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New institutional policies for university–industry links in Japan

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Abstract

This paper reports on changes in Japan's national and private universities for promoting university–industry links (UIL). The paper is shaped by the body of literature that has observed factors that may support university 'entrepreneurialism'. This includes organizational capacity, personnel, policies, incentives and institutional background. Drawing on interview and survey fieldwork, the measures adopted following changes to the governance of the national universities in 2004 are reviewed. Through comparison with private universities it is observed that the reform has had an influential effect on the university system. The policy implications of the paper relate to broadening the range of areas for collaboration with industry, reducing the limitations for personnel transfer and skill development, and expanding the range of incentives at universities.

Keywords: University–industry links; University; Incorporation; Personnel; Organizational change

1. Introduction

This paper looks at recent changes to Japan's universities and the measures adopted to promote university–industry links (UIL). Since the early 1990s Japanese policy-makers have sought to confront economic slowdown, demographic challenges, and increased economic and technological competition from other countries, especially in other parts of Asia. Science and technology has been accorded increases in public expenditure as part of a long-term strategy to support economic growth. Similar to policy changes in other countries, Japan's universities have also been encouraged to develop closer links with industry.

In 2004, a 'radical' change (Yamamoto, 2004) was introduced through the National University Incorporation Law (2003) which granted the national universities (NUs) autonomy from government. This Law intends to promote greater organizational diversity and distinctiveness, more active and socially engaged institutions, and may also have promoted greater inter-university competition (Amano, 2004; Kiyonari, 2005). Considering the possible significance of this in line with other policies that emphasize linking university results more closely with societal needs, this paper will explore the reforms introduced by Japan's universities for UIL.

To do this, the National and Private Universities (PU) will be compared drawing on findings from the literature on entrepreneurial universities. Entrepreneurial universities are those universities that seek to innovate in how they go about their business (Clark, 1998) in order to generate funds to enable them to maintain and enhance their

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position (Shattock, 2004). Research that has investigated these organizational and cultural changes emphasize the following points: (1) organizational capacity for UIL, (2) UIL personnel, (3) UIL policy structures, (4) incentives, and (5) institutional history and background. Considering that much of the literature on university "entrepreneurialism" has so far focused on institutions in the United States or Europe, this paper will be an initial review and analysis in the Asian context.

The structure of the paper will be as follows. First, in Section 2 a review of the literature relating to university entrepreneurialism will be performed. The five points from the literature on entrepreneurial universities will be discussed in greater detail and each point linked to current debate and commentary in Japan. In Section 3 a more specific introduction to the reforms introduced to the Japanese innovation system and universities since the early 1990s will be outlined. In Section 4 the methodology and data supporting the study is presented. The main empirical body of the paper is found in Section 5. This is divided into two subsections. The first subsection addresses the types of reforms introduced over the 2003–2005 period, specifically the one year before and one year subsequent to NU incorporation. Key issues prioritized over the 2005–2010 period are then discussed. The second sub-section is a statistical analysis of the factors that may influence university UIL performance. The chief finding is that personnel issues appear to be of some importance. However, to relate this finding more closely to the institutional level, two case studies are then introduced which suggest that a broader range of factors may contribute to institutional UIL performance. In the conclusion, a summary of the findings are outlined, as well as policy suggestions and areas for future research. The weaknesses of the study are also discussed.

2. University entrepreneurialism: key points from the literature

University research plays an important role in product development (Mansfield, 1995), regional innovation (Jaffe, 1989) and industrial patents (Branstetter and Ogura, 2005). Other research suggests that UIL can enhance faculty research performance (Gulbrandsen and Smeby, 2005). Some now argue that universities complement teaching and research activities with entrepreneurial activities (Etzkowitz, 1983), leading policy-makers, university presidents and administrators to develop ambitions for economically exploiting university research (Slaughter and Leslie, 1997). In line with these developments, university level factors that may enhance UIL have become the subject of some attention. Here, research has noted the importance of UIL organizations, the skills in such organizations, the policies which structure, clarify and motivate behaviour, and the institutional background.

UIL organizations within or associated with a university can comprise licensing and technology transfer offices, strategic research offices or incubation and venture support organizations. Here, findings suggest that UIL performance may be enhanced by the number of specific UIL organizations (Clark, 1998) and the degree of decentralization that may exist (Bercovitz et al., 2001). At the personnel level, the range of skills within UIL organizations (Siegel et al., 2003; O'Shea et al., 2005), and the relationships held with faculty (Thursby and Thursby, 2003) may influence performance. However, if technology transfer skills are poor or institutional inertia has set in, then universities may be inefficient at technology transfer (Thursby and Kemp, 2002).

In the case of Japan, the institutional base for UIL has historically been inadequate (Sakakibara, 2001). However, following policy activity over the 1990s Technology Licensing Offices (TLOs) began to be established that were later complemented by other organizations such as Venture Business Laboratories, Incubation Centers, and Intellectual Property Headquarters. Some are now questioning whether this institutional basis for UIL has been too ambitious (Nishizawa and Habuki, 2006) with many TLOs facing financial difficulties through small royalty receipts and reliance on matching funds and subsidy (METI, 2005a). Furthermore, personnel capable of implementing reform initiatives have been noted to be of concern (Kobayashi and Okubo, 2004) with problems in technology transfer staff recruitment (Kitagawa, 2002) amid concerns over the training and skills of such staff (Omi, 2005).

