Agency in national innovation systems: Institutional entrepreneurship and the professionalization of Taiwanese IT

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Abstract

This paper examines institutional entrepreneurship as a form of internal agency within national innovation systems. In particular, we consider the entrepreneurship of Taiwanese IT firms over 1980–2007 in creating a new professionalized organizational form markedly different from the traditional Taiwanese model of family business. We compare two successful sectors – personal computers and semiconductors – and one failure – hard disk drives. We emphasize how entrepreneurial firms used strategies of framing, aggregating and networking (F.A.N.) to build legitimacy, mobilize local resources and reach out beyond the limitations of their immediate contexts. We discuss how F.A.N. strategies may evolve from ‘introversion’ to ‘extraversion’ and develop implications for policy-makers and further research.

1. Introduction

The national innovation system tradition of research has highlighted the importance to economic development of the idiosyncratic and interrelated nature of institutions within particular countries (Godin, 2009; Lundvall, 1992; Nelson, 1992). One central institution within these national innovation systems is a country’s characteristic organizational form, in other words, the typical set of ownership, managerial practices, strategies and target markets adopted by national firms (Rao and Singh, 2001; Whitley, 1992). Within a national innovation system, firms are likely to benefit from fitting their organizational forms closely to surrounding institutions. The problem of adaptation, however, is that established organizational forms may come to limit innovation and change (Lundvall et al., 2006; Storz, 2008). In a dynamic world, local fit can easily become competitive constraint. To survive, firms may therefore have to innovate organizationally against the logics of their own national innovation systems.

This paper extends the basic national systems of innovation framework in order to accommodate such contra-system innovation. In particular, we incorporate institutional entrepreneurship, the ‘activities of actors who have an interest in particular institutional arrangements and who leverage resources to create new institutions or to transform existing ones’ (Maguire et al., 2004, p. 657). These actors exercise agency by making a difference to the systems in which they participate (Giddens, 1984). Building on the case of Taiwanese IT firms, we show how, by enrolling diverse resources, institutional entrepreneurs may not only transcend constraints on their own account; as their strategies shift from introversion to extraversion, they may also contribute to the transformation of national innovation systems at large.

In particular, between 1980 and 2007, Taiwanese IT entrepreneurs achieved a radical shift in dominant organizational form, moving from the traditional – and successful – Taiwanese model of familial subcontracting, to a new form based on professional management and investment in innovation, design, marketing and service. The strategies behind this shift were cognitive and social as much as economic and technological: entrepreneurs framed new visions, aggregated local supporters and networked overseas. In pointing to these strategies, we emphasize entrepreneurs’ institutional creativity rather than technological fit with national systems (Chang et al., 2006; Dosi and Kogut, 1993; Hill, 1995; Porter, 1990), supportive state policy (Amsden and Chu, 2003; Dodgson et al., 2008; Wade, 1990) or wider processes of economic modernization (Kim and Utterback, 1983; Rostow, 1960). None of the three sectors we focus on – personal computers, semiconductors and hard disk drives (HDDs) – was a natural fit with Taiwan’s original system. The branding involved in personal computers, and the high technology and large capital investments of the other two sectors, were alien and risky in the Taiwanese environment. State support was valuable, but firm interests and state policy conflicted sometimes and state interventions could fall short. Finally, professionalization was...
not the inevitable product of insertion into a world economy or global processes of modernization. While Taiwan’s semiconductor manufacturers linked up with leading Western companies, its hard disk drive firms did not and were soon overtaken by Singapore. Hong Kong’s entrepreneurs, starting with a similar Chinese familial organizational form, by and large resisted an equivalent professionalization despite their long-standing participation in the Western economy (Sharif and Baark, 2008). In short, the creation of Taiwan’s professionalized IT firms was the hard-won product of entrepreneurial initiative and choice.

Our incorporation of institutional entrepreneurship has implications both for national innovation systems theory and for practical state policy. First, the concept of institutional entrepreneurship adds to national innovation systems theory a source of internal agency that, while still respecting national institutions as non-trivial constraints, has the potential of generating change on its own behalf. Second, this highlighting of institutional entrepreneurship encourages state policy-makers working within a national innovation systems framework to re-evaluate the role of firm-level initiatives and to support them with specific measures to promote wider endogenous change. A national innovation systems theory that allows for institutional entrepreneurship offers both greater explanatory breadth and a larger policy repertoire.

The paper continues as follows. The next two sections build on the existing literature on innovation systems and institutional entrepreneurship in order to develop the framing, aggregating and networking (F.A.N.) strategies of new form creation. We continue by providing details about our research methods. We next introduce the two central organizational forms – familial (old) and professional (new) – and show how our particular firms relate to them. The main empirical section outlines the framing, aggregating and networking strategies by which institutional entrepreneurs managed their shift to the professional form. We then develop propositions for how F.A.N. strategies may evolve over time, with increasing repercussions on the national innovation system at large. The paper concludes with implications for policy-makers and further research.

