knowledge of the IP landscape*

Nine of the ten items measuring 'knowledge of the IP landscape' variables loaded on a single factor, except for KNOW7, "Use of regular searches and patent watches by a patent attorney or other professional". Values for this KNOW7 variable from the principal component analysis were 0.587 for factor 1 and 0.633 for factor 2, which are not too dissimilar (see Table

9). For this reason all of the KNOW variables will be retained in the measure for the revised instrument. The test of reliability indicated that this instrument is acceptable with a Cronbach's alpha of 0.880.

INSERT TABLE 9 HERE

*Promote an IP culture*

A factor analysis of the seven items measuring the promotion of an IP culture showed two factors. CULT 5 was removed from the analysis and a subsequent exploratory factor analysis was performed (see Table 10). The first factor appears to include the items relating to the promotion of IP research culture within the firm. Examples of items loading on factor one are state-of-the-art training, specialist IP management training and working with alliance partners. As a result, this factor will be named the promotion of IP research culture. The second factor, which comprises of CULT1 and CULT2, was probably perceived differently by respondents since those items refer to professional bodies such as AusBiotech (Australian biotechnology industry lobby group), and BIO (the equivalent world-wide body). The revised instrument will therefore delineate CULT1, and CULT2, as a factor related to interaction with the national and world-wide lobby groups through conference attendance and training. This factor will be named the promotion of IP professional culture. Reliability statistics for the two factors produced Cronbach alphas of 0.797 and 0.890, respectively.

INSERT TABLE 10 HERE

The seven proposed dimensions of IP management practices in the original instrument has been re-stated into thirteen factors with high Cronbach's Alphas (Cronbach, 1951). These new factors, along with their Cronbach's alphas, are presented in Table 11.

INSERT TABLE 11 HERE

### **Limitations**

Firms in the biotechnology industry like other high-technology industries such as the semiconductor industry (Diabiaggio, 2007) are subject to collaborative outsourcing from the research and development to commercialisation stage of product development. One anticipated effect of the various strategic alliances formed by biotechnology firms is that measurement of IP management practices in a vertically disintegrated firm will be very different from a firm with high-level knowledge integration. Since our survey was piloted by random mail-out it does not take into consideration this effect on responses.

### **Future Research**

The original 78-item measure of IP management practices could be trialled with another industry to discover whether factor loadings reveal unique differences in the perceptions of biotechnology firm IP managers and those in other industries. The revised instrument (Table 11) can now be used in a larger study with appropriate independent variables to measure determinants of IP management practice. In addition, the anticipated measurement problem with vertically integrated and disintegrated firms, will inform a further study using a case study approach with vertically integrated and vertically disintegrated firm's managers to identify measurement items likely to need redesign for a more robust instrument.

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**Table 1: The Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity for each dimension of the IP management practices measure.**

<b>Variable</b>	<b>KMO</b>	<b>BTS Chi-square</b>	<b>BTS Sig.</b>
<b>RK1 to RK22</b>	0.560	462.094	0.000
<b>C&amp;P1 to C&amp;P10</b>	0.696	280.413	0.000
<b>MSPA1 to MSPA9</b>	0.807	259.909	0.000
<b>DM1 to DM12</b>	0.814	268.836	0.000
<b>BPSV1 to BPSV9</b>	0.856	245.567	0.000
<b>KNOW1 to KNOW9</b>	0.835	272.974	0.000
<b>CULT1 to CULT7</b>	0.707	161.298	0.000

**Table 2: Results of the factor analysis of the RK, C&P, MS/PA, DM, BPSV, KNOW and CULT dimensions of IP management practice, reporting number of loading factors (Factor No.), Eigenvalues and the cumulative variance explained by the loading factors (Cumulative %).**

<b>Dimension</b>	<b>Factor No.</b>	<b>Eigenvalue</b>	<b>Cumulative %</b>
<b>RK</b>	1 (1)	4.665 (3.922)	21.204 (30.172)
	2 (2)	2.727 (1.661)	33.602 (42.947)
	3 (3)	1.867 (1.446)	42.086 (54.070)
	4 (4)	1.796 (1.214)	50.249 (63.407)
	5	1.429	56.743
	6	1.271	62.519
	7	1.207	68.003
<b>C&amp;P</b>	1	3.699	36.993
	2	2.059	57.582
	3	1.225	69.832
<b>MS/PA</b>	1	4.245	47.169
	2	1.400	62.725
	3	1.058	74.485
<b>DM</b>	1	4.716	39.301
	2	1.488	51.703
<b>BPSV</b>	1	4.619	51.321
	2	1.002	62.450
<b>KNOW</b>	1	4.636	51.512
	2	1.187	64.698
<b>CULT</b>	1	3.148	44.970
	2	1.368	64.512

