8. RESULTS

Note 1: The reference at the end of each heading below refers to the paragraph above in which the objectives are developed and motivated.

Note 2: Numerical rounding results in many cases in a series of percentages not adding up to 100%.

Note 3: In several Tables below the presence of two companies with 20 in-licences and 25 out-licences respectively is indicated with A and B. This enables identification and consideration of the possible confounding caused by their appearance in the results.

Note 3: ρ = Spearman correlation coefficients.

Note 4: α = Cronbach's alpha, measure of the internal consistency of set.

Note 5: C = accompanying item-scale correlation coefficients.

8.1 Company and industry sector demographics - 6.1

Survey objectives were to profile technology licensing within South African manufacturing industry sectors and *vis-à-vis* domestic versus export markets, company ownership and size, capital intensity of operations, automation and capabilities of research and development, design, development and commercialisation and geographic spread of licences. Characteristics surveyed appear in questions 1 to 11, 22, 23, 116 to 120 and 227 to 229 in Annexure A.

Further objectives were to profile for South African manufacturing companies the broad nature of the technology transfer relationship where a licence is involved, size of the other party, extent of technology adaptation required, whether research and development cost is regarded as sunk, whether transfer cost is pertinently charged and whether their Boards are sufficiently knowledgeable in relevant technology. Characteristics surveyed appear in questions 445 to 451 in Annexure A.

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8.1.1 Formation of industry sectors

To explore possible similarities and differences between industry sectors suitable sectors had to be formed from 81 responses, preserving individual anonymity, capturing a reasonable number of responses per sector and creating a reasonably homogeneous sector. Direct use of recognized systems such as the Standard Industrial Classification system proved unworkable and sectors as shown in Table 36 were arbitrarily synthesized with the aim of creating generic

groups. Within any one sector a variety of activities and products and substantial size differences exist. Further substantive description of any sector is not possible due to confidentiality requirements, except to confirm that the information, communication and telecommunication (ICT) sector does per definition not include producers of only software.

8.1.2 Licences per industry sector

Table 36 reflects by industry sector the number of respondents that reported licences and the number of licences that were reported by them. Table 37 reflects combinations of licensing activity reported by each sector. Compared to the overall 29% rate of out-licensing reported, 12% of firms in the SAIS survey reported transferring or selling technology. This difference probably arises because the SAIS survey included services including financial companies and because this survey eliminated non-licensors *a priori*.

Licensing activity seems to be most intense in the chemicals including paper and textiles sector with an average 6,1 licences per respondent and 85% of respondents licensing. Building materials and components seemingly is second with a substantially lower average of four licences per respondent which are also concentrated on only three of seven respondents resulting in this sector having the most, 57%, non-licensing companies. Electrical, light shows lowest activity. From this sector came the comment that innovations are mostly incremental and are seldom considered to be economically or legally enforceably patentable.

Numbers of licences and their density per sector should be approached with care. For example, a company in the food and healthcare sector reported the maximum of 25 out-licences. It is exploiting its intellectual property through a system approximating joint venturing. If its 25 licences are removed the sector drops to second lowest overall and out-licensing activity level, while as reported it has the highest out-licensing level. Although it arguably has a skewing effect its reported position has to be accepted as a reported fact in this survey. This example also illustrates that a variety of licence types were included, a fact that should be borne in mind.

Even after removal of the 25 out-licences the food and healthcare sector still has more out-licences than in-licences, as does building materials and components mostly as a result of its

activity in South Africa and Africa.

Industry sector	Respondents (N)				In-licences		Out-licences		Total licences	
	N	%	With licences	% of N	Number	No/N	Number	No/N	Number	No/N
Automotive components	10	*12*	8	*80*	29	2,9	0	0	29	2,9
Building materials & components	7	*9*	3	*43*	13	1,9	15	2,1	28	4,0
Chemicals including paper and textiles	13	*16*	11	*85*	51	3,9	28	2,2	79	6,1
Electrical, light	6	*7*	3	*50*	2	0,3	1	0,2	3	0,5
Heavy engineering	11	*14*	7	*64*	28	2,5	2	0,2	30	2,7
Food & healthcare	11	*14*	7	*64*	8	0,7	35	3,2	43	3,9
ICT & electronics	9	*11*	5	*55*	13	1,4	13	1,4	26	2,9
Metal products & machinery	14	*17*	9	*64*	24	1,7	5	0,4	29	2,1
Total	81	*100*	53	*65*	168	2,1	99	1,2	267	3,3
Ratio					1,7		1,0			
Maximum spread per company					0 to 20		0 to 25			

Table 36. Technology licences per industry sector.

Industry sector	Respondents	Respondents reporting licences						No licences	
		In only		Out only		Both			
		No	%	No	%	No	%	No	%
Automotive components	10	8	*80*	0	*0*	0	*0*	2	*20*
Building materials & components	7	1	*14*	0	*0*	2	*29*	4	*57*
Chemicals including paper and textiles	13	4	*31*	3	*23*	4	*31*	2	*15*
Electrical, light	6	2	*33*	1	*17*	0	*0*	3	*50*
Heavy engineering	11	6	*55*	0	*0*	1	*9*	4	*36*
Food & healthcare	11	1	*9*	4	*36*	2	*18*	4	*36*
ICT & electronics	9	2	*22*	1	*11*	2	*22*	4	*44*
Metal products & machinery	14	6	*43*	2	*14*	1	*7*	5	*36*

Total	81	30	*37*	11	*14*	12	*15*	28	*35*

Table 37. Combinations of licensing activity per industry sector.

It is noteworthy that 80% of all the respondent companies from the automotive components sector have licences; and in-licences only. This seems to be the case because several companies are subsidiaries of or controlled by developed world vehicle manufacturers including first tier components suppliers who are also important and prescriptive customers outsourcing their branded designs (Table 39) and confirms the scenario identified by Barnes and Kaplinsky (4.3.1 – p52).

The ratio of in- to out-licences of 1,7 may reflect South Africa's status as developing country when compared with the 1,0 of Japan (Table 8, p70) and the deduced 0,8 ratio of companies respectively so involved of the world-wide survey (Table 6, p57).

Table 38 shows the ratios of incidence of types of relationship when licences are present. Note that the results of Table 6 (p57) reflected in Table 38 represent responses when respondents were allowed to select multiple relationships, while the current survey allowed only one choice. Cross licensing occurs least and South African manufacturing companies are lagging the "world" when it comes to co-development and joint venturing. This is perhaps regrettable from the point of view of intrinsic advancement of South African manufacturing companies' technology. It should however be borne in mind that the "world" results include companies also from other industries and of other types including even research institutes. Even so the conclusion from these results and the ratio of in- to out-licences is clearly that South African manufacturing companies are fairly large net importers of technology. Against the background of the technology colonies postulated by De Wet (p4) the question arises whether the importers are aspiring to independence from their licensors and the results point to confirmation of De Wet's proposition. The remarks at 8.11, 8.12 and 8.14 on pp163, 168 and 173 regarding deployment of IP and use of licences are also relevant.

Nature of relationship	SA manufacturing companies		World-wide survey Table 6, p57
	In-licences	Out-licences	
Out-licence	-	17,00	2,20
In-licence	31,00	-	1,70
Co-development	7,50	6,33	1,53
Strategic alliance	-	-	1,45
Joint venture	10,50	9,11	1,35

Cross licence (Incidence arbitrarily set at 1.00)	1,00	1,00	1,00

Table 38. Ratio of incidence of types of licensing relationships.

8.1.3 Company ownership and licences

Table 39 shows that 65% of the respondent companies are in private hands while 35% have broader ownership; and that 69% are owned domestically, 16% by foreign owners and 15% have mixed ownership.

The ratio of in- to out-licences seems to increase when foreign ownership occurs. Against pure foreign ownership it is 3,0 which is notably higher than the average of 1,7. Much of this phenomenon can be ascribed to the automotive components sector for reasons advanced above. Against pure foreign ownership the lowest licensing activity also appears and this renders the ratio suspect due to the small numbers underlying its calculation. The seeming

Ownership		Private			Public			Domestic			Foreign			Domestic/ foreign		
Industry sector	N	Licences			Licences			Licences			Licences			Licences		
		In	Out	Co's	In	Out	Co's	In	Out	Co's	In	Out	Co's	In	Out	Co's
Automotive components	10	22		7	7		3	19		5	10		5			
Building materials & components	7	1		4	12	15	3	13	15	6			1			
Chemicals incl. paper & textiles	13	7	5	6	44 B	23	7	41 B	14	10				10	14	3
Electrical, light	6	1		4	1	1	2	1	1	4				1		2
Heavy engineering	11	27	2	10	1		1	20	2	7	5		3	3		1
Food & healthcare	11	2	30 A	6	6	5	5	2	31 A	6	0	3	3	6	1	2
ICT & electronics	9	8	4	6	5	9	3	13	11	7	0	2	1			1
Metal products & machinery	14	14	5	10	10		4	18	5	11				6		3
Total	81	82	46	53	86	53	28	127	79	56	15	5	13	26	15	12
Ratio in/out		1,78			1,62			1,61			3,00			1,73		

Licences/ company	In	Out	In	Out	In	Out	In	Out	In	Out
	1,55	0,86	3,07	1,89	2,26	1,41	1,15	0,38	2,17	1,25

Note: Company totals include companies with no licences.

Table 39. Company ownership and licences.

ratio of 1,78 for domestically owned companies is skewed by the one company with 25 out-licences and increases to 3,73 if only one out-licence is recognised for this company.

While the small sample may be subject to undue influence from this company it is worth reiterating that there is no reason to remove it or an arbitrary part of its licences. The density of out-licences across total companies responding is clearly lower than that of in-licences.

8.1.4 Company sales volume and portion derived from in-licences

Table 40 shows that respondents were reasonably representative across the sales volume range. Not surprisingly, the chemicals including paper and textiles sector is weighted towards greater volumes. None of the heavy engineering sector respondents has sales exceeding R500m per year. This may be partly because job shopping is prevalent and each is supplying just parts of big projects. No trend in licensing activity against sales size could be discerned.

Industry sector	Domestic sales (Rm/year) and % derived from in-licences						Export sales (Rm/year) and % derived from in-licences					
	<10	10-50	51-200	201-500	>500	%	<10	10-50	51-200	201-500	>500	%
	N						N					
Automotive components	2	0	2	3	3	11	1	5	2	1	1	10
Building materials & components	0	1	2	2	2	8	2	4	1	0	0	8
Chemicals including paper and textiles	2	2	1	1	7	15	2	1	4	3	3	15
Electrical, light	1	2	1	1	1	7	1	2	3	0	0	5
Heavy engineering	2	4	2	3	0	15	4	2	4	1	0	15
Food & healthcare	4	2	0	2	3	18	5	2	0	2	1	19
ICT & electronics	4	1	1	0	3	13	4	2	1	1	1	14

Metal products & machinery	2	5	2	1	4	13	7	2	2	2	1	14
Total	17	17	11	13	23	100	26	20	17	10	7	100
			N = 81							N = 80		

Table 40. Company sales size and portion derived from in-licences.

Food and healthcare shows the greatest proportion of sales derived from in-licences which seems to indicate, read with its second lowest density of in-licences that the few licences are of importance. This is consistent with the view that bigger volumes across fewer products may be sought. The next sectors, fairly closely behind are chemicals, heavy engineering, ICT and electronics and metal products and machinery. This finding seems intuitively correct except for the latter which is skewed by one company showing a very high proportion due to an extraordinary arrangement including a licence allowing South and Southern African exploitation of machinery.

The light electrical sector has the lowest proportion which is perhaps caused by its second lowest in-licensing intensity. Building material and components with relatively low in-licensing activity as well as the lowest proportion of companies licensing (43%, Table 36, p122) also ranks lowly.

Automotive components is third lowest and has about 60% of the highest proportion. It also shows the second highest in-licensing density. This may point to in-licences with low added value and raises questions about their technological content.

Table 41 suggests that patent holdings increase with company size as measured by domestic sales, even if the two companies which reported a combined holding of 632 patents and whose sales ratings correspond and are identified by X are removed. After such, strictly speaking, incorrect removal the distribution of average patents per company in the case of export sales retains the approximately normal distribution with no discernible trend.

Domestic	Sales (Rm/year)					Notes
	<10	10-50	51-200	201-500	>500	
Number of companies	14	17	11	11	18	71
Total patents	127	222	87	215	895 X	
Average patents per company	9	13	8	20	50	ρ=0,12
Export						

Number of companies	23	19	16	9	3	70
Total patents	289	124	1006 X	93	30	
Average patents per company	13	7	63	10	10	ρ=0,18

Table 41. Company sales size and extent of patent holding.

8.1.5 Geographic spread of in- plus out-licences

Table 42 shows the geographic spread of licences reported. Clearly international licensing is most intense to and from Europe with 35% of all licences reported. (The SAIS survey reported a high concentration of innovation partners in Europe.) This intensity exceeds even that within South Africa. North America is next at only 13% followed by Asia at 7%. These findings seem to confirm South Africa's past and continuing contact with Europe and perhaps builds on Kang's contention that the Europeans are most truly global (6.3, p90).

While the chemicals including paper and textiles sector also follows this trend it shows relatively intense activity within South Africa. Some distortion is introduced by one chemical company that has 20 in-licences from mostly other companies within the same group.

This sector with building materials and components and food and healthcare are the only three active in Africa. This may point to South Africa indeed seeking opportunities in Africa, perhaps especially in sectors where needs are high leading to local activity.

Industry sector	RSA	Africa	Europe	North America	South America	Asia	Middle East	Other
Automotive components	0	0	19	2	0	8	0	0
Building materials & components	17	4	5	0	1	0	0	1
Chemicals including paper and textiles	42	5	17	8	2	3	1	1
Electrical, light	1	0	1	1	0	0	0	0
Heavy engineering	1	0	13	9	5	0	0	2
Food & healthcare	5	8	15	5	2	5	2	1
ICT & electronics	9	0	11	3	0	2	0	1
Metal products & machinery	8	0	13	6	0	2	0	0
Total = 267	83	17	94	34	10	20	3	6
%	31	6	35	13	4	7	1	2

Table 42. Geographic spread of in- plus out-licences.

Table 43 accentuates the higher licensing activity within South Africa and between South Africa and Europe. An expected result is what appears to be net in-licensing by South Africa apart from with Africa, South America and the Middle East. The apparent in-licensing activity in South Africa is somewhat distorted by one company's 20 in-licences from mostly others within the same group. Perhaps in- and out-licensing within South Africa is actually more balanced. The question arises why the ratio of in- to out-licences is relatively higher in the case of Europe. This ratio declines for other countries and arguably the lower in-company to out-company ratios serve as an indication that South African manufacturing companies are searching for and getting out-licensing opportunities in other parts of the world, as seems to be the case for Africa.

Area	Number of licences		Max. number/company		Number of companies *	
	Inwards	Outwards	Inwards	Outwards	Inwards	Outwards
RSA	46	37	20	10	12	11
Africa	2	15	2	4	1	6
Europe	74	20	7	8	26	9
North America	25	9	5	2	14	7
South America	5	5	5	2	1	4
Asia	13	7	6	4	7	3
Middle East	0	3	0	2	0	2
Various	3	3	1	1	3	3
Total	168	99			64	45

* These totals are greater than those in Table 36 because companies here can be counted more than once if they have licences in more than one area.