Institutional policy for UIL can shape institutional direction and also provide transparent and unambiguous regulations for clarifying relationships (Debackere and Veugelers, 2005). One area where such institutional policy may play some role is where rewards are set out in licenses (Lach and Schankerman, 2003) or for start-ups (Link and Scott, 2005; Di Gregorio and Shane, 2003) that can motivate interest in UIL for academics (however, see Markman et al., 2004). Beyond such financial rewards, other factors can relate to recognition and acknowledgement either through prizes or as a factor in recruitment or staff appraisal. Institutional development and the philosophy that guided university establishment may also have some bearing upon later UIL activities (Feldman and Desroches, 2004) although this can be moderated at departmental levels (Kenney and Goe, 2004).

These policy and institutional issues are particularly significant in Japan where it is argued that over much of the post war period various factors undermined UIL due to student opposition (Hashimoto, 1999), inadequate research performance (Low et al., 1999) regulatory burdens (Collins and Wakoh, 2000), and uncertain rules (Sakakibara, 2001). There were also disincentives for faculty engagement in UIL, where patent applications were not important in assessing academic performance and promotion criteria (Yoshihara and Tamai, 1999) compounded by uncertainty over conflict of interest issues (Sakakibara and Ijichi, 2001).

While much research appears to suggest that institutional factors can be of importance, others have questioned the significance of institutional UIL policies. Audretsch and Lehman (2005), for instance, observed that such policies may have minimum influence to surrounding knowledge based firms. Other research suggested that much university patenting would have occurred without governmental policy intervention (Mowery et al., 2004). However, despite such arguments, policy makers have sought to draw on the US technology transfer experience (Mowery et al., 2004), with many countries now reshaping their UIL structures towards a more legalistic transfer model. Japan is one such country and from the mid 1990s various reforms were introduced that have sought to amend many of the problems outlined above. These reforms have also given rise to debate surrounding the viability of the system adopted by Japan. These issues will be discussed further in the next section.

3. Universities in Japan and innovation system reform

Japan's National Universities have been identified as a key actor in the Japanese innovation system performing most scientific and engineering work (OECD 2002). NUs are funded mostly by central government but also charge tuition fees to students. By contrast the private universities (PU) are mostly self-funded through tuition fees and donations and tend to be more active in the social sciences or humanities, with a few key outliers that are strong in science and technology activities. Yet, while the PUs have a longer history of incorporation than the NUs, PUs have traditionally been disadvantaged by having a smaller research staff and research budget (Kondo, 2006). Consequently, disciplinary orientation and research capacity has undermined PU performance in UIL, with the number of collaborative and contract cases being a tiny fraction of that in the NUs (Kondo, 2006).

At a general level however, both types of universities faced disadvantages in UIL: the NUs from regulatory, social and faculty constraints; the PUs from research capacity and disciplinary orientation. This is in contrast to the early development of universities in Japan, where the contribution to society was more explicit. For instance, following the Meiji Restoration in 1868 a key role for the universities was promoting 'the industrial development of the nation' (Commission on the History of Science and Technology Policy, 1991). As an example, in 1898 the Education Minister stated that: 'Tokyo Imperial University is a place where people study basic principles and increase their knowledge in response to the needs of the state . . . they are then supposed to apply what they have learned, diligently and sincerely, making the utility of science apparent' (Bartholomew, 1989). In the period following the end of World War II, however, the factors outlined above in Section 2 began to limit the role of universities to that of graduate supply (see Hashimoto, 1999).

The absence of clear UIL policy combined with student and faculty opposition did not however totally diminish UIL activities. In many cases, UIL merely became an informal exercise (Hicks, 1993) proceeding on the basis of a give and take relationship (Aoki and Harayama, 2003). According to some studies, analysis suggested that the scale of interaction between universities was significant. Pechter, for instance, found in his bibliometric study that there was a 'substantial' relationship (Pechter, 2001). Survey results from firms also suggested that companies frequently derived technological information from publications, symposiums, patents and informal information exchange (Goto and Nagata, 1997). Collaboration was not uniform for all types of companies however, with small and medium sized enterprises facing the greatest barriers in UIL engagement (Aoki and Harayama, 2003).

Over the 1990s, economic downturn, economic competition from other parts of Asia, population decline and the aging of society led to a combination of policy strategies, one of which was greater emphasis on science and technology. Through this, the US model of technology driven growth and the perceived roles played by US universities began to influence Japanese science and technology policy-makers. Expanded government expenditure on science and technology implemented on the basis of the Science and Technology Basic Law (1995: Law 130) was linked with various policies to develop a new UIL system (see NISTEP, 2005).

Such UIL policies have included granting tax concessions for company R&D expenditures in UIL activities; allowing university professors to become company

directors, the Technology Transfer Law (1998: Law 52) allowing the establishment of licensing offices; a Japanese version of the Bayh–Dole Law (1999), the establishment of Intellectual Property Headquarters (IPHQs) at universities (2003); amidst other initiatives such as increasing the number of university spin-offs, developing UIL specific research programmes, utilizing funds to support organizations involved in technology transfer, and human resource development (METI, 2005b; MEXT, 2005).