**Table 3: Results of factor analysis on the reduced record keeping instrument**

<b>Dimension</b>	<b>Factor No.</b>	<b>Eigenvalue</b>	<b>Cumulative %</b>
<b>RK</b>	1	3.922	30.172
	2	1.661	42.947
	3	1.446	54.070
	4	1.214	63.407

**Table 4: Component matrix for record keeping dimensions**

	Component			
	1	2	3	4
RK18	<b>.840</b>	.297	.096	.108
RK17	<b>.753</b>	.331	.162	.052
RK14	<b>.743</b>	.110	.190	-.064
RK15	<b>.667</b>	-.200	-.076	.450
RK19	.149	<b>.783</b>	.237	.082
RK12	.116	<b>.703</b>	-.293	.277
RK10	.213	<b>.649</b>	.228	.083
RK21	.309	-.116	<b>.759</b>	.100
RK1	-.057	.341	<b>.665</b>	.191
RK20	.261	.327	<b>.513</b>	-.295
RK11	.076	.192	-.289	<b>.768</b>
RK22	.216	.067	.409	<b>.615</b>
RK9	-.006	.150	.218	<b>.574</b>

**Table 5: Component matrix for IP capture and protection mechanisms**

	Component	
	1	2
C&P10	<b>.879</b>	.002
C&P8	<b>.872</b>	-.052
C&P4	<b>.821</b>	.092
C&P3	<b>.736</b>	.400
C&P6	<b>.733</b>	.070
C&P1	-.080	<b>.928</b>
C&P2	.005	<b>.898</b>
C&P7	.273	<b>.506</b>

**Table 6: Component matrix for IP management services or traditional patent attorney services**

	Component		
	1	2	3
MS/PA5	<b>.902</b>	.066	-.082
MS/PA3	<b>.783</b>	.131	.342
MS/PA4	<b>.735</b>	.336	.182
MS/PA6	<b>.673</b>	.334	-.447
MS/PA1	<b>.587</b>	.287	.270
MS/PA8	.228	<b>.878</b>	-.096
MS/PA9	.125	<b>.844</b>	.204
MS/PA7	.271	<b>.824</b>	.249
MS/PA2	.168	.215	<b>.833</b>

**Table 7: Component matrix for defensive measures**

	Component	
	1	2
DM8	<b>.833</b>	.164
DM5	<b>.776</b>	-.009
DM10	<b>.752</b>	.237
DM6	<b>.752</b>	.205
DM2	<b>.608</b>	.336
DM1	.019	<b>.845</b>
DM7	.114	<b>.786</b>
DM3	.282	<b>.703</b>
DM4	.352	<b>.562</b>

**Table 8: Component matrix for business plan and strategic vision**

	Component	
	1	2
BPSV6	<b>.808</b>	.287
BPSV9	<b>.794</b>	.189
BPSV2	<b>.750</b>	.217
BPSV1	<b>.675</b>	.205
BPSV4	<b>.648</b>	.295
BPSV3	<b>.632</b>	.480
BPSV8	.241	<b>.828</b>
BPSV7	.233	<b>.826</b>
BPSV5	.262	<b>.654</b>

**Table 9: Component matrix for knowledge of IP landscape**

	Component	
	1	2
KNOW9	<b>.803</b>	.240
KNOW3	<b>.762</b>	-.299
KNOW4	<b>.759</b>	.050
KNOW6	<b>.728</b>	-.438
KNOW5	<b>.720</b>	-.451
KNOW1	<b>.697</b>	-.213
KNOW2	<b>.693</b>	.217
KNOW8	<b>.690</b>	.386
KNOW7	.587	<b>.633</b>

**Table 10: Component matrix for promoting an IP culture**

	Component	
	1	2
CULT6	<b>.809</b>	.081
CULT4	<b>.795</b>	.216
CULT7	<b>.771</b>	.145
CULT3	<b>.730</b>	.106
CULT1	.143	<b>.942</b>
CULT2	.175	<b>.931</b>

**Table 11: Reliability testing of each measure of firm IP management practices. Cronbach's Alpha reliability measure (Alpha) are reported for each new (\*) factor**