2. Innovation systems and institutional entrepreneurship

The innovation system tradition sees the nation state as a critical institutional field for the shaping of organizational forms (Lundvall, 1992; Nelson, 1992). National legal systems, education systems, research institutions, financing systems and networks of suppliers and customers combine to reinforce standard ways of organizing, competing and innovating. Organizations that conform to these standards gain both legitimacy and efficiency in their local interactions. As the nature of national institutions varies internationally, it becomes possible for countries to be characterized by quite distinctive organizational forms which are more or less competitive internationally according to the value derived from fit with their local contexts. The influence of national institutions on organizational forms can be especially strong in relatively small, culturally cohesive or politically centralized states. Accordingly, countries such as Taiwan, Singapore, South Korea, Denmark and Sweden tend to be characterized by particularly robust and distinctive organizational forms (Edquist and Hommen, 2008).

However, the circular reinforcement of national innovation systems need not always be entirely virtuous. Sometimes, systems of innovation become self-reproducing ‘systems of inertia’ (Hobday, 2004). This kind of institutional circularity provides a ready explanation for conservatism in organizational forms. Thus the failures of, for example, the French computer industry (Nohara and Verdier, 2001), the Brazilian leather goods industry (Schmitz, 1999) and many Japanese software firms (Anchordoguy, 2000) can be put down partly to the constraints imposed by their immediate institutional contexts. Yet there have also been some striking cases where clusters of high-tech firms have succeeded despite strong contrasts with local institutions. For example, the Finnish telecoms industry arose in an economy traditionally characterized by state-oriented, natural-resource conglomerates (Schienstock, 2004); Israel’s high-tech entrepreneurs emerged in an economy dominated by the state (Riegenbaum, 2007); and India has produced a vibrant knowledge-based service sector despite its origins as an overprotected, low-R&D country (Kapur and Ramamurti, 2001). A circular view of national innovation systems is hard-pressed to explain how embedded actors can gain sufficient detachment for such radical organizational innovations from within.

In institutional theory more generally, this problem of contra-system innovation is known as ‘the paradox of embedded agency’ (Seo and Creed, 2002). Where actors are ‘over-socialized’ by local institutions, internal challenges to the status quo are theoretically hard to explain (Whittington, 1992). Lundvall (2007, p. 110) highlights this kind of explanatory difficulty within innovation systems theory too: ‘There is an inherent risk that “system” brings with it a structuralist mode of explanation that neglects the critical role of agency’. Given the innovation system perspective’s influence on policy-making (Godin, 2009), the neglect of such agency risks becoming a self-fulfilling prophecy: to the extent that system-breaking entrepreneurial agents are theoretically absent, policy-makers will minimize support to such potential agents of system change.

In drawing on notions of institutional entrepreneurship (Garud et al., 2007), we seek to introduce the agency capable of explaining the endogenous creation of organizational forms, while hanging on to innovation system theory’s insights regarding the importance of national institutions. This simultaneous respect for both deliberate agency and institutional contexts contrasts with other theories of new form creation. Some theories are low on agency. For example, organizational ecology considers the emergence of new forms as shaped by the remote environmental pressures of population dynamics (e.g. Ruf, 2000), while complexity theoretic accounts attribute innovation to random or deterministic processes (e.g. Peterson and Meckler, 2001). Other perspectives underplay institutions. Thus theories of entrepreneurship from economics tend to see innovation as arising primarily from the exploitation of technological and market opportunities and characterize entrepreneurs individually rather than as full members of local societies (Dodd and Anderson, 2007). Likewise, the dynamic capabilities tradition in strategy sees change as primarily driven by organizationally specific routines and resources, with little sense of the firm as embedded in society (e.g. Teece, 2007). By contrast these alternative perspectives, therefore, institutional entrepreneurship theory can motivate an account that allows for creative agency even from within tightly integrated national innovation systems.