Against this background of reform, one of the more significant steps over recent years has been to grant the national universities corporate status. This idea had an extensive heritage that began to gain momentum over the latter half of the 1990s as policy makers sought for ways to reduce the size of the public sector, gained experience of granting autonomy to other public sector organizations (Yamamoto, 2004), and sought for ways to enhance the technological capacity of Japanese industry. In 2003 the National University Incorporation Law (Kokuritsu Daigaku Hōjinhō; Law 112) passed through Parliament with the change in status of the universities in April 2004.

Significantly for UIL, incorporation has allowed the universities to own intellectual property which has called forth strategic issues surrounding its use and exploitation. Furthermore, the Law has organizational and strategic implications. The purpose of the Law is to 'improve and develop the level of research and teaching', 'establish organizational and management facilities' (Law 112, paragraph 1) and make universities more responsive to society. The NUs will have: (1) a clearly defined philosophy and objectives through the use of publicly stated Annual and Medium Term Plans; (2) enhanced autonomy from government; (3) third-party evaluation; (4) accountability for management; (5) outsider participation in management through external audits and participation on the management board; (6) improved efficiency; and (7) improved information disclosure. Universities will also face pressures for cost rationalization with an annual reduction of 1% in the university operating grant (see Oba, 2006).

These two strands of policy activity, with the development of new policy models for UIL on the one hand, and the creation of autonomous universities that may seek to develop their own UIL strategies on the other, may have implications for how UIL will be implemented and performed. Furthermore, debate is beginning to emerge on the suitability of the system adopted vis-à-vis the earlier more informal UIL system. Some, for example, suggest that the new system may constrain interaction (Nagata, 2006); others meanwhile, suggest that open innovation and flexibility within the new structures will lead to wider and deeper linkages (Omi, 2005). While this debate is still only emerging, some research has partly supported this latter argument through noting that while the new policy model may have limited the openness of science, policies and strategies have nonetheless stimulated wider UIL interaction amongst a broader range of faculty participants (Walsh et al., 2006).

This paper will therefore take up these themes and seek to assess: (1) What types of UIL relevant reforms have been introduced following the National University Incorporation Law in reference to the five points outlined in Section 2. Furthermore: (2) to explore how universities are using UIL strategies and policies for developing links with industry. The methods and data used for the study will now be explained.

4. Methods and data

This paper is based on interview fieldwork, a survey and organizational documentation. From October 2004 to September 2005, 21 semi-structured interviews in UIL organizations affiliated with 10 universities were performed. Interviewees were vice presidents or organization directors (24%); professors or managers (57%) or associate professors/other (19%). The interviews were mostly undertaken in Japanese and of one and a half hour duration.

A questionnaire was also sent to 87 universities in August 2005. The sample frame was developed using Japan National University Association (JANU) and Japan Association of Private Colleges and Universities (SHIDAIREN) membership lists. Institutions without a UIL organization were excluded from the sample frame. Of the total 89 NUs, 66 were sent a copy of the questionnaire, with 47 respondents (including 4 former imperial universities[1]); 21 PUs were contacted with 14 respondents. The total response rate was 70.1%.

The questionnaire was addressed to the Director of each UIL organization. Later profile analysis revealed some differences however where 42% were either vice presidents or in charge of the liaison centre or similar UIL organization. 25.8% were at the deputy manager level, professor or associate professor level; 8% were either supervisors or technology coordinators; another 25% of respondents held unknown positions. Questions were either 1–5 Likert scaled or factual/descriptive questions. Respondent NUs had a mean of 1481 faculty and

[1] The former 'Imperial Universities' comprise Tokyo, Kyoto, Tōhoku, Hokkaido, Osaka, Nagoya, and Kyūshu.

7394 students; the PU respondents had a mean of 856 faculty and 13,377 students.

5. Organizational and policy reforms for UIL in Japanese universities

This Section is divided into two sections. In Section 5.1 the types of reforms introduced over 2003–2005 and the priorities for Japan's universities over 2005–2010 are outlined. In Section 5.2 a statistical analysis of the survey results using Tobit and OLS is performed.

5.1. Organizational and policy reform 2003–2005 and priorities 2005–2010

The period surrounding 2003–2005 covers the one-year prior to the introduction of the Incorporation Law, and one year subsequent to the Law. As will be seen below, significant organizational and policy reforms were introduced during this period and were formulated through internal university reviews, study tours and governmentally sponsored working group reviews (see Cabinet Office, 2004). These activities shaped university responses to the Incorporation Law.

It was noted above that the literature suggests that the organizational basis for UIL can be a key factor shaping institutional behaviour. Prior to the Incorporation Law, Japanese universities had accumulated a number of UIL organizations that included licensing offices, venture laboratories, or incubation centres, amongst other types of organization. According to the survey responses (Table 1), over the 2003–2005 period one of the main types of reforms was the unification of different UIL organizations into one body (NU: 72.72% ($n=32$); PU: 64.3% ($n=9$)) through establishing one organization where various types of UIL actions, such as licensing, contract or collaborative research, or spin-outs could be performed.