<b>Item</b>	<b>Description</b>	<b>Alpha</b>
<b>Physical records management</b>		
<b>RK18</b>	Maintaining physical security over electronic storage devices and IT systems	<b>0.782</b>
<b>RK17</b>	Maintaining physical security over document storage devices	
<b>RK14</b>	Archiving records after an appropriate period at a secure location	
<b>RK15</b>	Backup of IT storage devices	
<b>Records of firm IP</b>		
<b>RK19</b>	Recording of regular database searches related to the firm's IP assets	<b>0.660</b>
<b>RK12</b>	Minutes of meetings where IP matters have been discussed by management	
<b>RK10</b>	IP disclosure documents for your employees to record the development of new knowledge	
<b>IP capture – external aspects</b>		
<b>C&amp;P10</b>	Lodgement of a PCT patent application	<b>0.876</b>
<b>C&amp;P8</b>	Lodgement of a provisional patent application	
<b>C&amp;P4</b>	Hard-copy files of application for formal IP rights	
<b>C&amp;P3</b>	Manual or electronic database records of provisional or granted IP status	
<b>C&amp;P6</b>	Patent Attorney's reminder system to track critical renewal dates	
<b>IP capture – internal aspects</b>		
<b>C&amp;P1</b>	Logged use of important copyright material et. Technical manuals, brochures and website materials	<b>0.753</b>
<b>C&amp;P2</b>	Logged use of the firm's trade marks et. As used on documentation, advertising, packaging etc.	
<b>C&amp;P7</b>	Confidentiality agreements and secure documentation for maintaining employee know-how and trade secrets	
<b>IP management advisory services</b>		
<b>MS/PA1</b>	Business process improvements advice aimed at enhancing safeguards for the firm's IP	<b>0.824</b>
<b>MS/PA3</b>	Advice on IP ownership within the group	
<b>MS/PA4</b>	Advice on IP licensing management issues	
<b>MS/PA5</b>	Advice on applying for formal protection of IP	
<b>MS/PA6</b>	Opinions on validity or infringement of existing IP rights	
<b>IP management control</b>		
<b>MS/PA7</b>	Setting up in-house IP records management system	<b>0.869</b>
<b>MS/PA8</b>	Carrying out of an IP audit	
<b>MS/PA9</b>	Drafting of firm IP policies and procedures	
<b>General defensive measures</b>		
<b>DM2</b>	Staff employment contracts contain IP provisions	<b>0.823</b>
<b>DM5</b>	IP provisions are made in contracts with external contractors	
<b>DM6</b>	Contractors and visitors sign confidentiality agreements with the firm	
<b>DM8</b>	Management of disclosure and the publication process for knowledge relating to IP assets	
<b>DM10</b>	Controlling third-party IP disclosures by firm employees to outsiders.	
<b>Defensive measures relating to staff turnover</b>		
<b>DM1</b>	Staff sign confidentiality agreements with the firm at commencement	<b>0.741</b>
<b>DM3</b>	Exit interviews with departing employees address IP issues	
<b>DM4</b>	The Induction program with new employees reviews the firm's IP policy documents and contractual obligations	
<b>DM7</b>	Physical security measures are maintained at the firm's premises	

**Table 11: Reliability testing of each measure of firm IP management practices. Cronbach's Alpha reliability measure (Alpha) are reported for each new (\*) factor (continued)**

<b>Strategic planning</b>		
<b>BPSV1</b>	IP management issues discussed fully in the business plan	<b>0.860</b>
<b>BPSV2</b>	IP is an agenda item of all team meetings	
<b>BPSV3</b>	IP is addressed in the mission statement of the firm	
<b>BPSV4</b>	The business has an 'IP Champion' who manages all facets of the firm's IP	
<b>BPSV6</b>	Strategic planning includes consideration of IP matters	
<b>BPSV9</b>	The firm budgets and plans for IP expenditure	
<b>IP risk management</b>		
<b>BPSV5</b>	The business has an in-house patent attorney/IP lawyer	<b>0.743</b>
<b>BPSV7</b>	Management has a documented IP policies and procedures manual	
<b>BPSV8</b>	An IP committee reviews IP matters and has responsibility for IP matters	
<b>Knowledge of the IP landscape</b>		
<b>KNOW1</b>	Information about new entrants to your market	<b>0.880</b>
<b>KNOW2</b>	Assessment of infringement risk against third parties	
<b>KNOW3</b>	Regular searches through free databases	
<b>KNOW4</b>	Regular searches through paid databases	
<b>KNOW5</b>	Regular review of scientific literature.	
<b>KNOW6</b>	Use of conferences and other literature	
<b>KNOW8</b>	Regular reviews of third-party prior art, either in-house or by patent attorney.	
<b>KNOW9</b>	Cross-referencing relevance of researched prior art to specific IP rights of the company	
<b>IP research culture</b>		
<b>CULT3</b>	Firm employees attend state-of-the-art training for their field of expertise	<b>0.797</b>
<b>CULT4</b>	Firm employees attend specialist IP management training	
<b>CULT6</b>	The firm's IP Champion or IP consultant regularly conducts IP training sessions	
<b>CULT7</b>	Firm employees work directly with employees of strategic alliance partner on different projects	
<b>IP professional culture</b>		
<b>CULT1</b>	Firm employees attend AusBiotech seminars	<b>0.890</b>
<b>CULT2</b>	Firm employees attend BIO or AusBiotech conference annually	