Table 43. Prevalence of licences.

8.1.6 Relationship between various company characteristics and licence intensity

Table 44 shows that respondents generally consider their capital intensity above average with none rating themselves not at all capital intensive. In-licence density is highest among those rating themselves lowest at partly capital intense. The fact that five of the nine respondents from the ICT and electronics sector rated themselves thus and have several in-licences contributed to this. Out-licensing shows a decided peak in the case of extreme capital intensity. This coincides with the high out-licensing activity in the chemicals including paper and textiles and the food and healthcare sectors; and probably also underlies the possibly higher in-licensing shown.

Automation shows a balanced distribution while the licensing pattern resembles that of capital intensity with high in-licensing under "minor" and an out-licensing peak under "extreme". In-licensing activity seems to increase with decreased automation except for the lowest automation level which includes job shops. Job shops show low activity which could be due to the one off nature of their activities. The overall trend could reflect increasing automation involving more turnkey equipment and jobbing shops doing things mostly once. Out-licensing increases with automation but not if the 25 out-licences of the single company are removed. The three companies rating themselves "extreme" are from the chemicals and food and healthcare sectors.

None of the Spearman correlation coefficients have statistically meaningful magnitude.

Attribute	Company view of attribute					Notes
Capital intensity	Extreme	Very	Average	Partly	Not at all	
Number of companies	10	31	27	12	0	80
%	13	39	34	15	0	100
No. of in-licences (N=80)	28	36	59	45 A	0	
Number per company	2,80	1,16	2,19	3,75	0	ρ=-0,13
No. of out-licences (N=80)	47 B	7	28	16	0	
Number per company	4,70	0,23	1,04	1,33	0	ρ=0,06
Automation	Extreme	Mostly	Mix	Minor	Job shop	
Number of companies	3	22	33	15	8	81
%	4	27	41	19	10	100
No. of in-licences (N=78)	0	40	75	46 A	7	
Number per company	0	1,82	2,27	3,07	0,88	ρ=-0,08
No. of out-licences (N=78)	10	37 B	30	15	7	
Number per company	3,33	1,68	0,91	1,00	0,88	ρ=-0,06

Table 44. Profile of perceived capital intensity and automation levels.

From Table 45 respondents having "excellent" research and development have the second lowest in-licence density after those with a "poor" rating. Those with a "none" rating have the second highest and is close to "adequate" when the 20 licences from a single company are removed from the latter and a deliberate policy not to do research could also contribute to this phenomenon. Out-licensing has a peak when research and development becomes "excellent", assisted by the contribution of 25 licences by one company . This could indicate that an excellent function and perhaps the best and most complete technology do indeed deliver out-licences. The lower peak against "adequate" could be due to increased awareness of active out-licensing practitioners that yet more could be done. Research and development with intent to license (62% report poor and none) and technology licensing and selling (29% adequate,

54% poor and none) are respectively decidedly and seemingly considered below average. Considering that 84% thought out-licensing is profitable for the licensor and 12% very profitable (Table 47, p132) the question why arises. It could be that the lack of proper organisation for out-licensing contributes (Table 84, p170) but the reason for this lack could in turn be questioned. Perhaps respondents are simply not sufficiently acquainted with what may be termed the licensing discipline. It is certainly true that certain companies would be practising technology which may not be appropriable but it should be borne in mind that all respondents were chosen because of some involvement in patents or licences. While this question can regrettably not be answered from this research it offers useful directed further research opportunities. See also Table 81, p167 for a sectoral profile.

Capability	Company view of capability					Notes
	Excellent	Good	Adequate	Poor	None	
Research & development is						
Number of companies	17	30	19	10	4	80
%	21	38	24	13	5	100
No. of in-licences (N=80)	20	54	75 A	10	9	
Number per company	1,18	1,80	3,95	1,00	2,25	ρ=-0,11
No. of out-licences (N=80)	50 B	12	31	6	0	
Number per company	2,94	0,40	1,63	0,60	0	ρ=0,04
R&D with intent to license is						
Number of companies	5	11	15	23	26	80
%	6	14	19	29	33	100
No. of in-licences (N=80)	11	27	38	29	63 A	
Number per company	2,20	2,45	2,53	1,26	2,42	ρ=0,10
No. of out-licences (N=80)	36 B	15	27	9	12	
Number per company	7,20	1,36	1,80	0,39	0,46	ρ=0,23
Design is						
Number of companies	20	41	11	4	4	80
%	25	51	14	5	5	100
No. of in-licences (N= 80)	34	104 A	8	7	15	
Number per company	1,70	2,54	0,73	1,75	3,75	ρ=0,03
No. of out-licences (N=80)	40 B	48	1	6	4	
Number per company	2,00	1,17	0,09	1,50	1,00	ρ=0,05
Development is						
Number of companies	16	36	17	4	7	80
%	20	45	21	5	9	100
No. of in-licences (N=80)	19	80 A	46	0	23	
Number per company	1,19	2,22	2,71	0	3,29	ρ=-0,11
No. of out-licences (N=80)	42 B	29	19	4	5	
Number per company	2,63	0,81	1,12	1,00	0,71	ρ=0,03
Technology licensing and selling is						
Number of companies	3	10	23	18	24	78
%	4	13	29	23	31	100
No. of in-licences (N=78)	11	11	52	31	62 A	
Number per company	3,67	1,10	2,26	1,72	2,58	ρ=-0,01
No. of out-licences (N=78)	28 B	25	19	20	7	
Number per company	9,33	2,50	0,83	1,11	0,29	ρ=0,35

Table 45. Profile of perceived development and licensing capabilities.

Out-licensing activity increases impressively when research and development with the intention to license is rated "excellent" and remains highest after removal of the single company's contribution of 25 licences. (This company rated itself "excellent" against all characteristics.) This phenomenon is accompanied by a weak Spearman correlation coefficient of 0,23 indicating positive correlation between research and development with intent to license and licensing activity and echoes the results for research and development.

Comparing licensing activity to design and development capability proves erratic. It is possible that companies from the chemicals and biotechnology sectors are confounding the overall results because these capabilities could best be associated with hardware.

No trend in in-licensing can be discerned as technology licensing and selling capability varies. It could be argued that the prompt in the questionnaire "Technology licensing and selling is Excellent … none" is illogical and caused confusion because of its implication that it concerns outward capability.

Out-licensing increases with capability to out-license and has a Spearman correlation coefficient of 0,35 which is still not statistically significant. When the capability peaks out-licensing increases strongly due to the contribution of the single company.

Note: The relationships between the first two attributes and the fifth attribute shown in Table 45 and patent portfolios are set out in Table 76, p161.

8.1.7 Inter-sector characteristics

Sectoral licensing and selling abilities are set out in Table 46. (For research and development with objective to license see Table 81, p167.

Technology licensing and selling is (%)	Excellent	Good	Adequate	Poor	None	N
Automotive components	0	10	20	10	60	10

Building materials and components	0	29	29	43	0	7
Chemicals including paper & textiles	0	8	25	33	33	12
Electrical, light	0	17	17	0	67	6
Heavy engineering	9	9	36	18	27	11
Food & healthcare	10	20	30	10	30	10
ICT & electronics	0	11	44	44	0	8
Metal products & machinery	8	8	31	23	31	13

Table 46. Sectoral technology licensing and selling ability.

The *caveat* raised in 8.1.6 above, that the question may have been confusing, applies to Table 46. The automotive components sector seems to acknowledge its one-sided in-licensing practice; as does the light electrical sector its scarcity of licences. Noteworthy is what may seem like a lack of self-confidence or may be realism reflected in the assessments of the others and especially by the relatively high activity chemicals and food, building and healthcare sectors.

8.1.8 Select other factors influencing licensing

Table 47 shows what may be expected, *viz.* that more in-licences come from bigger companies. It also shows somewhat surprisingly that more out-licences are concluded with smaller companies. This may mean that South African licensors avoid or fail to convince bigger international companies of the value of their technology and may be true even if the 37 out-licences to South Africa and the 15 to Africa, or 52%, are removed. Further research into this apparent phenomenon may yield interesting insights.

Usual size of other party (US$m/y)	<5	5 to 25	25+ to 50	50+ to 100	>100	Total
In-licence, companies	7	9	6	9	16	47
%	15	19	13	19	34	100
Out-licence, companies	10	12	7	1	4	34
%	29	35	21	3	12	100

Technology adaptation required	Extensively	Moderately	Not at all	
In-licence, companies	4	41	6	51
%	8	80	12	100
Out-licence, companies	5	23	9	37
%	14	62	24	100
Relevant technology knowledge of Board of Directors	Ample	Moderate	Not at all	
Companies	27	23	11	61
%	44	38	18	100
R&D cost is considered sunk	Yes	Sometimes	Never	
In-licence, companies	27	14	7	48

%	56	29	15	100
Out-licence, companies	19	14	3	36
%	53	39	8	100
Transfer cost is pertinently charged	Always	Usually	Never	
In-licence, companies	4	33	11	48
%	8	69	23	100
Out-licence, companies	4	22	10	
%	11	61	28	100
Respondent believes licensing is profitable for licensor	Very much	Yes	Worthless	
In-licence, companies	6	43	2	
%	12	84	4	100
Out-licence, companies	3	36	1	
%	8	90	3	100

Table 47. Other factors influencing licensing.

Moderate adaptation of licensed technology is mostly required.

The technology knowledge of Boards of directors is mostly sufficient, research and development cost is mostly regarded as sunk and transfer cost is mostly pertinently charged.

An overwhelming majority of respondents consider licensing to be profitable for the licensor. Useful further research establishing closer definitions of 'licensing' and analysing this finding against an arguably low licensing rate amongst South African manufacturing companies could provide valuable insights.

8.2 Companies' physical and personnel organisation - 6.5

Survey objectives: Profile South African manufacturing companies' organisation structure in terms of geographic spread, for research and development, for attempts to meld various units and disciplines to enhance technological productivity, and their perception of the prevalence of the Not Invented Here Syndrome. Characteristics surveyed appear in questions 21, 43 to 47, 49 to 51 and 130 in Annexure A.

For licensing organisation see 8.13 below.

Analyse prevalence of NIH syndrome.

…….

8.2.1 Physical location and organogram.

Table 48 provides an overview of respondents' physical locations and organograms regarding research and development. Not surprisingly, single unit operation predominates while research and development is unified even when companies operate several divisions and in several locations. This may mean that companies are to some extent alert to and avoiding the risk of imprisoned resources and bounded innovation warned against by Prahalad and Hamel (6.5.2, p98). Seven of the 80 respondents whose replies were useful reported no research and development function. Reasons are that technology is supplied from a parent company or a central source elsewhere in a group as well as small size rendering direct involvement of top and production management optimum. In the latter case research and development does take place albeit more informally.

Where no Head of research and development exists but research does take place the CEO generally is the *de facto* Head. Where a Head does exist the position reports to the CEO in 56% and to lesser functionaries in 43% of cases. Even in these the probability that this immediate superior reports to the CEO seems high and this means that companies are recognising the importance of the Chief Technical Officer as Foster urges. (6.5.2, p97).

Geographic location	Attribute					
	Geographic organisation		Operation of research and development		Research and development report node(s)	
	Companies reporting	%	Companies reporting	%	Companies reporting	%
One unit	34	42	49	61	49	70
Strategic business units	13	16	14	18	8	11
Divisions	10	12	9	11	11	16
Two or more locations	16	29				
One unit, divisions, two or more locations	1	1				
Strategic business units, divisions	1	1			1	1
Divisions, two or more locations	5	6				
Strategic business units, two or more locations	1	1				
One unit, divisions			1	1	1	1
No research and development			7	9		
Number of companies reporting	81	100	80	100	70	100
Head of research and development reports to (N = 81) ……						

CEO/ COO/ GM/ MD	Group Marketing Director	Technol./ Technical Director	Manufac-turing Director	Division Manager	Technol./ Technical Manager	Engineering Manager	New Business Manager	No Head
28	1	6	2	6	3	4	1	30
35%	1%	7%	2%	7%	4%	5%	1%	36%

Table 48. Companies' geographic organisation and organograms.

8.2.2 Management education and encouragement of innovative activities

Table 49 shows that respondents mostly deem management education very satisfactory. Only two of 80 respondents reported "uneven" education. It has to be recorded that the question may have been difficult to respond to because management was bundled together and perceptions of "good' will vary. As an example, a question raised by a respondent was: "All our top management have MBAs. Does this rate good or best?"

Out-licensing activity increases as management education improves but the Spearman correlation coefficient is weak at 0,19. This trend is maintained if the 25 out-licences contributed by a single company are removed. Arguably management education level measures sophistication of a company and increasing sophistication may require or result in increasing licensing activity. Again further research may be useful.

The question on manpower availability may have been too broad in not distinguishing between types and therefore responses should probably be read as tending to exclude blue collar workers. "Abundant" availability was selected by one company from the food and healthcare sector. "Can select" was not selected by any of the companies from the chemicals including paper and textiles, heavy engineering and ICT and electronics sectors, "scarcely" occurred mostly in the first two of these, indicating greater scarcity in these. Somewhat surprisingly no ICT and electronics company rated its situation "scarcely". This could perhaps be an effect of the slump in particularly this sector.

Attribute	Company view of attribute					Notes
Management education is	Best	Good	Average	Uneven	Weak	
Number of companies	15	49	15	2	0	81
%	19	60	19	2	0	100
No. of in-licences (N=81)	20	119 A	27	2	0	
Number per company	1,33	2,43	1,80	1,00	0	ρ=0,16
No. of out-licences (N=81)	42 B	51	6	0	0	

Number per company	2,80	1,04	0,40	0	0	ρ=0,19
Manpower availability	Scarcely	Can find	Fair	Can select	Abundant	
Number of companies	17	32	20	10	1	80
%	21	40	25	12	1	100

Table 49. Management education and manpower availability.

Table 50 shows good attention to the need to maximise technology capability among disciplines, functions and strategic business units. In the aggregate only 10 companies or 13% rated themselves under "not at all". This rating is encouraging, demonstrating respondents' awareness of the value of technology, while still leaving room for improvement.

It is not possible to suggest licensing activity trends against any of these attributes as the low Spearman coefficients of correlation also show. However, in out-licensing "sporadically" rated companies have least licensing activity for each attribute while out-licensing is highest for "continually" rated companies.

The aggregate is further discussed as part of Techno-economic networks in 8.3, p138.