Relatedly, the introduction of Intellectual property headquarters (IPHQs), which began to be established from 2003, are intended to promote UIL through strategic planning of intellectual property issues, collecting data and identifying necessary adjustments in regulations more specific to the university. A significant number have been introduced (NU: 61.3% ($n=43$); PU 50.0% ($n=7$)) and are to become the main actors to manage or set direction for other UIL organizations. However, as the TLOs began to be established from 1998 and had already begun to build relationships with universities, the IPHQs have added greater complexity to inter-organizational relations (Sumikura, 2006) especially with regard to the TLOs (Kneller, 2004). This

Table 1
Policy and organizational reforms over the 2003–2005 period

	Intellectual property policy	UIL strategy	Intellectual property ownership rules	Intellectual property headquarters	Technology licensing office	Collaborative research system	Conflict of interest policy	Training for administrative staff	UIL committee	One UIL organization
National university ($N=47$)										
Number	44	26	43	38	11	32	30	18	33	32
%	93.6	55.3	91.5	80.9	23.4	68.1	63.8	38.3	70.2	68.1
Private university ($N=14$)										
Number	7	5	8	7	1	8	4	4	8	9
%	50.0	35.7	57.1	50.0	7.1	57.1	28.6	28.6	57.1	64.3
Total										
Number	51	31	51	45	12	40	34	22	41	41
%	83.6	50.8	83.6	73.8	19.7	65.6	55.7	36.1	67.2	67.2

Source: Survey results.

has required strong management to ensure a harmonious relationship (Sumikura, 2006).

At the decision making level, special committees to deliberate upon UIL have also been established (NU: 53.2% ($n = 33$); PU: 57.1% ($n = 8$)). Interviewees suggested that these committees played a key role in setting and determining the outlines of UIL structures after incorporation and typically comprise the University Vice President, Director of the licensing office, and key members of faculty.

Policies and strategies can play an important role in structuring organizational behaviour and clarifying interaction but were previously largely absent in the Japanese case. Over the 2003–2005 period, however, a codification of UIL interaction has occurred. Intellectual property policies, which 93.6% of the NU sample ($n = 44$) and 50% of the PU sample ($n = 7$) have introduced can include provisions for the ownership of intellectual property, the role and function of the invention evaluation committee, and other matters such as the distribution of income for the use of patent rights, copyright and the means by which the university will market and transfer rights to industry. Such policies can also include provisions over conflict of interest, where concern over the distribution and use of time or the ownership of company equities has traditionally been cited (see Sakakibara and Ijichi, 2001; Tokushima, 2006). Separate from IP policies, some universities have also developed their own conflict of interest guidelines to provide clarity (NU: 63.8% ($n = 30$); PU: 28.6% ($n = 4$)); and in some cases have supported these policies by appointing specialist advisors.

By contrast with IP policies, UIL strategies have been less common. These have been introduced by 55.3% of the NU sample ($n = 26$) and 35.7% of the PU sample ($n = 5$). These are of a more strategic nature than intellectual property policies, setting out the main objectives or areas of priority such as collaborative and contract research, the relationship between different UIL organizations (for instance, Kyoto University) or merely set out a list of principles and objectives (for instance, Tōhoku University).

It was observed above that much commentary in Japan notes issues surrounding personnel involved in UIL. The survey results suggest that only a few universities engaged in the training of their administrative or managerial staff (NU: 38.3% ($n = 18$); PU: 28.6% ($n = 8$)), yet the scale of this issue was apparent from the interviews. One interviewee commented that 'In the case of the Japanese university they are good at research but not good at university administration. Japanese university managers are not professionals'. Furthermore, as another interviewee observed: 'The administrative staff were not trained enough to make the rules. They are very good at interpreting the rules. Different abilities are necessary for the staff but we do not have any training courses for that sort of thing'.

One means of acquiring such capacity would be through recruiting external experts which is one of the objectives of the Incorporation Law. However, many of these staff are often on short-term contracts that can be of constraint to the universities. Salary levels are perceived to be of some hindrance and there are also other factors that relate to transferability of pension funds. Furthermore, at some institutions, adaptation to university environments, especially at managerial and decision making levels, was presenting some difficulties for those with external experience.

Such comments are supported by the survey results which, by reference to Table 2, suggest that personnel issues have been a significant issue confronting the universities over the incorporation period (NU: Rank 1; PU: Rank 1). A further issue is felt to be a relative lack of interest on the part of academic faculty, particularly in the NU sample (NU: Rank 2; PU: Rank: 4) and issues relating to adequate incentives and recognition may be of relevance here. For instance, from Table 3 it is apparent that the importance placed on the introduction of incentives (NU: Rank 8) is somewhat lower than that accorded in the PUs (Rank 3).

Table 2
Current Issues confronting the universities (2005)

	NU rank ($n = 47$)	PU rank ($n = 14$)	Total mean	S.E.
UIL staffing issues	1	1	4.19	0.90
University faculty not sufficiently interested	2	4	3.22	1.01
Difficult UIL procedures	3	7	2.92	0.91
Insufficient demand from industry	4	6	3.00	0.88
No problems	5	5	2.90	1.20
Insufficient research results	6	2	3.00	0.96
Organizational culture incompatible for UIL	7	3	2.82	1.13

Source: Survey results.