**APPENDIX A – MEASUREMENT INSTRUMENT**

**1. To what extent is each of the following record-keeping and management practices used in your firm? (Please circle one answer in each line):**

		<i>Not at All</i>		<i>To some extent</i>		<i>To a great extent</i>
RK1	Authenticated (pages signed and dated) notebooks and diaries	1	2	3	4	5
RK2	Unauthenticated notebooks and diaries	1	2	3	4	5
RK3	Saved emails communicating significant findings within the firm	1	2	3	4	5
RK4	Recorded telephone/verbal conversations discussing significant	1	2	3	4	5
RK5	Record-keeping in a proprietary (in-house developed) electronic database.	1	2	3	4	5
RK6	Record-keeping in an off-the-shelf electronic database	1	2	3	4	5
RK7	Saved soft-copies of protocols and procedures related to new knowledge	1	2	3	4	5
RK8	Printed hard-copies of protocols and procedures related to new knowledge	1	2	3	4	5
RK9	Personal notes maintained in the employees' work area	1	2	3	4	5
RK10	Internal intellectual property (IP) disclosure documents for your employees to record the development of new knowledge	1	2	3	4	5
RK11	Filing of critical third-party agreements e.g. Disclosure agreements, confidentiality agreements, contracts, licenses and assignments.	1	2	3	4	5

RK12	Minutes of meetings where IP matters have been discussed by management	1	2	3	4	5
RK13	Filing important correspondence on site	1	2	3	4	5
RK14	Archiving records after an appropriate period at a secure location	1	2	3	4	5
RK15	Backup of IT storage devices	1	2	3	4	5
RK16	Notification of the firm's patent attorney of potential IP development	1	2	3	4	5
RK17	Maintaining physical security over document storage sites	1	2	3	4	5
RK18	Maintaining physical security over electronic storage devices and IT systems	1	2	3	4	5
RK19	Recording of regular database searches related to the firm's IP assets	1	2	3	4	5
RK20	Does your company use software for email encryption?	1	2	3	4	5
RK21	Visitors sign in and wear identification badges, must read and sign documentation setting out their obligations	1	2	3	4	5
RK22	Keeping hard and soft-copies of relevant third-party prior art	1	2	3	4	5

**2. To what extent are each of the following Intellectual Property (IP) capture and protection mechanisms used in your firm? (Please circle one answer in each line):**

		<i>Not at All</i>		<i>To some extent</i>		<i>To a great extent</i>
C&P1	Logged use of important copyright material e.g. technical manuals, brochures and web-site materials	1	2	3	4	5
C&P2	Logged use of the firm's trade marks e.g. as used on documentation, advertising, packaging etc.	1	2	3	4	5
C&P3	Manual or electronic database records of provisional or granted IP status	1	2	3	4	5
C&P4	Hard-copy files of application for formal IP rights	1	2	3	4	5
C&P5	In-house reminder system to track critical renewal dates	1	2	3	4	5
C&P6	Patent Attorney's reminder system to track critical renewal dates	1	2	3	4	5
C&P7	Confidentiality agreements and secure documentation for maintaining employee know-how and trade secrets	1	2	3	4	5
C&P8	Lodgement of a provisional patent application	1	2	3	4	5
C&P9	Lodgement of an innovation patent	1	2	3	4	5
C&P10	Lodgement of a PCT patent application	1	2	3	4	5

**3. To what extent does your firm obtain the following IP management services or traditional patent attorney services? (Please circle one answer in each line)**