Attribute	Company view of attribute				Notes
Alertness to the need to maximise, and actual deliberate maximisation of, technology capability.					
	Continually	Sporadically	Not at all	Not applicable	
Among disciplines					C=0,89
Number of companies	34	31	3	7	75
%	45	41	4	9	100
No. of in-licences (N=68)	85	73 A	2	2	
Number per company	2,50	2,35	0,67		ρ=0,06
No. of out-licences (N=68)	73 B	16	4	0	
Number per company	2,15	0,52	1,33		ρ=0,08
Among functions					C=0,92
Number of companies	31	35	3	6	75
%	41	47	4	8	100
No. of in-licences (N=69)	63	91 A	3	6	
Number per company	2,03	2,60	1,00		ρ=-0,07
No. of out-licences (N=69)	70 B	20	4	1	
Number per company	2,26	0,57	1,33		ρ=0,09
Among strategic business units					C=0,89
Number of companies	29	24	5	17	75
%	39	32	7	23	100
No. of in-licences (N=58)	87 A	32	8	34	
Number per company	3,00	1,33	1,60		ρ=0,13
No. of out-licences (N=58)	62 B	10	4	21	
Number per company	2,14	0,42	0,80		ρ=0,11

Aggregate *					
Number of reports (N)	28	33	10	4	75
%	37	44	13	5	100
No. of in-licences	66	74	21	1	
Number per company	2.36	2.24	2.10	0.25	
No. of out-licences	60	23	13	2	
Number per company	2.14	0.70	1.30	0.50	
Aggregate for correlation *					α=0,87
Number of reports (N)	33	36	2		71
%	46	51	3		100
No. of in-licences	78	82	1		
Number per company	2,36	2,28	0,50		ρ=0,05
No. of out-licences	74	18	4		
Number per company	2,24	0,50	2,00		ρ=0,10

Note: "Not applicable" ratings were ignored for correlation purposes.

Table 50. Management motivation.

* N here means companies that rated themselves against at least one of the three attributes. The aggregate rating was calculated by calculating an average for each company that rated itself against at least one attribute. Each such attribute average was rounded and the company placed in the rank thus indicated. Licences for each company so accounted for were added up and divided by the number of companies so qualifying to find the average number of licences per company.

What may seem anomalous – *e.g.* lower number of reports (= companies) and higher number of out-licences per company in the aggregate than in any of its constituent attributes – is correct because aggregation may place any company in a different rank and the companies therefore are not necessarily the same.

This approach applies to all other aggregates appearing henceforth.

8.2.3 Not Invented Here syndrome

From Table 51 the Not Invented Here (NIH) syndrome does not seem to be a general problem although only 23% of respondents reported its absence. The majority of cases seem to be "isolated" occurrence (59%). Only 4% of respondents reported "pervasive" presence. The "bothersome" ratings have relatively high licensing activity and it may be that such activity increases awareness of the syndrome.

Occurrence of Not Invented Here syndrome	Pervasive	Bothersome	Isolated	Absent	Notes
Number of companies	3	9	41	16	69
%	4	13	59	23	100
No. of in-licences (N=69)	13	21	70 A	47	
Number per company	1,42	2,33	1,71	2,94	ρ=0,06
No. of out-licences (N=69)	0	36 B	48	13	
Number per company	0	4,00	1,17	0,81	ρ=0,01

Table 51. Occurrence of Not Invented Here syndrome.

Table 52 indicates that the NIH syndrome is most felt in the food and healthcare sector followed by chemicals and ICT and electronics. As stated above this may reflect out-licensors that have come up against the syndrome amongst potential licencees and is an aspect that may be further researched.

Incidence of NIH syndrome (%)	Pervasive	Bothersome	Isolated	Absent	N
Automotive components	0	0	63	38	8
Building materials and components	0	17	83	0	6
Chemicals including paper & textiles	8	15	54	23	13
Electrical, light	0	0	60	40	5
Heavy engineering	13	0	63	25	8
Food & healthcare	11	22	56	11	9
ICT & electronics	0	22	56	22	9
Metal products & machinery	0	18	55	27	11

Table 52. Not Invented Here syndrome in sectors.

8.3 Techno-economic networks (TENs) - 2.3

Survey objectives: Profile characteristics 15 to 20 listed below for South African manfacturing companies. (For 49 to 51 see Table 50, p136.)

Notional postulate: A technology licensing and selling and acquisition TEN in a South African manufacturing company will manifest indirectly through the proposed indicants and will correlate positively with technology licensing and trading activities of the company.

Question in Annexure A	Characteristic or aggregate construct proposed as indicant of TEN activity	
15	Awareness of competitors' successes	
16	Awareness of competitors' failures	
17	Awareness of competitors' licensing activities	Aggregate
18	Top management's liking or disliking of licensing	
19	International experience	
20	Travel abroad	Aggregate
49	Maximisation of technology capabilities amongst disciplines	

50	Maximisation of technology capabilities amongst functions	Aggregate
51	Maximisation of technology capabilities amongst business units	

……...

Table 53 shows high awareness of competitors' successes and failures and somewhat less of their licensing activities which is understandable because these tend to be conducted in private. This attribute is the only one which contains a none rating by one company.

No trend in licensing activity against any of the attributes or the aggregate construct can be suggested although Cronbach's α = 0,76 and the item-scale correlation coefficients C are greater.

Attribute	Company view of attribute					Notes
	Awareness of competitors' - - -					
	Complete	Active	Average	Vague	None	
Successes						C=0,80
Number of companies	11	57	13	0	0	81
%	14	70	16	0	0	100
No. of in-licences N=81)	10	119 A	39	0	0	
Number per company	0,91	2,09	3,00	0	0	ρ=-0,19
No. of out-licences (N=81)	16	71 B	12	0	0	
Number per company	1,45	1,25	0,92	0	0	ρ=-0,01
Failures						C=0,87
Number of companies	7	54	15	5	0	81
%	9	67	19	6	0	100
No. of in-licences (N=81)	9	110 A	31	18	0	
Number per company	1,29	2,04	2,07	3,60	0	ρ=-0,11
No. of out-licences (N=81)	4	81 B	6	8	0	
Number per company	0,57	1,50	0,40	1,60	0	ρ=-0,04
Technology licensing activity						C=0,85
Number of companies	7	38	20	15	1	81
%	9	47	25	19	1	100
No. of in-licences (N=81)	29 A	75	34	30	0	
Number per company	4,14	1,97	1,70	2,00	0	ρ=0.08
No. of out-licences (N=81)	8	61 B	16	14	0	
Number per company	1,14	1,61	0,80	0,93	0	ρ=0,01
Aggregate awareness						α=0,76
Number of reports (N)	7	51	19	4	0	81
%	9	63	23	5	0	100
No. of in-licences	9	117	30	12	0	
Number per company	1,29	2,29	1,58	3,00	0	ρ=-0,02

No. of out-licences	4	80	7	8	0	
Number per company	0,57	1,57	0,37	2,00	0	ρ=0,06

Table 53. Awareness of competitive environment.

Table 54 shows that only 4% of management dislikes licensing with 44% accepting it and 52% liking it. International exposure seems very satisfactory with only 4% reporting only some or no international experience and 12% sporadic or no travel abroad.

It may be speculated that in-licensing activity, and out-licensing activity discounting the contribution of 25 licences from a single company, increase with liking. Increasing licensing activity with increasing international activities including for the aggregate construct may be possible. α = 0,80 with item-scale correlation coefficient C = 0,90 and 0,94 for the two constituent attributes.

Attribute	Company view of attribute					Notes
Top management's liking of licensing	Likes	Uses	Accepts	Ignores	Dislikes	
Number of companies	17	25	36	0	3	81
%	21	31	44	0	4	100
No. of in-licences (N=81)	45 A	62	60	0	1	
Number per company	2,65	2,48	1,67	0	0,33	ρ=0,10
No. of out-licences (N=81)	22	55 B	22	0	0	
Number per company	1,29	2,20	0,61	0	0	ρ=0,16
International experience	Excellent	Good	Fair	Some	None	C=0.90
Number of companies	23	44	10	2	1	80
%	29	55	13	3	1	100
No. of in-licences (N=80)	42	107 A	17	1	0	
Number per company	1,83	2,43	1,70	0,50	0	ρ=-0,01
No. of out-licences (N=80)	47 B	32	18	0	2	
Number per company	2,04	0,73	1,80	0	2,00	ρ=0,08
Travel abroad	Extensive	Often	Regular	Sporadic	None	C=0.94
Number of companies	26	28	16	9	1	80
%	33	35	20	11	1	100
No. of in-licences (N=80)	61	68 B	23	10	0	
Number per company	2,35	2,43	1,44	1,11	0	ρ=0,09
No. of out-licences (N=80)	65 A	22	5	5	0	
Number per company	2,50	0,79	0,31	0,56	0	ρ=0,17
Aggregate international experience and travel	Best				None	α=0,80
Number of reports (N)	16	38	21	4	2	81
%	20	47	26	5	2	100
No. of in-licences	27	103	35	3	0	
Number per company	1,69	2,71	1,67	0,75	0	ρ=0,07

No. of out-licences	47	29	20	1	2	
Number per company	2,94	0,76	0,95	0,25	1.00	ρ=0,09
Note: **Aggegate of maximisation amongst disciplines, functions and stategic business units : detail in Table 50 p136.**						

Table 54. Attitude to licensing and international exposure.

The aggregate construct from maximisation of technology capabilities detailed in Table 50, p136 may show increasing out-licensing activity with increasing attention to maximisation. α = 0,87 with higher item-scale correlation coefficients C for the constituent attributes.

Table 55 reflects assessments of top managements' attitudes to licensing across sectors. Considering the relatively low portion of sales derived from licensing and the several licences the automotive sector's high assessment of two "likes", seven "uses" and one "accepts" may be subject to the qualification question: "To best effect for self?"

Assessment in the chemicals sector seems conservative considering its seemingly highest licensing activity and ICT & electronics and heavy engineering seem resigned considering their middling activity.

It would appear that focussed further research into managements' attitudes to licensing may yield interesting insights.

Top management and licensing (%)	Likes	Uses	Accepts	Ignores	Dislikes	N
Automotive components	20	70	10	0	0	10
Building materials and components	14	67	29	0	0	7
Chemicals including paper & textiles	31	15	54	0	0	13
Electrical, light	17	17	50	17	0	6
Heavy engineering	9	27	55	9	0	11
Food & healthcare	45	27	27	0	0	11
ICT & electronics	22	11	56	11	0	9
Metal products & machinery	7	29	64	0	0	14

Table 55. Sectoral top managements' attitude to licensing.

Generalising from Table 56 all sectors are keeping up their international experience with chemicals the seeming leader. One smallish company from the ICT & electronics sector is

exploiting foreign technology yet insists that its international experience and travel (Table 54) are "none".

Incidence of international experience (%)	Excellent	Good	Fair	Some	None	N
Automotive components	11	89	0	0	0	9
Building materials and components	14	57	29	0	0	7
Chemicals including paper & textiles	31	69	0	0	0	13
Electrical, light	50	17	33	0	0	6
Heavy engineering	27	64	9	0	0	11
Food & healthcare	45	45	9	0	0	11
ICT & electronics	33	33	11	11	11	9
Metal products & machinery	21	50	21	7	0	14

Table 56. Incidence of sectoral international experience.

From Table 57 chemicals appear to be the leader also in international travel. Considering the small sample light electrical's "extensive" at 67% is probably misleading.

Incidence of international travel (%)	Extensive	Often	Regular	Sporadic	None	N
Automotive components	30	20	50	0	0	10
Building materials and components	0	43	43	14	0	7
Chemicals including paper & textiles	42	50	8	0	0	12
Electrical, light	67	0	17	17	0	6
Heavy engineering	27	36	18	18	0	11
Food & healthcare	27	45	18	9	0	11
ICT & electronics	56	11	0	22	11	9
Metal products & machinery	21	50	14	14	0	14

Table 57. Incidence of sectoral international travel.

For summary finding on notional postulate see 9.1.7, p198.

8.4 Approach to risk and pioneering - 6.2

Survey objectives: Profile South African manufacturing companies' perception of self

regarding risk taking or conservatism, pioneering or following.

Notional postulate: Risk taking and pioneering will correlate positively and conservatism and followership negatively with in- and out-licensing activities.

Question in Annexure A	Proposed indicant surveyed
13	Risk taker or conservative
14	Pioneer or follower

……

Table 58 shows no bias regarding orientation *vis-à-vis* risk taking or conservatism. Regarding pioneering 81% of respondents deemed themselves careful pioneers or pioneers. No trend in licensing activity can be suggested.

Attribute	Company view of attribute					Notes
Risk/conservatism	Risk taker	Tend to risk	Neutral	Careful	Conservative	
Number of companies	7	29	13	24	8	81
%	9	36	16	30	10	100
No. of in-licences (N=81)	15	38	53 A	34	28	
Number per company	2,14	1,31	4,08	1,42	3,50	ρ=-0,16
No. of out-licences N=81)	41 B	34	5	7	12	
Number per company	5,86	1,17	0,38	0,29	1,50	ρ=0,09
Pioneering	Pioneer	Careful	Neutral	Careful	Follower	
Number of companies	39	27	5	8	2	81
%	48	33	6	10	2	100
No. of in-licences (N=81)	61	49	35 A	22	1	
Number per company	1,56	1,81	7,00	2,75	0,50	ρ=-0,17
No. of out-licences (N=81)	79 B	16	4	0	0	
Number per company	2,03	0,59	0,80	0	0	ρ=0,25

Table 58. Profile of companies' economic orientation.

From Tables 58, 59 and 60 it seems that the respondents could be generalised as tending to pioneering but in conservative fashion.

Approach to risk (%)	Risk taker	Tend to risk	Neutral	Careful	Conservative	N
Automotive components	0	10	50	40	0	10
Building materials and components	0	71	29	0	0	7
Chemicals including paper & textiles	15	23	15	38	8	13
Electrical, light	0	50	0	33	17	6
Heavy engineering	0	18	18	55	0	11
Food & healthcare	9	55	0	9	27	11
ICT & electronics	22	44	11	22	0	9
Metal products & machinery	14	36	7	29	14	14

Table 59. Sectoral approach to risk taking.

Approach to pioneering (%)	Pioneer	Careful	Neutral	Careful	Follower	N
Automotive components	30	10	10	50	0	10
Building materials and components	43	57	0	0	0	7
Chemicals including paper & textiles	38	46	8	0	8	13
Electrical, light	50	33	17	0	0	6
Heavy engineering	36	55	0	9	0	11
Food & healthcare	73	18	9	0	0	11
ICT & electronics	56	33	11	0	0	9
Metal products & machinery	57	21	0	14	7	14

Table 60. Sectoral approach to pioneering.

For summary finding on notional postulate see 9.1.7, p198.

8.5 Accounting systems - 6.3

Survey objectives: Profile South African manufacturing companies' accounting systems in terms of divisionality, product line focus, short or long term, explicit encouragement of innovation, imposition by parent. Attempt to deduce impact on licensing. Refer question 25 in Annexure A.

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Table 61 indicates the frequency of occurrence of various orientations in accounting systems.

As expected several respondents reported the presence of more than one but only three list the combination of encouraging innovation and also recognising licensing income. Only 23% of respondents have a "short term" and 32% a "long term" view accounting system. For 45% time orientation seems to be irrelevant or "medium term". Clearly "detailed cost' systems are prevalent. This may well be inspired by several respondents being outsources because in-licences and not out-licences are most frequent when companies report this system.

A mere 5% indicated that licensing income from out-licences is recognised and only 5% has a system that encourages innovation. From the available data it does not appear that licensing activity is more intense at these.