Table 3
Anticipated reforms over the 2005–2010 period

	NU rank ($n=47$)	PU rank ($n=14$)	Total mean	S.E.
New sources of income from industry	1	2	4.19	0.55
Training for administrative staff	2	1	4.19	0.55
One university–industry link organization	3	8	3.90	0.62
Intellectual property policy	4	5	3.77	1.03
Collaborative research system	5	7	3.86	0.89
University–industry link strategy	6	7	3.73	0.68
Conflict of interest guidelines	7	4	3.84	0.65
Incentive system	8	3	3.79	0.48
Intellectual property headquarters	9	9	3.59	1.76
Intellectual property ownership rules	10	6	3.56	1.06
Technology licensing office	11	10	3.24	1.76

Source: Survey results.

Interviewee and other data suggested that few incentives had been developed outside of licensing agreements and survey results suggested that few institutions have yet developed systems for equity in spin-out formation (see Feldman et al., 2002) or the provision of sabbatical opportunities for those seeking to develop UIL projects. While the use of such rewards was recognized by interviewees, some noted the problems associated with their implementation. For instance, where conflict with the Board of Directors arose or where faculty members in departments less active in UIL were hostile to evaluating staff by their ability to generate external finance.

Most attention over the 2005–2010 period will be focused towards the issue of personnel. Many independent administrative institutions granted autonomy from government from 2001 have already begun tackling such issues and there are also an increasing range of organizations involved in professional training courses for UIL staff (see Woolgar, 2006). While such issues gain prominence, one of the main activities will be towards consolidating reforms undertaken and seeking to make such ventures profitable.

5.2. Statistical analysis of survey results

The literature review in Section 2 suggested five factors that may influence UIL performance. To recap: organizational capacity, personnel, policy structures, incentives and institutional history and background. Using data from the questionnaire as proxies for these factors, this section will analyze five variables against two dependent variables using Tobit and ordinary least squares (OLS) analysis. The two dependent variables are the mean income from industry over a three year period as indicated by questionnaire respondents (*Mn3yr*) using Tobit analysis, and a measure of the rate of change in this income from 2002 to 2005 (*IncomeChange*) using OLS.

The five independent variables consist of the following. The first independent variable concerns problems with the UIL system within the university (*UISystemProb*). Where problems with the UIL system may exist, then a negative relationship on industrial funding may exist. A second independent variable relates to problems regarding UIL relevant personnel (*UIStaffProb*). Considering the significance of this factor thus far from the literature review, survey and interview results, it would be anticipated that personnel problems would also have a negative relationship with income.

Thirdly, UIL organization staff suggested that faculty enthusiasm for engagement with industry was limited. The third variable therefore is a measure of perceptions of institutional culture towards UIL activity (*LackUICulture*). Fourthly, to assess whether managers and administrators felt there was a lack of results for exploitation with industry, an additional variable, *LackResults*, was included. Where there are insufficient technologies or ideas for exploitation, a negative relationship with income may exist. *InventorProp* refers to incentive measures by reference to percentage proportions set out in licensing agreements for inventors. Similar to studies performed in the US, it would be expected that *InventorProp* would hold a positive relationship with income from industry.

The results of the analysis are presented in Table 4.

Consistent with findings in earlier sections, UIL staffing issues appear to hold a negative relationship with university finance. This is statistically significant at the 1% level ($T=-2.96$; $P<0.01\%$). The proportion of licensing income is positive ($T=2.07$) and statistically significant at the 5% level ($P<0.05\%$). Of further interest is the result for Lack of Results (*LackResults*).

Table 4
Analysis of different factors on mean income over three years and income change over three years

Independent variables	Tobit model			OLS model		
	Dependent variable: *Mn3yr*			Dependent variable: income change		
	Coefficient	S.E.	*t*	Coefficient	S.E.	*t*
UISystemProb	0.7511	0.62	1.20	−8.99	11.2	−0.80
UIStaffProb	−1.65***	0.54	−2.96	−12.91	10.3	−1.25
LackUICult	−0.842	0.57	−1.47	8.10	9.5	0.85
InventorProp	0.071**	0.03	2.07	1.02	0.76	1.34
LackResults	1.20*	0.61	1.98	13.9	10.5	1.33
_cons	2.35	3.2	0.71	−22.1	62.3	−0.35
LR chi^2 (5)	14.59			F (5, 20)	1.83	
Prob > chi^2	0.01			Prob > F	0.15	
Pseudo R^2	0.11			R^2	0.31	
Number of observations: 27				Number of observations: 26		

* Statistically significant at 10% ($P < 0.10\%$).
** Statistically significant at 5% ($P < 0.05\%$).
*** Statistically significant at 1% ($P < 0.01\%$).

This is positive and statistically significant at the 10% level ($T = 1.98$; $P < 0.1\%$) and could reflect differences in perception between managers and supervisors in UIL organizations and faculty. With regard to the OLS model, the R^2 and F-test suggest that other factors may have more significance on accounting for the rate of change in funding from industry. These findings largely fit with our discussion thus far in suggesting that personnel issues may have a statistically significant relationship on university income. In light of the OLS model, however, it will be worthwhile exploring more qualitative, non-quantifiable data to explore how reforms have been implemented in different universities. The next section will therefore introduce two case studies.

6. Case studies

The case studies will outline the background of each institution with regard to UIL organizations, personnel, policy structures and possible incentives for promoting UIL activities. The two institutions are one NU and one PU. Both have performed strongly in external evaluations and were also recommended during interviews. Survey results, interview data, organizational documentation and bibliometric analysis support the analysis.