		<i>Not at all</i>		<i>To some extent</i>		<i>To a great extent</i>
MS/PA1	Business process improvements advice aimed at enhancing safeguards for the firm's IP	1	2	3	4	5
MS/PA2	Advice on your firm's organizational structure	1	2	3	4	5
MS/PA3	Advice on IP ownership within the group	1	2	3	4	5
MS/PA4	Advice on IP licensing management issues	1	2	3	4	5
MS/PA5	Advice on applying for formal protection of IP	1	2	3	4	5
MS/PA6	Opinions on validity or infringement of existing IP rights	1	2	3	4	5
MS/PA7	Setting up in-house IP records management system	1	2	3	4	5
MS/PA8	Carrying out of an IP audit	1	2	3	4	5
MS/PA9	Drafting of firm IP policies and procedures	1	2	3	4	5

**4. To what extent are the following defensive measures used in your firm to protect IP assets? (Please circle one answer in each line)**

		<i>Not at all</i>		<i>To some extent</i>		<i>To a great extent</i>
DM1	Staff sign confidentiality agreements with the firm at commencement	1	2	3	4	5
DM2	Staff employment contracts contain IP provisions	1	2	3	4	5
DM3	Exit interviews with departing employees address IP issues	1	2	3	4	5
DM4	The Induction program with new employees reviews the firm's IP policy documents and contractual obligations	1	2	3	4	5
DM5	IP provisions are made in contracts with external contractors	1	2	3	4	5
DM6	Contractors and visitors sign confidentiality agreements with the firm	1	2	3	4	5
DM7	Physical security measures are maintained at the firm's premises	1	2	3	4	5
DM8	Management of disclosure and the publication process for knowledge relating to IP assets	1	2	3	4	5
DM9	Management of continuous disclosure required by ASX listing-rules as it relates to IP	1	2	3	4	5
DM10	Controlling third-party IP disclosures by firm employees to outsiders.	1	2	3	4	5
DM11	Maintenance of hardware and software firewalls to protect valuable IT records	1	2	3	4	5
DM12	Use of appropriate document markings, such as "Confidential", ©, ™, ®.	1	2	3	4	5

**5. To what extent have the following IP management practices been part of your firm's Business Plan and Strategic Vision from inception? (Please circle one answer in each line)**

		<i>Not at all</i>		<i>To some extent</i>		<i>To a great extent</i>
BPSV1	IP management issues discussed fully in the business plan	1	2	3	4	5
BPSV2	IP is an agenda item of all team meetings	1	2	3	4	5
BPSV3	IP is addressed in the mission statement of the firm	1	2	3	4	5
BPSV4	The business has an 'IP Champion' who manages all facets of the firm's IP	1	2	3	4	5
BPSV5	The business has an in-house patent attorney/IP lawyer	1	2	3	4	5
BPSV6	Strategic planning includes consideration of IP matters	1	2	3	4	5
BPSV7	Management has a documented IP policies and procedures manual	1	2	3	4	5
BPSV8	An IP committee reviews IP matters and has responsibility for IP matters	1	2	3	4	5
BPSV9	The firm budgets and plans for IP expenditure	1	2	3	4	5

**6. To what extent have the following contributed to your firm's knowledge of the IP landscape? (Please circle one answer in each line)**

		<i>Not at all</i>		<i>To some extent</i>		<i>To a great extent</i>
KNOW1	Information about new entrants to your market	1	2	3	4	5
KNOW2	Assessment of infringement risk against third parties	1	2	3	4	5
KNOW3	Regular searches through free databases	1	2	3	4	5
KNOW4	Regular searches through paid databases	1	2	3	4	5
KNOW5	Regular review of scientific literature.	1	2	3	4	5
KNOW6	Use of conferences and other literature	1	2	3	4	5
KNOW7	Use of regular searches and patent watches by a patent attorney or other professional.	1	2	3	4	5
KNOW8	Regular reviews of third-party prior art, either in-house or by patent attorney.	1	2	3	4	5
KNOW9	Cross-referencing relevance of researched prior art to specific IP rights of the company	1	2	3	4	5

**7. To what extent does your firm promote an IP culture through the following education and training activities? (Please circle one answer in each line)**

		<i>Not at all</i>		<i>To some extent</i>		<i>To a great extent</i>
CULT1	Firm employees attend AusBiotech seminars	1	2	3	4	5
CULT2	Firm employees attend BIO or AusBiotech conferences annually	1	2	3	4	5
CULT3	Firm employees attend state-of-the-art training for their field of expertise	1	2	3	4	5
CULT4	Firm employees attend specialist IP management training	1	2	3	4	5
CULT5	Firm employees attend professional business conferences (e.g. CA Business Forum)	1	2	3	4	5
CULT6	The firm's IP Champion or IP consultant regularly conducts IP training sessions	1	2	3	4	5
CULT7	Firm employees work directly with employees of strategic alliance partner on different projects	1	2	3	4	5