The three companies reporting that licensing income is recognised and innovation is encouraged are from the building materials and components, chemicals and metal products and machinery sectors and respectively have in- and out-licences as follows: 2/0, 6/2, 5/13.

Accounting characteristic	Companies reporting (N=77)		Only companies having licences (%)					
	Number	%	In N	%	Out N	%	Either N	%
Divisional	29	38	13	17	11	14	19	25
Product line	24	31	14	18	5	6	16	21
Detailed cost	44	57	25	32	9	12	27	35
Short term view	18	23	10	13	8	10	15	19
Long term view	25	32	10	13	5	6	13	17
Encourages innovation	8	10	5	6	4	5	6	8
Imposed by parent company	18	23	9	12	4	5	11	14
Recognises licensing income	10	13	5	6	4	5	8	10
Total number of reports	176							
Encourages innovation and recognises licensing income	[3]							

Table 61. Overview of accounting systems.

8.6 Regulatory environment - 6.4

Survey objectives: Profile South African manufacturing companies' perception of patent, design and trade mark systems, licence agreement control systems, exchange control systems. Characteristics surveyed appear in questions 33 to 39 in Annexure A.

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From Table 62 respondents generally seem satisfied with regulatory systems with "unsound" ratings never exceeding 5%.

The two "perfect" assessments of agreement control abroad are suspect because it is doubtful that the particular two respondents have sufficient experience. Yet it has to be noted that other respondents also rated agreement control abroad relatively high. While the same ratings were requested for "agreement control" locally and abroad it would appear that the question which was intended to enquire about exchange control regulations impinging on payments pertaining to licences was framed and interpreted too broadly and the results have to be discarded.

Environmental attribute	Company view of attribute					Total
	Perfect	Good	Fair	Improve	Unsound	
RSA's patent system						
Number of companies	0	32	28	10	4	74
%	0	43	38	14	5	100
RSA's designs system						
Number of companies	0	26	30	8	3	67
%	0	39	45	12	4	100
RSA's trade marks system						
Number of companies	1	35	30	6	1	73
%	1	48	41	8	1	100
Agreement control – in RSA						
Number of companies	0	30	28	6	2	66
%	0	45	42	9	3	100
Agreement control – abroad						
Number of companies	2	33	22	5	1	63
%	3	52	35	8	2	100

Table 62. Regulatory environment.

8.7 Sensitivity to the future - 6.7

Survey objectives: Profile the characteristics listed below for South African manufacturing companies.

Notional postulate: The more a company chooses or is forced to plan ahead, the more licensing activity will intensify.

Question in Annexure A	Proposed indicant surveyed	
24	Environment friendly	
26	Market competition	
27	Technology competition	
121	Quality of unwritten knowledge	
122	Quality of complementary assets in heads	
123	Quality of technology portfolio	
	Quality of forward planning	
124	Scenario planning	
125	Awareness of S-curves	
126	Other	Aggregate

……..

Table 63 shows strong environmental friendliness ratings among respondents, yet only eight recorded ISO 14001 certification. The three companies (4%) who rated themselves "grudging" can be believed due to the nature of their operations which are relatively harmless. Possibly the effort to mount a dedicated environmental exercise is viewed as simply not worthwhile. High friendliness across sectors is confirmed by Table 65. No trends in licensing activity are discernible.

The respondents operate in a competitive environment while eight have each found a technology niche and report "minimal" competition and one may be considered to be protected by the entry barrier big volume.

Tacit knowledge is considered sufficient as is the quality of their technology portfolio while access to complementary assets seems to require more attention. The results regarding tacit knowledge, complementary assets and technology portfolios must be viewed with circumspection because it can be expected that respondents did not use the same and rigorous definition of each. An indication of this is that 11 did not respond to the question on complementary assets. The respondents reporting no technology portfolio are from the

automotive component and heavy engineering sectors and could be viewed as assemblers using technology from customers and suppliers and not focusing on an own portfolio as an out-licensor would. Perhaps they have not yet thought systematically about the technology within the companies.

Market competition may stimulate in-licensing activity. As access to complementary assets improves out-licensing seemingly also improves. This may be related to a strong, vested technology base and consequent self-confidence. This possibility is reinforced by the seemingly increasing out-licensing as technology portfolios are rated stronger.

Attribute	Company view of attribute					Notes
Environmental friendliness	Extreme	Positive	Average	Grudging	Not at all	
Number of companies	11	49	17	3	0	80
%	14	61	21	4	0	100
No. of in-licences (N=80)	10	139 A	17	2	0	
Number per company	0,91	2,84	1,00	0,67	0	ρ=0,04
No. of out-licences (N=80)	28 B	40	31	0	0	
Number per company	2,55	0,82	1,82	0	0	ρ=-0,02
Market competition is	Fierce	Strong	Fair	Minimal	None	
Number of companies	23	42	14	2	0	81
%	28	52	17	2	0	100
No. of in-licences (N=81)	59 A	89	20	0	0	
Number per company	2,57	2,12	1,43	0	0	ρ=0,09
No. of out-licences (N=81)	38 B	50	11	0	0	
Number per company	1,65	1,10	0,79	0	0	ρ=0,05
Technology competition is	Fierce	Strong	Fair	Minimal	None	
Number of companies	16	39	17	8	1	81
%	20	48	21	10	1	100
No. of in-licences (N=81)	23	103 A	35	7	0	
Number per company	1,44	2,64	2,06	0,88	0	ρ=0,04
No. of out-licences (N= 81)	30 B	45	17	6	1	
Number per company	1,88	1,15	1,00	0,75	1,00	ρ=-0,08
Quality of tacit knowledge	Excellent	Good	Adequate	Poor	None	
Number of companies	21	41	12	4	1	79
%	27	52	15	5	1	100
No. of in-licences (N=79)	58 A	69	26	1	14	
Number per company	2,76	1,68	2,17	0,25	14,00	ρ=0,01
No. of out-licences (N=79)	25	57 B	15	2	0	
Number per company	1,19	1,39	1,25	0,50	0	ρ=-0,14
Access to complementary	Excellent	Good	Adequate	Poor	None	

assets						
Number of companies	8	24	27	5	6	70
%	11	34	39	7	9	100
No. of in-licences (N=70)	17	35	74 A	0	27	
Number per company	2,13	1,46	2,74	0	4,50	ρ=-0,06
No. of out-licences (N=70)	19	36 B	37	4	1	
Number per company	2,38	1,50	1,37	0,80	0,17	ρ=0,16
Quality of technology portfolio	Excellent	Good	Adequate	Poor	None	
Number of companies	2	47	19	8	2	78
%	3	60	24	10	3	100
No. of in-licences (N=78)	0	119 A	33	1	14	
Number per company	0	2,53	1,74	0,13	7,00	ρ=0,12
No. of out-licences (N=78)	10	62 B	22	4	0	
Number per company	5,00	1,32	1,16	0,50	0	ρ=0,07

Table 63. Some competitive attributes of companies and their environment.

As shown in Table 64 respondents seem to be generally forward looking but the relatively high rating of "other techniques" and scenario planning which could arguably be considered more philosophical or perhaps more well-known may point to a relative absence of more rigorous forward planning. Only two respondents reported no use of forward planning techniques at all. It could be that they were thinking of strictly technology forward planning in which case their responses are acceptable because one is employing specialised and new technology in a niche market and the other is in an 'old and settled' industry.

Out-licensing seemingly increases as S-curve usage increases. It could be very interesting to explore this relationship between licensing and what may arguably be viewed as a "technology indicator" further.

Attribute	Company view of attribute					Notes
	Excellent	Good	Adequate	Poor	None	
Quality of forward planning in terms of - - -						
Scenario planning						C=0,82
Number of companies	1	40	22	11	6	80
%	1	50	28	14	8	100
No. of in-licences (N=80)	1	79	61 A	20	7	
Number per company	1,00	1,97	2,77	1,82	1,17	ρ=0,04
No. of out-licences (N=80)	1	60 B	30	5	3	
Number per company	1,00	1,50	1,36	0,45	0,50	ρ=-0,00
S-curves awareness						C=0,86
Number of companies	5	22	24	12	11	74
%	7	30	32	16	15	100
No. of in-licences (N=74)	22	35	41	31 A	21	
Number per company	4,40	1,59	1,71	2,58	1,91	ρ=0,03
No. of out-licences (N=74)	12	41 B	20	20	4	
Number per company	2,40	1,86	0,83	1,67	0,36	ρ=0,12

Other techniques						C=0,85
Number of companies	4	25	36	9	4	78
%	5	32	46	12	5	100
No. of in-licences (N=78)	16	67	64 A	12	3	
Number per company	4,00	2,68	1,78	1,33	0,75	ρ=0,21
No. of out-licences (N=78)	5	63 B	21	5	2	
Number per company	1,25	2,52	0,58	0,56	0.,0	ρ=0,22
Aggregate of forward planning						α=0,81
Number of reports (N)	1	26	37	10	6	80
%	1	33	46	13	8	100
No. of in-licences	6	61	85	7	9	
Number per company	6.00	2.35	2.30	0.70	1.50	ρ=0,10
No. of out-licences	0	63	28	5	3	
Number per company	0	2.42	0.76	0.50	0.50	ρ=0,16

Table 64. Sensitivity to the future.

"Other" techniques suggest increases in licensing as quality of forward planning improves but a reversal for out-licensing when an "excellent" rating is reached, even if the 25 licences contributed by the single company are eliminated. Even though only four companies rated themselves in this rank, exploring why and what the other techniques are could well be worth further research.

A similar pattern for the aggregate can be noted where $\alpha = 0,81$ and the item-scale correlation coefficients C are greater. The reversals are probably the consequence of respectively only four and one companies falling in the "excellent" rank which increases sensitivity to individual company characteristics.

Not surprisingly, environmental sensitivity from Table 65 is highest in the chemicals, food and healthcare and the heavy engineering sectors.

Environmental friendliness (%)	Extreme	Positive	Average	Grudging	Not at all	N
Automotive components	0	70	30	0	0	10
Building materials and components	29	43	29	0	0	7
Chemicals including paper & textiles	23	62	8	8	0	13
Electrical, light	0	67	17	17	0	6
Heavy engineering	9	73	18	0	0	11
Food & healthcare	27	55	18	0	0	11
ICT & electronics	0	63	25	13	0	8
Metal products & machinery	14	57	29	0	0	14

Table 65. Sectoral approach to the environment.

Table 66 shows the aggregated result of the three forward planning attributes listed in Table 64 by sector as an indication of the attention respondents pay to future planning. Light electrical and metal products and machinery seem to be least concerned with forward planning. ICT and electronics companies can be said to be planning decently or not at all.

Future planning (%)	Excellent	Good	Adequate	Poor	None	N
Automotive components	0	20	60	20	0	10
Building materials and components	0	29	71	0	0	7
Chemicals including paper & textiles	0	46	54	0	0	13
Electrical, light	0	0	67	17	17	6
Heavy engineering	9	36	36	9	9	11
Food & healthcare	0	40	40	20	0	10
ICT & electronics	0	44	33	0	22	9
Metal products & machinery	0	29	29	29	14	14

Table 66. Sectoral forward planning – aggregate indicant.

For summary finding on notional postulate see 9.1.7, p198.

8.8 Innovation levels - 2.4

Survey objectives: Profile the characteristics listed below for South African manufacturing companies.

Notional postulate: Innovative activities in a South African manufacturing company will manifest indirectly through the characteristics surveyed and will correlate positively with technology licensing and trading activities

Question in Annexure A	Characteristic surveyed		
29	Use of SPII funds		
30	Use of Innovation Fund of DTI		
31	Use of THRIPS funds		
32	Use of other innovation funding		Aggregate
40	International co-development		
41	Offset/countertrade activities	Aggregate	
42	Aspiration to progress from OEM to own brand manufacturing		Aggregate

Encouragement of innovative activity:		
52	In products and processes	
53	In production	
54	In logistics	
55	In management	Aggregate

……...

Table 67 shows in the aggregate that only 54% of respondents had tried to use or actually used public funding aimed at encouraging technology development. Underlying data show that seven (9%) did not know any funds and a further 14 (18%) admitted to not knowing what at least one of the available funds was. Qualifying criteria and scarcity of funds may have played a role in reducing usage or application rate but the ignorance rate among respondents which are all fairly to quite sophisticated is probably too high and could and should be reduced. (SAIS (p87) returned 7% used and 93% tried; and an equivalent European innovation survey returned 21% used and 79% tried.)

Attribute	Company view of attribute					Notes
	Maximally	Yes	Tried	No	What is it?	
Companies' use of National funding for innovation - - -						
SPII funds						C=0,83
Number of companies	4	18	8	33	16	79
%	5	23	10	42	20	100
No. of in-licences (N=63)	2	36	23	87 A		
Number per company	0,50	2,00	2,88	2,64		ρ=-0,11
No. of out-licences (N=63)	0	47 B	11	34		
Number per company	0	2,61	1,38	1,03		ρ=0,08
Innovation Fund of DTI						C=0,75
Number of companies	2	16	13	38	10	79
%	3	20	16	48	13	100
No. of in-licences (N=69)	1	34	20	100 A		
Number per company	0,50	2,13	1,54	2,63		ρ=-0,03
No. of out-licences (N=69)	2	33 B	8	51		
Number per company	1,00	2,06	0,62	1,34		ρ=-0,00
THRIPS funds						C=0,81
Number of companies	2	13	6	39	20	80
%	3	16	8	49	25	100
No. of in-licences (N=60)	5	35	8	101 A		
Number per company	2,50	2,69	1,33	2,59		ρ=0,05
No. of out-licences (N=60)	0	46 B	4	42		
Number per company	0	3,54	0,67	1,08		ρ=0,19
Other DTI/IDC/DACST funds						C=0,74
Number of companies	1	19	8	37	14	79
%	1	24	10	47	18	100

No. of in-licences (N=65)	5	42	25	87 A		
Number per company	5,00	2,21	3,13	2,35		ρ=0,10
No. of out-licences (N=65)	0	41 B	15	38		
Number per company	0	2,16	1,88	1,03		ρ=0,06
Aggregate of public funds usage						α=0,83
Number of reports (N)	1	11	27	33		72
%	1	15	38	46		100
No. of in-licences	1	25	59	79		
Number per company	1,00	2,27	2,19	2,39		ρ=-0,09
No. of out-licences	0	29	34	33		
Number per company	0	2,64	1,26	1,00		ρ=0,01

Note: Frequencies in the What is it? rank are ignored for correlation.

Table 67. Public funding usage.

DTI : Department of Trade and Industry.

SPII : Support Programme for Industrial Innovation of DTI.

THRIPS : Technology and Human Resources for Industry Programme of DTI.

The aggregate construct may point to increasing out-licensing with increasing use of public development funding; and increasing use of in-licensing with decreasing use of such funding with α = 0,83 and all item-scale correlation coefficients C except that for SPII funds lower. Interestingly, the pattern of the two companies with the most in and out-licences, A = consistently "not used" and B = consistently "yes, used" respectively, appearing below, seems to bear this out strikingly.