6.1. Case 1: A national university

This case reveals the regional nature of collaboration based principally in the School of Agriculture and School of Medicine. The institution has been 'lucky' its UIL staff recruitment, and personnel is not the key factor shaping UIL activity. The university has a number of comprehensive agreements with firms which appear to be deepening. At the same time the university builds on its regional links to establish more national relationships. This case may suggest that UIL within the more formal structures has the potential to deepen and broaden as has been suggested (Omi, 2005).

Case 1 is a multi campus university established in the late 1940s. The university has an extensive history in local educational agricultural and technical schools from the early 19th century. At the time of its foundation the university sought to have wide links with its local surroundings. The university now has five faculties including a School of Agriculture and a Medical School. As an actor in UIL Case 1 was one of the first universities to establish a TLO and according to external evaluations has been noted to have a diverse and multilayered UIL system. Strengths relating to personnel and UIL procedures were emphasized in one recently performed external evaluation. The university has a broad range of priorities for UIL, which include agriculture, chemicals, medicine, electronics and construction. These are areas where the university feels it holds some strength as well as where there is demand from industry, much of which is in the local area.

Links with industry are mostly of a local nature with income from industry and donations at around 3% of university income. Contract research and collaborative research have both increased dramatically since the early 1990s, with contract research increasing by 92% from 1992 to 2004 and collaborative research increasing 88% over the same period. Most of this activity is concen-

trated within the Engineering Department. For joint UIL papers, the School of Medicine and the Engineering Faculty figure prominently, followed by the Science Faculty and Veterinary Faculty.

As of May 2005, the university holds four endowed chairs with two in the School of Medicine and two in the School of Engineering. Internships began to be provided by the university in the late 1990s, with over 220 students placed in 110 regional companies for 2004. In late 2004 a comprehensive agreement with a regional bank was signed that centres upon personnel development (including internships) and strengthening research on East Asia. This agreement builds on previously sponsored lectures and seminars at the university. The Management of Technology course provided by the university was established in 2001 and developed through consultation with local industry. The TLO operates a membership system with 72 corporate members.

Organizationally, aside from the intellectual property headquarters (IPHQ), there is also a private stock TLO and a start-up support centre, which includes a collaborative research support bureau (attached to a regional innovation centre), a venture business laboratory and business incubation centre. Each of these organizations is placed within one overarching organization. The IPHQ is responsible for supporting the application of patent rights, providing information to patentees as well as organizing seminars and communications with the public. The IPHQ will be the focal point for UIL as the university moves to adopt the 'one window' policy. This troika of organizations was felt to work effectively and smoothly by interviewees and external commentators felt that the university and TLO held a good working relationship as part of a broader positive relationship between those with external experience and those with university backgrounds. Both the IPHQ and TLO engage in activities such as the marketing and licensing of technologies. The University is also engaged in a regional knowledge cluster sponsored by MEXT that facilitates interaction with locally based firms.

In terms of personnel and their role within the university, the former President had previously worked overseas which allowed for the observation of various practices and shaped the UIL system adopted. The Vice President in charge of academic research is also the Director of the IPHQ. Most of the senior managers have come directly from the university but have been complemented by staff from regional companies who serve as visiting professors. Within UIL organizations for the University, Case 1 also reported problems with personnel issues, and intends to give priority to this issue over the next five years. It currently has two coordinators supported by MEXT and one by the local government. Using its own funds, the university has also supported another two coordinators; but it was felt by interviewees that the university had been 'lucky' in its recruitment and was aware of wider problems in the overall situation.

At a strategic level the university has what can be seen as a regional orientation, but this has broadened over recent years. Under the general objective of improving relations with industry the main themes set out in the Medium Term Plan are to increase collaborative research with local industry; promote the Management of Technology course as means of nurturing local skills and to strengthen the attitude within and outside the university for establishing businesses. The IP Policy, which emerged from a working group established in 2003 states that the objective of the university is to broaden the use of university intellectual property and contribute to culture and society. Aside from the IP policy is a 'Basic Idea' for promoting relations with industry. This sets out four key relationship structures such as collaborative research, contract research, donations and other activities, such as sponsored professorships. The university provides easily accessible resources that clarify these issues on its homepage.

The university is particularly active in seeking to develop understanding of UIL related issues and in 2005 a consultation office was established for handling enquiries concerning patents and other issues. Furthermore, at a regional level the university organizes conferences for the development of UIL skills and management of IPHQs. In 2005 a textbook was published which explains the processes of handling intellectual property, models for the practical use of patents, and copyright. To broaden the regional dimension of the university's strategy, in 2005 a Tokyo Liaison Office was established to provide information and serve as a platform for liaising with government and industry.

There is no recognition of working with industry in evaluating personnel, although there could be some flexibility in this through the employment rules recognizing work that 'makes a substantial contribution to the corporation'. The main form of incentive is in terms set out in licensing agreements. Here, the inventor receives 30% of royalties, the research group of the inventor receives 30%, the university and TLO each receive 20%. Notification fees are and registration fees have also been praised in one evaluation. The TLO and IPHQ play a supporting role in this process and may recommend alternative courses of action such as the development of a business plan for a venture company, where necessary.

6.2. Case 2: A private university

Case 2 shows the types of organizational reforms that have been embarked upon and, similar to Case 1, shows how this institution is building on strong regional links to develop a more national and international profile. Case 2, has also implemented several comprehensive agreements with firms and is active in information dissemination, the training of students, and eventually staff.