Table 68 indicates that chemicals including paper and textiles, light electrical, food and healthcare and ICT and electronics have had most success in winning financial support. Light electrical with lowest licensing intensity is a somewhat surprising finding but the expressed possibility that innovations may be marginal and not usefully protectable may play a role.

Building materials and components has tried hard but to no avail and only limited success is evident for automotive components.

Further study, unrelated to this research, to establish why knowledge of public development funds appears to be disappointing; and allocation criteria and their practical effect, perhaps also on exploitation may be useful.

Use of public technology development funds (%)	Maximally	Yes	Tried	No	N

Automotive components	0	20	70	10	10
Building materials and components	0	0	86	14	7
Chemicals including paper & textiles	0	54	38	8	13
Electrical, light	17	33	33	17	6
Heavy engineering	9	27	45	18	11
Food & healthcare	9	45	36	9	11
ICT & electronics	33	22	11	33	9
Metal products & machinery	23	8	54	15	13

Table 68. Sectoral use of public technology development funds – aggregate indicant.

In Table 69 respondents report that 27% are involved "intensively" or "frequently" in international co-development, 32% "often" and 40% "seldom" or "not at all". This should be read against the more than 70% rating international travel and experience "extensive/often" and "good/excellent" (Table 54, p140) and does not seem to give cause for concern because international co-development is a specialised activity. Both in- and out-licensing activity seemingly intensify as co-development increases although the small numbers actually involved in co-development signal caution in the interpretation.

More research to establish the exact nature of co-development will be useful; also with a view to establish the presence, or not, of cross-licensing and joint venturing.

Attribute	Company view of attribute					Notes
	Intensive	Frequent	Often	Seldom	Not at all	
International co-development						C=0,68
Number of companies	4	17	25	24	7	77
%	5	22	32	31	9	100
No. of in-licences (N=77)	16	45	55 A	44	7	
Number per company	4,00	2,65	2,20	1,83	1,00	ρ=0,20
No. of out-licences (N=77)	2	56 B	24	12	2	
Number per company	0,50	3,29	0,96	0,50	0,29	ρ=0,26
Offset/countertrade activities						C=0,68
Number of companies	5	8	5	28	31	77
%	6	10	6	36	40	100
No. of in-licences (N=77)	15	25	19	69 A	40	
Number per company	3,00	3,13	3,80	2,46	1,29	ρ=0,17
No. of out-licences (N=77)	2	10	5	64 B	14	
Number per company	0,40	1,25	1,00	2,29	0,45	ρ=0,12
Aspiration to progress from OEM to own brand manufacture	Already own brand manufacturer	Across the board	Most products	Some products	Not at all	C=0,67
Number of companies	37	8	7	18	9	79
%	47	10	9	23	11	100

No. of in-licences (N=79)	76	8	13	64 A	7	
Number per company	2,05	1,00	1,86	3,56	0,78	ρ =0,08
No. of out-licences (N=79)	54 B	3	15	15	2	
Number per company	1,46	0,38	2,14	0,83	0,22	ρ =0,05
Aggregate of all above attributes						α=0,49
Number of reports (N)	3	16	34	23	4	80
%	4	20	43	29	5	100
No. of in-licences	9	55	42	58	4	
Number per company	3,00	3,44	1,24	2,52	1,00	ρ =0,12
No. of out-licences	9	48	30	16	1	
Number per company	1,33	3,00	0,88	0,70	0,25	ρ =0,22
Aggregate of only first two of above attributes *						α =0,63
Number of reports (N)	0	10	18	29	21	78
%	0	13	23	37	27	100
No. of in-licences	0	0	29	53	60	
Number per company	0	2,90	2,94	2,07	1,24	ρ =0,20
No. of out-licences	0	3	7	57	24	
Number per company	0	0,70	3,17	0,83	0,38	ρ =0,20

* C = 0,82 and 0,87 respectively for the remaining two underlying indicants.

Table 69. International involvement and aspiration to own brand.

OEM : Original Equipment Manufacturer.

It is perhaps encouraging that 22% of respondents are involved "often" to "intensively" in offset/countertrade activities. This also confirms international awareness. It is encouraging that 47% are already own brand manufacturers (albeit that many are smallish) and that a further 19% are far advanced or striving strongly to own brand manufacture. Licensing may increase as international co-development and offset/countertrade activities increase while small numbers again underlie this outcome. No trend regarding OEM aspirations or status is discernible.

The aggregate of three indicants is clearly deleteriously affected by the inclusion of OEM aspirations and the aggregate without this attribute seems to support the trend comments above, with α = 0,63 and the item-scale correlation coefficients C = 0,82 and 0,87.

Table 70 shows that 78% (seven of 9) companies in the ICT & electronics sector reported manufacturing own brands. Automotive components has the lowest rating and seems not to desire any change. This is again a function of their being out-sources. Building materials seems to have the most aspirants towards OEM manufacturing, followed by chemicals including paper & textiles. Light electrical seems almost dichotomous with a 67% OEM

rating but also 17% with no aspiration at all.

Aspiration to become an own brand manufacturer (%)	Already has own brand	Across the board	Most products	Some products	None	N
Automotive components	10	10	0	50	30	10
Building materials and components	29	0	43	29	0	7
Chemicals including paper & textiles	36	18	9	27	9	11
Electrical, light	67	17	0	0	17	6
Heavy engineering	36	18	18	18	9	11
Food & healthcare	45	9	9	27	0	11
ICT & electronics	78	0	0	11	11	9
Metal products & machinery	71	7	0	14	7	14

Table 70. Sectoral approach to original equipment manufacturing.

In Table 71 respondents report generally high continual attention to encouraging innovative activities. "Continual" encouragement of innovative activities in the aggregate is reported by 56% and "sporadic" encouragement by 43%. The perhaps non-obvious management activities are rated a good 60% and 35% respectively. Products and processes get most attention and logistics least. The "not applicable" rating is by an engineering contracting company with fewer than 50 employees. (Of the SAIS sample population 57% (p47) reported innovative products and 39% (p50) innovative processes created during the period 1998 - 2000.)

Attribute	Company view of attribute				Notes
	Continually	Sporadically	Not at all	Not applic.	
Encouragement of innovative activities regarding - - -					
Products and processes					C=0.71
Number of companies	61	19	0	1	81
%	75	23	0	1	100
No. of in-licences (N=81)	134 A	34	0	0	
Number per company (N=80)	2,20	1,79	0		ρ =-0.04
No. of out-licences (N=81)	89 B	10	0	0	
Number per company (N=80)	1,46	0,53	0		ρ =0.04
Production					C=0.77
Number of companies	55	21	4	1	81
%	68	26	5	1	100
No. of in-licences (N=81)	95	67 A	2	4	
Number per company (N=80)	1,73	3,19	0,50		ρ =-0.06
No. of out-licences (N=81)	81 B	16	2	0	
Number per company (N=80)	1,47	0,76	0,50		ρ =-0.08
Logistics					C=0.86
Number of companies	45	34	1	1	81
%	56	42	1	1	100
No. of in-licences (N=81)	102 A	62	0	4	
Number per company (N=1)	2,27	1,82	0		ρ =0.04
No. of out-licences (N=81)	41	56 B	2	0	

Number per company (N=80)	0,91	1,65	2,00		ρ=-0.07
Management					C=0.83
Number of companies	49	28	4	0	81
%	60	35	5	0	100
No. of in-licences (N=81)	117 A	45	6	0	
Number per company	2,39	1,61	1,50		ρ=0.09
No. of out-licences (N=81)	80 B	19	0	0	
Number per company	1,63	0,68	0		ρ=0.06
Aggregate encouragement					α=0.80
Number of reports (N)	45	35	1		81
%	56	43	1		100
No. of in-licences	111	57	0		
Number per company	2,47	1,63	0		ρ=0.04
No. of out-licences	78	19	2		
Number per company	1,73	0,54	2,00		ρ=-0.04

Table 71. Profile of innovative characteristics.

As encouragement of innovation in the listed items increases licensing activity seems to increase, with three exceptions. In-licensing seems independent of production innovation and out-licensing seems to decrease with greater attention to logistics. No trend in out-licensing can be discerned from the aggregate, possibly because of the effect of logistics. $\alpha = 0{,}80$ and all item-scale correlation coefficients C are greater. In-licensing seems to increase with improving encouragement.

Table 72 confirms high attention to innovative activities by virtually all sectors.

Encouragement of innovative activities (%)	Continually	Sporadically	Not at all	N
Automotive components	90	10	0	10
Building materials and components	43	57	0	7
Chemicals including paper & textiles	77	23	0	13
Electrical, light	50	50	0	6
Heavy engineering	64	36	0	11
Food & healthcare	27	73	0	11
ICT & electronics	33	56	11	9
Metal products & machinery	50	50	0	14

Table 72. Sectoral approach to encouraging innovative activities – aggregate indicant.

From Table 73 automotive components, heavy engineering and building materials and components seem laggards in international aspirations while ICT and electronics leads.

International involvement (%)	Intensive	Frequent	Often	Seldom	Not at all	N
Automotive components	0	10	40	50	0	10

Building materials and components	0	14	43	43	0	7
Chemicals including paper & textiles	0	25	42	33	0	12
Electrical, light	0	0	83	0	17	6
Heavy engineering	0	27	27	36	9	11
Food & healthcare	0	45	18	27	9	11
ICT & electronics	33	11	44	0	11	9
Metal products & machinery	0	14	57	29	0	14

Table 73. Sectoral incidence of international co-development, offset/countertrade and aspiration to become OEM – aggregate indicant.

For summary finding on notional postulate see 9.1.7, p198.

8.9 Sensitivity to learning from in-licensing - 3.3

Survey objectives: Profile South African manufacturing companies' sensitivity to learning as licensees. Characteristics surveyed appear in questions 211 to 226 in Annexure A.

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Results shown in Table 74 reflect responses to the question "How is corporate learning managed when technology is licensed inwards?" and are congruent with the highest value rating assigned to know-how in licences (Table100, p180).

Attribute	Company view of attribute				Total
Planning horizon	Long term	Sporadic	Short	Immediate	
Number of companies	37	8	13	1	59
%	63	14	22	2	100
Strategic intent is communicated to all personnel	Fully	Reasonably	Sketchily	Not	
Number of companies	10	33	12	4	59
%	17	56	20	7	100
Priority of learning in venture is	Top	Planned	Also ran	Neglected	
Number of companies	4	33	13	5	55
%	7	60	24	9	100
Learning process is	Planned	Fair	Sketchy	Random	
Number of companies	11	38	5	5	59
%	19	64	8	8	100
Human Resources are involved	Fully	Fairly	In passing	Not at all	
Number of companies	10	24	16	7	57
%	18	42	28	12	100
Staffing assignments are	Thorough	Fair	To get by	Neglected	
Number of companies	8	42	7	1	58
%	14	72	12	2	100
Team members are	Top class	Fair	Can improve	Inadequate	
Number of companies	22	25	12	0	59
%	37	42	20	0	100
Control is	Taken over	Shared	Poor	Surrendered	
Number of companies	7	46	4	0	57

Attribute	Company view of attribute				Total
Planning horizon	Long term	Sporadic	Short	Immediate	
%	12	81	7	0	100
Learning depends on partner	Not at all	50:50	Largely	Completely	
Number of companies	11	32	13	1	57
%	19	56	23	2	100
Cross-cultural competence is	Excellent	Good	Average	Poor	
Number of companies	2	28	24	4	58
%	3	48	41	7	100
Cross-disciplinary competence is	Excellent	Good	Average	Poor	
Number of companies	2	39	16	2	59
%	3	66	27	3	100
Team career structure plan is	Clear	Framework	Vague	Not at all	
Number of companies	6	25	25	2	58
%	10	43	43	3	100
Responsibility for learning is	Clear	Good	Vague	Not clear	
Number of companies	9	35	12	2	58
%	16	60	21	3	100
Performance measures are	Long term	Medium term	Short term	Immediate	
Number of companies	6	32	20	1	59
%	10	54	34	2	100
Rewards for learning are	Excellent	Fair	Poor	Absent	
Number of companies	2	35	13	9	59
%	3	59	22	15	100
Tolerance of learning barriers is	High	Acceptable	Sketchy	Absent	
Number of companies	3	39	12	3	57
%	5	68	21	5	100

Table 74. Profile of companies' sensitivity to learning as licensees.

It indicates that the learning process is planned and mostly long term (63%), that the strategic intent is widely communicated, that learning priority is high and the process adjudged fair (64%) and planned (19%). Control of the process is shared in 81% and taken over in 12% of cases. Learning is considered to depend on both parties in 56% and not at all on the licensor in 19% of cases. Cross cultural competence is suspect with a 48% average to poor rating. In some cases the companies reporting poor or inadequate learning do not really need intensive learning due to the nature of their operations. Nevertheless the process can be improved at many of them.

8.10 Appropriability - 3.4

Survey objectives: Profile South African manufacturing companies' appropriability awareness in terms of the intensity and spread of use of appropriability instruments and their relevant organisation. Characteristics surveyed appear in questions 101 to 106 and 110 to 114 in

Annexure A. Analyse intellectual property (IP) holdings per group.

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8.10.1 Statutory intellectual property portfolios

Attribute	All companies surveyed					Total holding	
	Total	No report	Number reporting holding number incl. nil	Number with at least one holding	% with holding	Number	Maximum per company
South Africa :							
Patents plus applications	81	10	71	53	75	877	200
Designs plus applications	81	17	64	30	47	341	50
Trade marks plus applications	81	14	67	48	72	542	84
Elsewhere :							
Patents plus applications	81	14	67	33	49	669	200
Designs plus applications	81	17	64	13	20	128	50
Trade marks plus applications	81	17	64	28	44	317	50

Table 75. Profile of companies' intellectual property portfolios.

Several respondents did not respond to the simple yes or no questions regarding their statutory intellectual property holdings. These are listed under "no report" in Table 75. Respondents that did supply numbers of these holdings did so under the invitation to provide an approximate number (in the hope of increasing the response rate) and in some cases a clearly rounded number was discernible. All numbers should be considered with circumspection.

Only 75% of the respondents hold South African patents or applications and half avail themselves of registered designs in South Africa. Foreign holdings of all types of statutory intellectual property are considerably smaller against the background of all but one respondent reporting export sales activity.

Portfolios per company groupings are not analysed because the input information is considered too vague and unreliable.

The relationship between patents held and select attribute and aggregate ranking is set out in

Table 76. The presence of two companies with notably large domestic : foreign holdings of 200 : 200 and 132 : 100 patents respectively is indicated by the letters A and B. Patent holdings seemingly increase as ranking improves except for the construct aggregate international involvement. This tendency is weakly confirmed by the Spearman correlation coefficients. When A and B are removed from the aggregate international involvement construct the shown negative correlation is cancelled with average patents per company of 11 in the "poor" and "none" ranks.

This finding corresponds with several others reported, *viz.* that licensing activity increases with increasing ranking of various attributes. However, no relation between patent holdings and out-licences could be found. The Spearman correlation coefficient was a weak 0,20 while statistics for domestic and foreign patents reported returned a mean of 21,8, a standard deviation of 56,8, median of 5,0, minimum of 0 and maximum of 400,0.