Established at the turn of the twentieth century, Case 2 comprises two campuses and maintains a number of junior and high schools as well as an international university campus in a separate prefecture. This university is evaluated highly both by the interviewees for the study who emphasized the managerial competences of the university and by government sponsored evaluations. According to a government survey, this university performs particularly strongly with no areas highlighted as problematic. In another evaluation of the university IPHQ, university performance was graded in the highest band with the recommendation that this university's system become a model for other small and regionally focused institutions. The university has also received a government prize for its UIL activities.

The University itself comprises nine graduate schools mostly related to social sciences and law; there is a research centre for science and engineering and a number of Centres of Excellence (COE) in the life sciences, engineering, humanities and information/electronics fields. For 2004, tuition fees comprised 47% of university income, with donations around 1.24% and grants at 8.3%. Income from industry is reported at 2.8% for 2004, increasing from 2.5% in 2003. 10 venture companies have been produced from 2002 to 2004. In 2003 there were 133 cases of contract research and 17 cases of collaborative research, with no time-series data available. In terms of sectoral priorities for UIL, electronic machinery is the most important sector followed by foods, chemicals, pharmaceuticals and information sciences with most collaboration occurring with firms in the same region or prefecture. Collaboration with Japanese companies outside of this area accounts for around one-fifth of activities. Publications are concentrated in the faculty of science and engineering and electrical engineering and numerically stable over a five-year period.

Special courses for industry are also provided through the Management of Technology programme which was established in 2005. As part of a growing trend, there are also three comprehensive agreements with three electronics companies which encompass at a general level human, technological and information transfer but also prioritize personnel training and interchange. These programmes are implemented through e-learning and collaborative and information transfer in specific research areas and will also include participation in government research programmes and the provision of internships and training.

While the university acknowledges that a major role for promoting UIL was to expand the funding base and contribute to society equally, the university also felt competitive pressures from the national universities to have motivated reform activities. As with other private universities, Case 2 also introduced various reforms in the period surrounding 2003–2005. These included an intellectual property policy (April 2004), UIL policy (April 2004), IP rules (April 2004), conflict of interest management policy (April 2004) and the establishment of an IPHQ (2003). The Intellectual Property policy of the university outlines the basic thinking on UIL which emphasizes the need to respond to scientific and technological change but contribute to welfare and society. The Intellectual Property Committee deliberates upon all inventions; and the rights to work related inventions (those that have involved university funds, facilities or other resources) are granted to the university. Licensing proportions for inventors are 50% and 50% for the university. These reforms were additional to those that occurred elsewhere, such as rules for collaborative research, the introduction of staff training, a UIL committee and the unification of different organizations into 'one window'.

Organizationally, the base for UIL within this university has accumulated since the early 1990s when a donations office was established. A liaison office was then established in the mid 1990s, holding two offices in Tokyo and Osaka, followed by a collaborative research centre and UIL laboratory. Relations with an external TLO were maintained from 1998 for licensing activities and in 2003 the university established an IPHQ, headed by the university vice-president. The Liaison Office provides a 'one-stop' service that covers IP management, strategic planning, venture and incubation support. The Office has offices on the two campuses and around 100 related staff, one of the largest such offices in Japan. Within the Liaison Office are the venture incubation centre, which provides office space at discounted rates, and a strategic research planning office. The office maintains a database on research topics and supports collaborative research, instruction, office rental and endowed chairs amongst other activities.

Attention raising activities and seminars appear to play a large role in UIL promotion activities through trying to promote understanding amongst faculty. Each faculty member is also encouraged to set out their

research area on one side of A4 which can then be used at fairs and forums. With respect of recruitment considerations, however, there is no weight accorded to achievement in working successfully with industry and greater weight is given to research and tuition. Outside of licensing incentives there are no opportunities for venture capital equities or sabbaticals by which to develop a company. There are, however, a number of areas where the university is active and provides internships and entrepreneurial related training for students. Although personnel issues have featured prominently throughout the discussion thus far, this factor did not figure prominently for Case 2. The university had successfully recruited people from companies, and also maintained a relationship with a local bank which had seen the introduction of professional management training courses. Over the 2005–2010 period nurturing personnel through developing a more professional staff profile will be important, but is secondary to the generation of additional finance from industry. Other issues are more strategic and relate to developing a more international profile and strengthening the liaison office.

7. Conclusion

This paper began by outlining the emerging literature on 'entrepreneurial universities', recognized as those that seek to innovate in how they go about their business in order to generate funds to maintain and enhance their position. Five factors that may influence university engagement with industry were located from the literature: the range of organizations involved in UIL, personnel issues, UIL policies, incentive systems and institutional background and development. While these factors have been of note in the American setting, little was known about their relevance in other country contexts, especially the Asian context. Due to policy emulation and policy transfer, other countries have sought to draw on American institutional structures and policies for UIL. This is relevant to the Japanese case.