Attribute	Company view of attribute					Notes
	Excellent	Good	Adequate	Poor	None	
Research & development is						
Number of companies	16	24	17	10	4	71
Patents total	326	913 A,B	278	28	1	
Patents average per company	20	38	16	3	-	ρ=0,34
R&D to license is						
Number of companies	4	9	13	21	24	71
Patents total	80	100	250	686 A	430 B	
Patents average per company	20	11	19	33	18	ρ=0,37
Technology licensing is						
Number of companies	3	7	20	16	23	71
Patents total	80	70	214	636 A	496 B	
Patents average per company	27	10	11	40	22	ρ=0,21
Technology portfolio is	Complete	Good	Adequate	Poor	None	
Number of companies	1	42	16	8	2	71
Patents total	29	1307 A, B	53	128	9	
Patents average per	29	31	3	16	5	ρ=0,29

company						
Aggregate use of national funds for innovation - 1	Maximally	Yes	Tried	No		
Number of companies		9	21	41		71
Patents total		496	577 a	473 B		
Patents average per company		55	27	12		ρ=0,42
Aggregate international involvement – 2	Intensive	Frequent	Often	Seldom	Not at all	
Number of companies	2	9	12	28	20	71
Patents total	4	73	294	709 A	466 B	
Patents average per company	2	8	25	25	23	ρ=-0,17
Aggregate encouragement of innovative activities - 3	Continually	Sporadically	Not at all			
Number of companies	39	31	1			71
Patents total	1194 A, B	348	4			
Patents average per company	31	11	1			ρ=0,12

Constituent characteristics 1 - in Table 67, p152: 2 – in Table 54, p139; 3 – in Table 71,p155.

Table 76. Patent holding against select attribute ranking.

8.10.2 IP management aspects

Table 77 shows that confidentiality agreements with employees are reported most frequently by 64 companies compared with about half as many with each of visitors and inventors. About 25% of respondents have agreements only with employees; and 19% with employees, visitors and inventors. A total of only 21% of companies do not have agreements with employees.

Respondents seem to be reasonably aware of the need for confidentiality agreements with inventors, 45% reporting that they have such agreements.

Awareness of South Africa's obligations under the Agreement on Trade Related Aspects of Intellectual Property is not high with 70% admitting this. This may point to weak general IP knowledge.

Confidentiality agreements with	Employees	Visitors	Inventors	N	%
	X			25	31
		X		4	5
			X	4	5

	X	X		7	9
	X		X	13	16
	X	X	X	19	23
		X	X	1	1
No information or none				8	10
Total occurrence	64	31	37		
Aware of RSA's TRIPS obligations	Well	Reasonably	Not really	Total	
Number of companies	6	14	47	67	
%	9	21	70	100	
Lawyers on staff	General counsel	Patent counsel	Both	None	No response
Number of companies	19	7	4	54	5
Use of outside lawyers					
Number of companies	31	55	16	47	4
Patent systems used	EEC	ARIPO	Eurasian	OAPI	PCT
Number of companies	14	6	0	3	22
% usage	32	13	0	7	49

Table 77. Organisation of IP activities.

Results confirm that outside patent counsel is used when necessary, only seven companies having patent counsel in-house with four of these having general counsel colleagues as well. The 47 that reported no use of outside counsel probably did so considering intellectual property and licensing only.

Respondents seem to have taken to the Patent Cooperation Treaty with 49% reporting using it. Very little IP activity is reported in Africa and none in Eurasia.

8.11 IP portfolio's - 4.1

Survey objective: Profile frequency of occurrence of IP data bases and explore possible correlation between them and technology strategy activities. Characteristics surveyed appear below.

Notional postulate: Increased IP awareness will correlate positively with licensing activities.

Question in Annexure A	Characteristic surveyed	

108	Quality of IP data base	Aggregate
109	Quality of IP planning	
117	Research and development with objective to license	
127	Quality of technology strategy	Aggregate
128	Quality of technology/core competence audits - internally	
129	Quality of technology/core competence audits - externally	

……...

Table 78 suggests increasing licensing activity as IP data bases get better organised and that some IP planning lead to more licensing activity. The aggregate indicant indicates that intellectual property planning is not afforded the attention it deserves, with 51% indicating "not good" planning and 30% no planning. Further research to establish reasons for this phenomenon may be useful. It also points to increased licensing activity, especially out-licensing, as aggregate IP planning improves. α = 0,77 with the item-scale correlation coefficients 0,90 and 0,91.

Attribute	Company view of attribute			Notes
IP data base is	Organised	So-so	None	C=0,90
Number of companies	31	36	13	80
%	39	45	16	100
No. of in-licences (N=80)	86 A	72	10	
Number per company	2,77	2,00	0,77	ρ=0,04
No. of out-licences (N=80)	57 B	40	2	
Number per company	1,84	1,11	0,15	ρ=0,14
IP planning is done	Regularly	Sporadically	Never	C=0,91
Number of companies	20	34	24	78
%	26	44	31	100
No. of in-licences (N=78)	38	108 A	21	
Number per company	1,90	3,18	0,88	ρ=0,12
No. of out-licences (N=78)	49 B	41	9	
Number per company	2,45	1,21	0,38	ρ=0,21
Aggregate IP planning quality	Well run	Not good	Never	α=0,77

Number of reports (N)	15	41	24	80
%	19	51	30	100
No. of in-licences	23	124	21	
Number per company	1,53	3,02	0,88	ρ=0,07
No. of out-licences	46	44	9	
Number per company	3,07	1,07	0,38	ρ=0,16
Note: The aggregate is further analysed across select company groupings in Table79.				

Table 78. Profile of indicants of companies' awareness of IP management.

Sectorally, it can be seen from Table 79 that IP planning seems poorest in the heavy engineering and automotive sectors. These results can be reconciled to automotive only licensing in but hardly with heavy engineering showing middling licensing activity.

Food and healthcare seems the best planner, a finding which is not surprising because of healthcare's general involvement in patenting and trade marking.

Sectoral IP planning –aggregate (%)	Well run	Not good	Never	N
Automotive components	10	40	50	10
Building materials and components	0	100	0	7
Chemicals including paper & textiles	31	62	8	13
Electrical, light	0	67	33	6
Heavy engineering	0	45	55	11
Food & healthcare	50	30	20	10
ICT & electronics	11	56	33	9
Metal products & machinery	29	36	36	14

Table 79. Sectoral IP planning – aggregate indicant.

The aggregate indicant IP planning quality appearing in Table 80 is discussed at Table 78, p164.

From Table 80 respondents reporting "adequate" or better and those reporting "poor" or no research and development with the objective to license are about evenly split. Technology management strategy is likewise divided about evenly between "sporadically partial" and worse and "sporadically complete" and better. Technology auditing is not frequently practised with "sporadically complete" and better ranking for 49% internal and 25% external auditing.

Accepting the indications of the aggregate indicant only a disappointing 43% of respondents can arguably be said to pay reasonable and proper attention to technology strategy while 10%

admit no planning and 48% what could be dangerous and short-sighted practice.

As stated at table 78, p164, results for aggregate IP planning point to increased licensing activity, especially out-licensing, as aggregate IP planning improves. α = 0,77 with the item-scale correlation coefficients C greater. Licensing activity increases as research and development with the intention to license improves with out-licensing dramatically increasing when the "excellent" rating is reached and remains highest after removal of the single company's contribution of 25 licences. This phenomenon is accompanied by a weak Spearman correlation coefficient of 0,23 indicating positive correlation between research and development with intent to license and licensing activity.

Improved quality of technology strategy management (ρ = 0,12 for in- and 0,15 for out-licensing) as well as internal auditing activity (ρ = 0,22 and 0,07) seem to lead to increased licensing. No seeming trend is discernible regarding external technology auditing.

The aggregate also points to increased licensing activity with α = 0,85 and the item-scale correlation coefficients C = 0,89 except for external auditing where it is 0,78.

Annexure D lists respondents' rating of themselves under the two aggregate attributes and one simple attribute. Inspection of the frequency of occurrence of consistent or approximately consistent ratings of weak, middling or good for the three attributes by each respondent indicates that 53 of the 80 responses (66%) could be considered consistent. In other words, a company tends to be weak, middling or good in all attributes.

Attribute	Company view of attribute					Notes
Aggregate IP planning quality from Table 78, p164	Well run	Not good	Never			α=0,77
Number of reports	15	41	24			80
%	19	51	30			100
No. of in-licences	23	124	21			
Number per company	1,53	3,02	0,88			ρ=0,07
No. of out-licences	46	44	9			
Number per company	3,07	1,07	0,38			ρ=0,16
R&D with objective to license from Table 45, p130	Excellent	Good	Adequate	Poor	None	
Number of reports	5	11	15	23	26	80
%	6	14	19	29	33	100
No. of in-licences (N = 80)	11	27	38	29	63 A	
Number per company	2,20	2,45	2,53	1,26	2,42	ρ=0,10
No. of out-licences (N=80)	36 B	15	27	9	12	
Number per company	7,20	1,36	1,80	0,39	0,46	ρ=0,23

Quality of technology management ….	Regular and complete	Sporadic, complete	Sporadic, partial	Ad hoc	None	
Strategy						C=0,89
Number of companies	21	21	21	8	9	80
%	26	26	26	10	11	100
No. of in-licences (N=80)	57	38	51 A	14	8	
Number per company	2,71	1,81	2,43	1,75	0,89	ρ=0,12
No. of out-licences (N=80)	57 B	11	22	4	5	
Number per company	2,71	0,52	1,05	0,50	0,56	ρ=0,15
Internal audits						C=0,89
Number of companies	16	23	20	13	7	79
%	20	29	25	16	9	100
No. of in-licences (N=79)	28	72	54 A	7	6	
Number per company	1,75	3,13	2,70	0,54	0,86	ρ=0,22
No. of out-licences (N=79)	50 B	22	14	10	3	
Number per company	3,13	0,96	0,70	0,77	0,43	ρ=0,07
External audits						C=0,78
Number of companies	7	12	23	19	14	75
%	9	16	31	25	19	100
No. of in-licences (N=75)	6	32	58 A	30	32	
Number per company	0,86	2,67	2,52	1,58	2,29	ρ=0,07
No. Of out-licences (N=75)	3	46 B	23	19	6	
Number per company	0,43	3,83	1,00	1,00	0,43	ρ=0,06
Aggregate of strategy and audits						α=0,85
Number of reports	10	24	24	14	8	80
%	13	30	30	18	10	100
No. of in-licences	17	46	84	13	8	
Number per company	1,70	1,92	3,50	0,93	1,00	ρ=0,15
No. of out-licences	37	30	19	9	4	
Number per company	3,70	1,25	0,79	0,64	0,50	ρ=0,09

Table 80. Profile of technology and IP planning.

Compared to the approximately 78% of respondents who reported some technology strategy, in the case of the total SAIS sample 32% reported thus while for all sectors excluding financial at a high 96% the range reported was from 15 – 50% (p58).

Table 81 shows that research and development with objective to license is rated "poor" and "none" by more that half the companies in all sectors except food and healthcare. ICT and electronics seems to be more active.

Sectoral research and development with objective to license (%)	Excellent	Good	Adequate	Poor	None	N
Automotive components	0	20	0	20	60	10

Building materials and components	0	14	29	29	29	7
Chemicals including paper & textiles	8	8	15	38	31	13
Electrical, light	0	0	33	17	50	6
Heavy engineering	0	18	18	27	36	11
Food & healthcare	20	20	30	20	10	10
ICT & electronics	11	33	0	33	22	9
Metal products & machinery	7	0	29	36	29	14

Table 81. Sectoral research and development with objective to license.

From Table 82 it appears that the light electrical sector has a rather casual approach to technology management. Chemicals including paper and textiles fares best followed by food and healthcare and building materials. Considering ICT and electronics against research and development for licensing it may be signalling that it has recently turned to such research in an effort to bolster its technology management quality.

Quality of technology management (%)	Regular and complete	Sporadic, complete	Sporadic, partial	Ad hoc	None	N
Automotive components	10	20	50	10	10	10
Building materials and components	14	43	29	14	0	7
Chemicals including paper & textiles	15	54	23	8	0	13
Electrical, light	0	0	50	50	0	6
Heavy engineering	0	45	9	36	9	11
Food & healthcare	20	40	10	20	10	10
ICT & electronics	22	11	44	0	22	9
Metal products & machinery	14	14	36	14	21	14

Table 82. Sectoral technology management – aggregate indicant.

Further research into IP planning could yield interesting insights. Such research should be considered within the framework of IP deployment. See 8.12, p168.

For summary finding on notional postulate see 9.1.7, p198.

8.12 Deployment of IP - 4.2

Survey objective: Establish overarching goal to which South African manufacturing companies apply their intellectual property. Question 107 appearing in Annexure A was: "Broadly, for what purpose do you use your intellectual property?"

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Respondents were invited to mark one or more of the four objectives presented randomly. It is

clear from Table 83 that manufacturing companies are mostly interested in exercising the exclusive rights they may obtain from their intellectual property through deterrence and monopolisation. This result could have been biased by some respondents perhaps not having borne in mind that intellectual property encompasses more than statutory intellectual property. Altogether 19% of respondents expressed interest in earning royalties. One company from the chemicals and food and one from the healthcare sector (3%) were exclusively interested in royalties.

Highest interest in earning royalties is also shown by these sectors with 36% and 33% respectively.

The findings correspond broadly with the 1994 Japanese survey results under "Future" in Table 3, p49 which show aspiration to monopolise and deter as highest priority.

Elements of the picket fence, smokescreen and bargaining chip patent strategies (4.2, p45) seem to be present. It would be interesting to explore further to what extent, if any, these strategies are deliberately being developed and used by South African companies. It may be possible that *e.g.* the toll gate and bargaining chip strategies if employed systematically and in a focussed manner, may open opportunities to cross-license. In parallel, the influence of company size may be investigated. Maybe South African companies are too small to be able to develop or afford sufficient numbers of patents. Also inviting further attention is the seeming defensive use of IP against the expressed high liking of licensing and the belief that it is profitable for the licensor.

Industry sector	Automotive components		Building materials & components		Chemicals incl. paper & textiles		Electrical, light		Heavy engineering		Food & healthcare		ICT & electronics		Metal products & machinery		All	
Purpose is to -	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Monopolise=1			2	29			2	33	2	22			3	33	3	21	12	16
Deter others=2	6	86	3	43	5	42	1	17	4	44	2	18	2	22	6	43	29	39
Earn royalties=3					1	8					1	9					2	3
Defend=4							1	17	1	11							2	3

1,2					2	17	1	17			5	45	2	22	3	21	13	17
1,3					1	8											1	1
1,4																		
2,3	1	14	1	14											1	7	3	4
2,4					1	8	1	17	1	11			1	11			4	5
3,4					2	17			1	11	1	9					4	5
1,2,3															1	7	1	1
1,2,4			1	14													1	1
1,3,4																		
2,3,4											1	9					1	1
1,2,3,4											1	9	1	11			2	3
Total reports	7	100	7	100	12	100	6	100	9	100	11	100	9	100	14	100	75	100
Co's in sector	10		7		13		6		11		11		9		14		81	
Companies showing an interest in -																		
Monopolies			3	43	3	25	3	50	2	22	6	55	6	67	7	50	30	40
Deterrence	7	100	5	71	8	67	3	50	5	56	9	82	6	67	11	79	54	72
Royalties	1	14	1	14	4	33			1	11	4	36	1	11	2	14	14	19
Defending			1	14	3	25	2	33	3	33	3	28	2	22			14	19

Table 83. Broad IP application objectives of manufacturing companies.

8.13 Licensing organisations - 5.5

Survey objectives: Establish frequency of occurrence of a specialised licensing function, South African industrial companies' own view of their technology trading prowess, methods used to identify potential licensees, departments or functions involved in the licensing process including evaluation, agreement negotiation, agreement compilation, contract administration and how licensees are approached. Characteristics surveyed appear in questions 47, 48, 120 and 420 to 441 in Annexure A.

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Table 84 shows that 31% of respondents report no licensing activity at all while 23% consider the functioning thereof as "poorly". This compares with 35%, not the same companies, that had no licences as such to report. (See also prior discussion of this attribute at Table 45, p130.) Licensing is not recognized within the accounting system in 45% of cases and only in 17% as profit centre. Of the 13 companies forming the 17% two had no licences at all at the time of the survey and three had only out-licences.

At 89% of respondents no specific Head of licensing exists. It appears to be general practice

that this function is assigned to a functionary who has other main responsibilities, such as even the CEO. This practice probably is mainly a result of low licensing activity in general and the broad variety of specialist functions that get involved with licensing. (Table 86 below.)

Attribute	Company view of attribute					Total
Technology licensing and selling is run	Excellently	Well	Adequately	Poorly	Not	
Number of companies	3	10	23	18	24	78
%	4	13	29	23	31	100
Licensing is seen as a	Cost centre	Service centre	Profit centre	None		
Number of companies	22	7	13	35		77
%	29	9	17	45		100
Head of Licensing reports to (N = 81)	CEO/COO/ GM/MD	Technical/ Technology Director	Technical/ Technology Manager	Division Manager	R&D Manager	No Head
Number of companies	4	2	1	1	1	72
%	5	2	1	1	1	89

Table 84. Positioning of licensing function.

Table 85 shows responses to the request to rank on a scale between 0 and 9 the value assigned to some methods to identify possible licencees, offered at random in the questionnaire. Clearly respondents claim to know their industry and that most leads are identified along this route. The question can of course be raised whether the knowledge is indeed as strong as seemingly claimed, considering also the scarcity of licences to and from *e.g.* Eurasia. Using brokers seems not to be favoured and this aspect could be investigated to establish whether increased usage may not lead to more out-licensing by manufacturing companies.

Method/place	Companies' rating	Rating between 0 and 9	
		Minimum	Maximum
We know industry	5,55	0	9
Word of mouth	3,60	0	8
Shows/fairs	3,58	0	9
Desk search	2,65	0	9
Broker/agent	2,10	0	9
Total number of companies	40		

Table 85. Profile of methods used to identify possible licensees.

Table 86 shows the results of again requesting rating on the scale from 0 to 9 of randomly offered business functions and departments considered to be involved in licensing. Note that it would be advisable to bear in mind that the set of questions may well have appeared daunting to the respondents and that some may not have distinguished fittingly between in- and out-licensing.

Department or function	Evaluation of subject technology		Negotiation		Agreement (contract compilation)		Contract administration	
Licence direction	In	Out	In	Out	In	Out	In	Out
	Each column shows the rating on the left and the ranking on the right							
Legal	2,65 6	2,91 6	4,19 4	4,24 3	6,52 2	7,06 1	2,28 5	3,14 4
Research	5,57 4	6,15 3	3,29 5	3,45 5	2,56 7	2,83 7	1,58 8	1,04 9
Licensing	1,24 9	1,28 9	1,92 8	1,96 9	2,08 8	2,04 8	1,64 7	2,52 5
Accounting	1,77 7	1,61 8	2,76 6	2,03 7	4,19 4	3,39 5	6,83 1	5,59 1
Sales/marketing	5,65 3	4,64 4	5,31 2	4,63 2	4,26 3	4,00 3	3,22 3	3,52 3
Technical/engineering	7,67 1	6,34 2	5,02 3	4,10 4	4,12 5	3,65 4	2,38 4	2,44 6
Manufacturing	5,04 5	3,94 5	2,73 7	2,00 8	2,03 9	1,52 9	2,05 6	1,88 7
Top management	7,36 2	7,18 1	7,74 1	7,39 1	7,42 1	6,94 2	4,02 2	4,00 2
Outside counsel	1,61 8	1,65 7	1,77 9	2,07 6	3,27 6	3,38 6	1,29 9	1,19 8
Broker/agent	0,67 0	0,90 10	0,51 10	0,68 10	0,35 10	0,69 10	0,22 10	0,56 10

N varied between 25 and 47.

Table 86. Extent of involvement of various departments or functions in licensing process.

An outstanding feature is the involvement of top management throughout the process. This could be signifying the attendance of the 'decision maker' in most activities rather than a working involvement. It could also for the set of respondents be due to their smaller size and less intense licensing activity which renders a specialised licensing function uneconomic. (20% have fewer than 50 and 51% have fewer than 249 employees.)

The technological functions are duly involved during evaluation and negotiation and their seemingly much reduced involvement during contract administration could be because respondents were thinking of paper work rather than transfer of know-how when responding to the question. It appears that legal involvement may well be of the nature of writing up what

had been agreed rather than making agreements which indicates that operational management is retaining the lead in the licensing process.

Table 87 shows a rough approximation of the relative involvement of the various departments or functions in licensing. These results were generated by adding the ranking numbers in Table 86 for each function or department across all four phases and expressing the totals relative to that of the top ranked one.

Department or function	SA manufacturing companies across all phases		Worldwide survey Table 31, p84
Licence direction	Both		Both
	Rating	Relative weight	Respondents reporting use %
Top management	1	100	Not available
Sales/marketing	2	52	50
Legal	3	44	70
Technical/engineering	4	41	55
Accounting	5	31	38
Research	6	25	60
Manufacturing	7	21	29
Outside counsel	8	20	Not available
Licensing	9	19	59
Broker/agent	10	15	Not available

Table 87. Comparison in principle of South African and worldwide use of functions.

The results can be compared to a limited extent with prior reported research which did not use the same functions. "Worldwide" results which came from generally larger respondents show relatively more use of the legal, research and technical/engineering functions; and a licensing function. This could be mostly a function of size.

Table 88 indicates that licencees are mostly approached in a personal manner and that they are studied beforehand. Selective mailshots are used to some extent. A mass approach is not favoured. These results are congruent with the claim 'we know industry' in Table 85, p171. Brokers are again least used.

Method of approach	In-licensing		Out-licensing	
	Rating	Rank	Rating	Rank
In person by visit	7,55	1	7,53	1
Target invited to visit licensor	4,69	2	5,23	2
Following study of target	4,49	3	4,12	3

Selective mail	1,04	4	1,39	5
Via broker	0,80	5	1,47	4
General mailshot	0,07	6	0,03	6
IP assigned to broker	0,05	7	0,03	6

N varied between 33 and 47.

Table 88. Methods of approaching potential licensees.

8.14 Reasons for licensing or not – 4.3

Survey objectives: Profile South African industrial companies' reasons for licensing and not licensing, inwards and outwards. Characteristics surveyed appear in questions 107, 230 to 245 and 401 to 407 in Annexure A.

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From Table 89 it can be concluded that in-licensing is driven by the need to obtain and hold market share through access to future and innovative technology. This focus seems satisfactory. Skills acquisition as such is not a priority but this does not mean that learning is precluded and the results are congruent with those reported in 8.9, p157 : Learning.

Out-licensing is driven by the need to secure and expand market share also through substituting direct sales. Arguably there is a tendency to attempt to do this through licensing spin-off technology rather than core technology. Given this situation it would have been interesting to have established also the ranking of licensing for royalty and the like income *per se* in contrast to substitution of sales. Setting of standards and complying with patent working requirements are not very important.

It may be interesting to attempt to research the degree to which these reasons are intertwined, if at all, with the deployment strategies. Refer 8.12, p168.

Reason	In-licensing		Out-licensing	
	Rating	Rank	Rating	Rank
Competitive advantage	6,72	1	5,68	3
Strategic reasons	6,70	2	6,64	1
Access to future technology	6,64	3	3,70	9
Market entry	6,09	4	5,78	2
More innovative technology	5,78	5		
Obtain cost advantage	5,17	6		
Reduce risk	5,06	7	4,05	7
Skills acquisition	4,91	8		
Diversification advantage	4,74	9		
Spin-off technology			4,53	4
Substitute direct sales			4,34	5

Regional differences			2,85	11
To set industry standards			3,58	10
To settle/prevent infringement	2,65	10	3,82	8
Response to competitors			4,15	6
Comply with patent working requirements			2,79	12

N varied between 38 and 49.

Table 89. Reasons for licensing inwards or outwards.

From Table 90 an inhibiting factor in licensing generally appears to be fear of revealing own know-how and losing control. This is perhaps overrated and the focus should maybe be on co-operation under controlled conditions – a constructive challenge. The phenomenon could be a function of relative smallness against what are perceived as or are multi-national giants.

The relatively high rating afforded the fear of revealing own know-how in out-licensing may raise questions regarding the perceived value of and enforceability of statutory protection; and a possibly fallacious overvaluation of local know-how.

The insights of Teece and Kim (3.2, p28) are pertinent. Kim's warning that technology transfer cannot be stopped and his paradigms of strategies for suppliers and recipients of technology should be heeded. A more systematic integration of these and market entry and retention strategies such as set out by Roberts and Berry (Fig. 11, p54) and factors affecting technology acquisition and disposition in perhaps the manner Ford suggests in Figures 9 and 10 (p52) may well lead to new insights for manufacturing companies and perhaps lead to the identification of opportunities for cooperation partly based on intellectual property being deployed as active assets.

There seems to be awareness that a licensee could be building a licensor's trademark to the licensee's detriment.

Objection	In-licensing		Out-licensing	
	Rating	Rank	Rating	Rank
Reveal own know-how	4,83	1	6,26	1
Dilute market			3,92	3
Lose close control	4,11	2	4,97	2
Debilitate or subjugate own R&D	3,80	3	3,56	4
Build licensor's trade mark	3,15	4		
Administrative burden	2,37	5	2,73	5
Excessive grant-back required	2,32	6		

N varied between 37 and 47.

Table 90. Objections to licensing inwards or outwards.

8.15 Content of and added value in licences - 5.2.2

Survey objectives: Establish technology or IP content of licences, bases on which royalties are calculated, royalty and payment types used, relative influence of licence terms and conditions on remuneration rates, desirability of restrictions, relative importance of some licence terms and conditions, impact of licences. Characteristics surveyed appear in questions 301 to 321, 328 to 336, 337 to 342, 343 to 348, 349 to 352, 408 to 416 and 417 to 419 in Annexure A.

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Table 91, again rating randomly presented aspects on a scale between 0 and 9, points to confirmation of the generally held view that purchased technology can be more advantageous to fast and cheaper market access than going it alone. In out-licensing the accent shifts somewhat to newness and patent strength pointing to the perceived out-licensing requirement to offer the latest and best. In both cases exclusivity is important as it is in the cases of the Japanese and USA surveys (Tables 16 and 17, p73).

Somewhat surprisingly trademarks and grant backs do not seem to play any significant role.

Note: The four transfer cost items which appear separated in Table 91 were presented in a bundle in the questionnaire.

Factor	In-licensing		Out-licensing	
	Rating	Rank	Rating	Rank
R&D expenditure	5,61	1	5,35	3
Age/maturity of technology	5,58	2	6,15	1
Exclusivity	5,45	3	6,12	2
Transfer cost – technical	5,19	4	4,69	8
Assistance offered	5,06	5	5,06	4
Industry norms	4,98	6	4,86	7
Licensee's market size	4,73	7	4,91	6
Patent strength	4,32	8	4,94	5
Technical assistance fees	4,10	9	3,97	13
Cost of lost opportunity	4,02	10	3,42	16
Transfer cost – marketing	3,92	11	4,64	10

Patent life remaining	3,83	12	4,67	9
Risk	3,79	13	3,82	14
Trade mark	3,67	14	4,39	11
Transfer cost – training	3,43	15	4,09	12
Lump sums	3,20	16	3,16	18
Characteristics of licensee nation	3,07	17	3,45	15
Transfer cost – legal	2,52	18	3,38	17
Grant backs	2,02	19	2,31	19
Take what is available	1,77	20	1,93	20

N varied between 28 and 52.

Table 91. Some factors influencing the magnitude of royalties.

From Table 92 no significant differences exist between in- and out-licences regarding the frequency with which restrictions are sought. Territory and quality seem paramount.

Restriction	In-licensing		Out-licensing		39 USA firms 1977 (Table 18, p74)	
	Rating	Rank	Rating	Rank	%	Rank
Territorial	6,28	1	6,56	1	82,4	1
Quality control on finished goods	5,05	2	5,90	2	55,9	3
Quality controls on materials	4,48	3	4,77	4	29,4	4
Prohibition on handling competitors' products	3,79	4	4,84	3	23,5	5a
Export quantity	2,81	5	3,40	6	14,7	6
Export price	2,81	6	4,23	5	5,9	8
Tied supply	1,88	7	2,10	8	11,8	7
Export through designated agent	1,61	8	2,81	7	23,5	5b
Grant backs	1,03	9	1,52	9	70,6	2

N varied between 27 and 46.

Table 92. Frequency with which restrictions are sought.

The relatively high frequency of prohibiting the handling of competitors' products in the case of out-licensing is surprising. It seems that South African manufacturing companies as licensors are trying harder to coerce licensees to handle only their licensed products. Further research may yield interesting insights. The importance with which grant backs are viewed by the USA firms may indicate a greater awareness of and perhaps position of strength from which to capture relevant technology in order to strengthen the licensor's position even more. The less importance South African manufacturing companies place on this may be related to the relative absence of cross-licensing and cooperative development.

The result in Table 93 that sales and not net sales is the base on which royalties are calculated is surprising at first glance and could be alarming. Arguably this result could be because the respondents did not think clearly about the difference. If so, the results would correspond with

the Japanese and world results. Yet sales is also frequently reported by the Japanese and world. As could be expected profit is much less used. Other methods reported refer to mixtures of the options offered.

Base	In-licensing		Out-licensing		Japan Table 10 5.2.2, p70	World Table 11 5.2.2, p71
	Rating	Rank	Rating	Rank	Weight %	% reports
Sales %	5,83	1	6,17	1	25,2	21
Per unit	4,22	2	4,46	2		26
Net sales %	3,00	3	4,18	3	69,4	39
Profit %	1,94	4	2,21	5	5,4	17
Period amounts	1,67	5	2,46	4		16
Other	0,18		0,61			

N varied between between 28 and 43.

Table 93. Base on which royalty is calculated.