Focusing the study upon the 2003–2005 period, which directly covered the one-year prior to and one year subsequent to the incorporation of the universities, it was observed that Japanese universities adopted many policies and initiatives for linking research results with industry. This was through intellectual property policies, conflict of interest guidelines, intellectual property ownership rules and UIL strategies. There have also been reforms that have sought to consolidate the different organizations that have emerged. These institutional and policy changes will now be embedded further with less organizational or policy development over the 2005–2010 period. It can be said, therefore, that many of the universities have indeed oriented themselves towards developing organizations and policies that seek to generate more funds. Yet, it must be remembered that many of these initiatives have emerged from government prompting and only a minority of institutions have begun to carve out their own niche areas.

Survey respondents and interviewees suggested that personnel issues in UIL organizations have been a key factor shaping institutional performance and the statistical analysis suggested that there may be some accuracy in this belief. However, the broader context of UIL should also be acknowledged and the case studies contributed to this perspective. From these studies, the broad strategic vision, organizational base, institutional background, and diversity of links appear to have an important role to play. Personnel issues should therefore be seen as part of a package of policies and issues that need to be addressed. This can tie in with current debates over UIL in Japan, and appear to suggest that it may be possible for institutional and strategic agendas to have a broadening or deepening effect upon UIL activities.

How would these findings from an Asian oriented paper relate to other studies? Firstly, the findings appear to largely fit with earlier research undertaken in the United States which emphasizes the role of personnel skills in UIL offices (Siegel et al., 2003; O'Shea et al., 2005). In addition, other findings that emphasize cultural and organizational factors (Kenney and Goe, 2004; Feldman and Desroches, 2004) are also of importance. The statistical analysis suggested that, similar to Lach and Schankerman (2003) and other studies, incentives also hold a positive relationship with UIL performance. This leads to a second point which concerns the types of policies that may be of relevance. If formal models, strategic objectives, and policies have been introduced and are deemed to be of significance for UIL as suggested by the statistical and case study analysis, then over the longer term Japanese UIL may follow patterns witnessed in the US. That is, patterns whereby a select few universities are fortunate to possess highly profitable licenses with most institutions making only modest profits on their licensing activities (see AUTM, 2005). This places emphasis on the types of policies and strategies that may be desirable for Japanese institutions and policy makers. At this stage, the following could be suggested:

- First, universities may need to broaden the range of UIL activities in which they are engaged at a strategic level. Currently, there may be too much focus placed upon licensing and spin-outs, with less emphasis placed on other forms of profitable activities entered

into by universities elsewhere. For instance, training programmes, consultancy, contract and collaborative research.

- Secondly, greater prominence could be given to thinking about how to reward and motivate staff to maintain greater interest in UIL activities, in particular through a broader range of incentive or acknowledgement systems. For instance, greater use of equity arrangements, wider use of incentives for UIL collaborative research or recognition of UIL in terms of staff appraisal and evaluation.
- Thirdly, attention could be directed towards personnel issues. First in terms of reducing the costs for transfer between different sectors of the economy, allowing for universities to draw on the skills of those with broader experiences. Second in nurturing and providing better skills for those already employed in UIL organizations. The range of training courses for staff in such organizations in Japan are limited in comparison to elsewhere, but there are also important issues which relate to age profiles and issues of sustainability.

While these points have been addressed specifically to Japanese universities, they may also be of relevance to other countries in Asia where the granting of greater autonomy to universities is increasingly popular. This has happened in several Asian countries and is currently being discussed in Taiwan and awaiting implementation in South Korea. To some degree this study suggests that the American UIL model can be transferred to other countries. This poses risks however in terms of financial burdens for universities and the overall risks associated with radically changing the policy system. Whether the newer policy model as adopted in Japan holds benefits against older informal systems is not entirely clear.

The scale of reforms has therefore revealed a rich seam for further exploratory research. Firstly in terms of the policies introduced and the organizations that have been developed. By this, further research could explore the influence of UIL policies and regulations and how they may influence faculty behaviour. It is not known, for instance, how academics who would previously collaborate with firms view the new regulations and whether they are viewed as burdensome. Nor is it known, for that matter, how such policies are implemented at the 'street level' and whether the substance of what is written on paper is actually what occurs within the institution. Detailed survey or observational studies would provide useful insights into the Japanese system of operationalizing UIL (see, for instance Owen-Smith, 2005). Secondly, further assessment of the role and influence of public grants and funds to support UIL activities may be desirable. The significance of these and how they may influence and possibly inflate statistical measures of UIL outputs, or support unviable organizations is not known. Research on this theme would provide greater insights into the scale of UIL and also allow for greater care in use of comparative measures and policy prescription. Likewise, assessment of other sources of UIL income could allow universities more certainty over the types of strategies that might be successful. Thirdly, further work needs to be done in assessing the influence of the new system to evaluate whether it has led to increased UIL activities or has indeed hindered interaction, as suggested by some studies.

The limitations in this study should also be highlighted. These arise from the possible differences in perceptions between personnel at different organizational levels. This study draws in the main from those in UIL relevant management or administrative positions who may hold different interpretations and opinions to other academic staff (Siegel et al., 2003). A second issue that requires acknowledgement is how industry perceives the reforms. This has not been taken into account and should be a key element to any future studies of university reform efforts or of Japanese UIL. In defence, the scale of reforms in Japanese universities was felt to warrant a study in its own right to assess exactly how far reforms have been extended and how universities are seeking to work with industry. The third weakness concerns the failure to look at institutions that do not hold a UIL organization. It is not known how they manage or have responded to incorporation and whether this could possibly represent a more diverse university environment to that presented in this paper.

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