Table 94 confirms that know-how is most important in a licence, by a considerable margin. It occurs most frequently. Trademarks seem to occur very seldom.

Content	In-licensing		Out-licensing	
	Rating	Rank	Rating	Rank
Know-how only	5,60	1	5,27	1
Know-how plus patent	3,76	2	4,07	2
Patent only	3,29	3	3,36	4
Know-how plus trade mark	2,13	4	3,45	3
Know-how plus patent plus trade mark	1,86	5	2,32	6
Patent plus trade mark	1,48	6	2,93	5

N varied between 28 and 47.

Table 94. IP content of licences.

Table 95 points clearly to running royalties as the preferred payment type, followed by the combination up front lump sum plus running royalties. Minimum royalties are gratifyingly scarce in in-licensing but rather more important in out-licensing. The moderation by the Department of Trade and Industry of in-licences may well have what can be seen as a beneficial influence (6.4.2, p92). Comparison with the prior studies requires care because definitions of categories vary with options offered to respondents. It can be speculated that South African manufacturing companies and Japanese companies seek reassurance through up front lump sums or minimum royalties in roughly the same proportion. The same applies

to the world results if up front fees are seen as approximating lump sum payment.

Payment type	In-licensing		Out-licensing		Japan Table 12 5.2.2, p71	World Table 13 5.2.2, p71
	Rating	Rank	Rating	Rank	Weight %	% reports
Running royalty	6,59	1	5,90	1		28
Lump sum plus running royalty	3,63	2	3,79	2		
Up front lump sum	2,13	3	3,47	3	66,9	22
Minimum royalties or payments	1,98	4	3,21	4	32,4	25
Up front fees						32
Mixture of methods						41

N varied between 29 and 49.

Table 95. Frequency of occurrence of payment types.

Table 96 lists some contingent factors in licensing that are usually addressed in agreements. Ratings are rather flat across these. Nevertheless, as licensees South African manufacturing companies are clearly concerned about service to be provided by licensors, confidentiality and access to improvements, echoing their prior expressed need for access to know-how and fear of loss of information. As licensors these companies again stress confidentiality and improvements. A concern about enforcement of rights is also evident from the relative ranking of governing law, enforcement and termination. For the world, governing law seems important along with accounting (and reporting) and confidentiality. It would be prudent to point out here how easily understanding of these attributes can vary. The question in the questionnaire (Annexure A) was "What is the relative importance of the following factors to you in licensing?" Regarding accounting for instance, a high rating would be possible because of its pervading presence; or a low rating because it may be considered routine.

Contingent factor in licensing	In-licensing		Out-licensing		World Table 17 (Extract) 5.2.2, p73
	Rating	Rank	Rating	Rank	% reports
Provision of service	6,54	1	4,86	6	
Confidentiality	6,40	2	7,42	1	90
Provisions regarding improvements	6,04	3	5,86	2	75
Termination	6,00	4	5,29	5	
Infringement/enforcement	5,33	5	5,64	3	78

Governing law	5,16	6	5,40	4	93
Dispute resolution	4,78	7	4,56	7	84
Non-contest clause	4,02	8	4,42	8	20
Accounting	3,70	9	3,79	9	92

N varied between 31 and 47.

Table 96. Importance of contingent factors in licensing.

From Table 97 it transpires as expected that licensed technology mostly represents minor improvements and seldom revolutionary improvements.

Impact of licensed technology	In-licensing		Out-licensing	
	Rating	Rank	Rating	Rank
Minor improvement	5,61	1	4,00	1
Major improvement	4,88	2	5,41	2
Revolutionary	2,33	3	3,41	3

N varied between 29 and 44.

Table 97. Impact of licensed technology.

8.16 Valuation of licensed technology - 5.4

Survey objectives: Establish methods used to calculate royalties, maturity or obsolescence discounts and the relative values placed on patents, trade marks and know-how. Characteristics surveyed appear as questions 322 to 327, 353 to 356 and 442 to 444 in Annexure A.

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As Table 98 shows income based royalty calculation is most used by a wide margin. Calculations to determine current value from future values are not important, as Contractor also found (5.4, p80). The 25% rule is seldom used.

Method	In-licensing		Out-licensing	
	Rating	Rank	Rating	Rank
Income based	7,73	1	7,23	1
Mixture	1,78	2	2,54	2
Other	1,43	3	1,76	4
Discounted cash flow	1,29	4	2,07	3
25% rule	0,88	5	1,24	5
Asset based	0,80	6	1,18	6

N varied between 28 and 30.

Table 98. Methods used to calculate royalties.

According to Table 99 technology at the laboratory stage is virtually valueless in licensing compared to fully developed technology. The higher assessment of the latter is perhaps consistent with the search for know-how and the stress on proper technology transfer. "World" values from Table 22, p78 seem to decrease more gradually. This differential may be a pointer to technology colonies.

Technology maturity stage (maximum 9 arbitrarily set)	In-licensing		Out-licensing		World Table 22 5.3, p77
	Rating	Rank	Rating	Rank	Relative rate
Fully developed	9,00	1	9,00	1	10,0
Pilot/prototype	2,41	2	2,85	2	8,0
Detailed design	2,03	3	2,20	3	6,5
Laboratory stage	0,48	4	0,75	4	5,0

N varied between 20 and 29.

Table 99. Influence of stage of development of technology on royalty.

Table 100 confirms the highest value of know-how.

Type of intellectual property	In-licensing	Out-licensing
	Rating	Rating
Know-how	7,46	7,33
Patent	5,15	5,69
Trade mark	3,09	3,81

N varied between 36 and 48.

Table 100. Relative value of forms of intellectual property.

8.17 Sources of technology - 5.3

Survey objectives: Establish frequency of occurrence of sources of in-licensable technology (questions 201 to 210 in Annexure A) and of technology (question 115).

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8.17.1 Sources of in-licensable technology

Table 101 shows that respondents indicated that 60% of their in-licensable technology is sourced abroad. This ratio of 1,5 is approximately confirmed by the ratio of 1,4 reported in the SAIS survey. Although this may be expected because more is available abroad, it may well also be a symptom of technology colonies. Suppliers and other companies are the main equal sources. The prominent relative role of suppliers could be the result of South Africa being regarded as a developing economy in many respects and could confirm its dependence and its distribution rather than originating role. It is interesting that local and foreign researchers/laboratories serve equally as sources. Inventors abroad are a negligible source as opposed to domestically where inventors rank almost on a par with the marginally main sources suppliers and customers.

Some use of foreign patent literature is evident but this could be improved dramatically. Local patent literature plays almost no role and this could perhaps be taken as a sign that it is not highly regarded, perhaps because South Africa does not have official substantive examination.

Source of licensable technology	Domestic		Foreign		Total	
	Mean %	Rank	Mean %	Rank	Mean %	Rank
Customers	8,96	1	5,56	4	14,00	3
Suppliers	8,32	2	20,21	1	27,49	1
Inventors	7,60	3	1,36	6	8,64	5
Researchers/laboratories	6,51	4	6,17	3	12,22	4
Other companies	6,00	5	20,13	2	25,18	2
Government agencies/laboratories	1,66	6	0,42	9	2,00	8
Friends/acquaintances	1,13	7	1,17	7	2,22	7
Patent literature	0,32	8	3,98	5	4,15	6
Broker/agent assisted	0,02	9	0,47	8	0,47	9
Total of all above (%)	40,52		59,47		100	

N = 53

Table 101. Proportion of in-licensable technology obtained from indicated sources.

8.17.2 Sources of technology in general

Table 102 indicates that a somewhat surprising 29% of respondents use only single sources of technology. Internal research and development and own innovation occur most frequently at

13% and 10% of respondents with the first most used by metal products and machinery and the latter most used by heavy engineering. The latter could be viewed as consistent with the nature of jobbing shops.

Industry sector	Automotive components	Building materials & components	Chemicals incl. paper & textiles	Electrical, light	Heavy engineering	Food & healthcare	ICT & electronics	Metal products & machinery	All
Source	%								
Internal R&D=1	20				18	20	11	23	13
Contract out=2		17							1
License in=3	10	17	8		9			8	5
Own innovation=4	10	17	8		27		11	8	10
None				17					1
1, 2	10				9	10	11	8	6
1, 3		17	8						3
1, 4			23	50		20	11	23	16
2, 3	10								1
2, 4	10							8	3
3, 4					9	10			3
1, 2, 3	10								1
1, 2, 4	10			33	9	20	11	8	10
1, 3, 4	10	17	31			10	33	15	16
2, 3, 4					9				1
1, 2, 3, 4	10	17	23		9	10	11		10
Total reports	10	6	13	6	11	10	9	13	78
Companies in sector	10	7	13	6	11	11	9	14	81

Note: More detail in Annexure C.

Table 102. Company sources of technology.

Internal research and development plus own innovation and these two in conjunction with in-licensing are most used as combinations, by 15% of respondents. The two are most popular in electrical, light at 50% and the three in ICT & electronics at 33%.

Only 10% reported using all four sources. One reported no source. It is smallish and started operating fairly recently using what could almost be viewed as a turn-key package to produce

its products. It has been deploying the manufacturing technology to closely allied but differently designed products and has probably not been confronted yet with a need to seek really new technology. It has certainly been innovating upon its existing technology and in this sense at least its rating of itself should be faulted.

As expected, contracting out is not viewed as a technology source.

Table 103 shows that internal research and development at 74% and innovation at 68% of respondents are most frequently reported. ICT and electronics and chemicals including paper are the leaders. Contracting out is least popular but heavily used by the automotive sector.

While two of the six electrical, light sector companies reported one in-licence each they do not report in-licensing as source at all and report relying on internal research and development and own innovation.

Industry sector	Automotive components	Building materials & components	Chemicals incl. paper & textiles	Electrical, light	Heavy engineering	Food & healthcare	ICT & electronics	Metal products & machinery	All
Companies per sector and total using any one source (% of N=78):									
Internal R&D	70	50	85	83	45	90	89	76	74
Contract out	60	33	23	33	36	30	33	23	35
License in	40	67	82	-	36	40	44	23	40
Own innovation	50	50	85	83	64	70	78	62	68
Total reports	10	6	13	6	11	10	9	13	78
Companies in sector	10	7	13	6	11	11	9	14	81

Note: Detail in Annexure C.

Table 103. Frequency of use of technology sources.

From Table 104 it can be argued that companies indicating in-licensing as source of technology do tend to in-license while own innovation play an important role in stimulating in-licensing activity.

Source reported	N	In-licences			
		Companies		Licences	
	Σ=78	N	%	N	N/co
3, 4	2	2	100	15	7,5
2, 3, 4	1	1	100	4	4,0
1, 2, 3	1	1	100	2	2,0
2, 3	1	1	100	1	1,0
1, 3, 4	12	11	92	65	5,9
License in = 3	4	3	75	15	5,0
1, 2, 3, 4	8	6	75	22	3,7
2, 4	2	1	59	1	1,0
Internal R&D = 1	10	5	50	16	3,2
1, 3	2	1	50	1	1,0
Contract out = 2	1				
Own innovation = 4	8	3	38	10	3,3
1, 2, 4	8	3	38	8	2,7
1, 2	5				
1, 4	12	4	33	8	2,0

Table 104. Technology source and in-licensing activity.

Table 105 may point to internal research and development and own innovation stimulating out-licensing.

From both Tables 104 and 105 it seems that use of more than one source of technology stimulates licensing activity among manufacturing companies.

Source reported	N	Out-licences	
		Companies	Licences

	Σ=78	N	%	N	N/co.
1, 2, 3, 4	8	4	50	29	7,3
3, 4	2	1	50	2	2,0
1, 3, 4	12	5	42	21	4,2
1, 2	5	2	40	3	1,5
1, 2, 4	8	3	38	29	9,7
License in = 3	4	1	25	2	2,0
Own innovation = 4	8	2	25	4	2,0
Internal R&D = 1	10	2	20	2	1,0
1, 4	12	2	17	6	3,0
2, 3	1				
1, 2, 3	1				
2, 3, 4	1				
2, 4	2				
1, 3	2				
Contract out = 2	1				

Table 105. Technology source and out-licensing activity.

8.18 Use of information and licensing - 6.6

Survey objectives: Establish intensity of use of information sources by South African manufacturing companies. Sources investigated appear in questions 131 to 148 in Annexure A.

Notional postulate: Increasing intensity of use of information sources will lead to increasing licensing activity.

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Table 106 indicates that journals, papers and professional literature are the major sources of information for the respondents. Customers, related companies, suppliers and visits to fairs and information seeking visits abroad are also fairly prominent. South African universities are not neglected.

Information source	Frequency of rating reported					Total	C
	Extensive	Often	Sporadic	Seldom	Never		
Use of one or more gatekeeper	3	25	18	8	12	66	0,64

%	5	38	27	12	18	100	
Use of journals/papers	12	36	19	8	4	79	0,63
%	15	46	24	10	5	100	
Use of professional literature	21	36	16	4	3	80	0,71
%	26	45	20	5	4	100	
Use of libraries	12	16	22	19	9	78	0,78
%	15	21	28	24	12	100	
Use of RSA patent specifications	3	14	22	23	17	79	0,68
%	4	18	28	29	22	100	
Use of foreign patent specifications	3	18	15	24	20	80	0,67
%	4	23	19	30	25	100	
Visits to RSA fairs, exhibitions	4	32	29	12	3	80	0,33
%	5	40	36	15	4	100	
Visits to foreign fairs, exhibitions	8	25	34	9	4	80	0,60
%	10	31	43	11	5	100	
Use of universities and research institutes							
In RSA	9	20	25	19	6	79	0,72
%	11	25	32	24	8	100	
In other countries	4	6	12	25	32	79	0,58
%	5	8	15	32	41	100	
Domestic information seeking visits	7	13	38	16	5	79	0,61
%	9	16	48	20	6	100	
Information seeking visits abroad	6	27	26	14	6	79	0,66
%	8	34	33	18	8	100	
Use of parent/daughter/sister company	11	22	12	10	22	77	0,33
%	14	29	16	13	29	100	
Polling customers for information	12	29	24	12	3	80	0,50
%	15	36	30	15	4	100	
Polling suppliers for information	10	26	22	14	7	79	0,58
%	13	33	28	18	9	100	
Use of new personnel	4	14	37	21	3	79	0,46
%	5	18	47	27	4	100	
Use of consultants	6	11	27	29	7	80	0,50
%	8	14	34	36	9	100	
Use of in-licences	10	12	15	24	18	79	0,34
%	13	15	19	30	23	100	
Aggregate use						α=0,87	
Number of reports	0	20	43	16	1	80	
%	0	25	54	20	1	100	
No. of in-licences	0	56	76	32	0		
Number/company	0	2,80	1,77	2,00	0	ρ=0,15	
No. of out-licences	0	25	67	7	0		
Number/company	0	1,25	1,56	0,44	0	ρ=0,16	

Table 106. Frequency of use of information sources.

Use of patent specifications seems rather low and respondents could make more use of them.

Aggregate use of information sources centres on “sporadic” at 54% with 20% “seldom” and 25% “often”.

For summary finding on notional postulate see 9.1.7, p198.