Institutional entrepreneurship refers to both individual entrepreneurs and managerial teams (Maguire et al., 2004). These actors are neither the under-socialized entrepreneurs of some economic theories, nor the over-socialized conformists of strong-form institutional theories. Their institutional positions constrain, but they can also provide them with the resources necessary for agency. Here, entrepreneurial needs are different to those of the state and large firms, alternative internal agents of system change (Larédo and Mustar, 2001). Nation states and large firms already have substantial resources and capabilities. Entrepreneurs, on the other hand, have to develop ideas, win support and build credibility more or less from scratch. This entrepreneurial predicament places a high value on cognitive and social processes (Dorado, 2005). New ideas need to both convince and mobilize supporters (Greenwood and Suddaby, 2006; Maguire et al., 2004). To a greater
The F.A.N. framework we shall develop next draws on these insights about the agency of institutional entrepreneurs, while still recognizing the kinds of constraints highlighted in national systems of innovation theory. The three F.A.N. strategies of framing, aggregating and networking address respectively the creation of new and credible visions capable of inspiring system actors, the scraping together of available people and resources within a local system, and the translating of new resources and ideas between different systems. Each of these strategies has its particular focus of action and involves characteristic resources, skills and, of course, problems. Our initial introduction of these strategies treats them as stable. However, our longitudinal account will show how each of these strategies evolves, moving from what we term introversion towards extraversion. Building on our case, we shall propose that F.A.N. strategies tend over time to shift from an inward concern for the building of the organizations themselves to a more outward influence on the wider systems in which they are embedded. It is in this sense that these strategies may offer a double benefit, as change is not confined to particular firms and industries but resonates through the national innovation system at large.

### 3. The F.A.N. framework

Table 1 summarizes the F.A.N. framework. The columns refer to the three strategies of framing, aggregating and networking. The rows define the key dimensions that differentiate the strategies one from another, as follows: action focus, basic resources, social skills and characteristic problems.

#### 3.1. Framing

##### 3.1.1. Action focus

The first strategy available to institutional entrepreneurs is framing the new venture, as institutional entrepreneurs present their innovation persuasively enough to build understanding, confidence and a sense of direction. Framing is essentially a cognitive mechanism, often involving the use of rhetorical devices, symbolic languages, metaphors and analogies to motivate people to reach certain goals (Campbell, 2005). Thus this strategy serves the diagnostic, prognostic, and motivational functions (Benford and Snow, 2000) necessary to support practices that run counter to institutionalized codes or rules. A notable example of framing is Intel’s Moore’s Law with regard to advances in semiconductors. Framing to define both core issues and characteristic solutions to problems associated with framing involve issues of relevance and resonance. A frame must be seen relevant to the realities or experiences of key audiences. It must also aligned enough to the projects of their targeted groups to produce ‘frame resonance’ (Hargadon and Douglas, 2001). A lack of such resonance will tend to failure. At the same time, framers need to be able to appeal to convincing or reliable referents or models (Snow and Benford, 1988). Framing is less persuasive in the absence of a plausible and successful model.

##### 3.1.2. Basic resources

Framing requires both cognitive resources, the intellectual capacity to conceive new visions, and social resources, the legitimacy to be able to claim attention (Dorado, 2005; Maguire et al., 2004). Beyond these, the institutional entrepreneur needs access to the communications media required to exercise the required ‘pedagogy’ or influence (Oakes et al., 1998). Legitimacy and access to communications media typically imply some degree of ‘insider’ positioning within the innovation system, though not to the extent of smothering the potential for entrepreneurial creativity (Greenwood and Suddaby, 2006).

##### 3.1.3. Social skills

Skilful persuasion is key to framing, as strategic actors seek to justify their new activity by re-interpreting the environment and its opportunities. In this sense, institutional entrepreneurs must be effective ‘sense-givers’ (Gioia and Chittipeddi, 1991), capable of manipulating discourse and symbols in order to influence, motivate and give direction.

##### 3.1.4. Problems

The problems associated with framing involve issues of relevance and resonance. A frame must be seen relevant to the realities or experiences of key audiences. It must also aligned enough to the projects of their targeted groups to produce ‘frame resonance’ (Hargadon and Douglas, 2001). A lack of such resonance will tend to failure. At the same time, framers need to be able to appeal to convincing or reliable referents or models (Snow and Benford, 1988). Framing is less persuasive in the absence of a plausible and successful model.

#### 3.2. Aggregating

##### 3.2.1. Action focus

The second strategy is aggregating, in which institutional entrepreneurs combine resources and actors within an industry or immediate system in order to overcome existing institutional constraints (Maguire et al., 2004). The focus is collective. Thus aggregating can take the form either of collecting necessary resources within organizational boundaries through mergers and acquisitions, or ‘convening’ inter-organizational resources through alliances and coalitions (Dorado, 2005). A classic example of aggregating is the early America automobile industry where momentum for the motor car, an unfamiliar and suspect innovation, was built first through trade associations, clubs and leagues and then consolidated through the acquisition of smaller enterprises by firms such as General Motors (Rao et al., 2000).

##### 3.2.2. Basic resources

In creating new institutions, entrepreneurs need to win the trust of required collaborators (Aldrich and Foil, 1994). Such trust facilitates also the transition of the novel to the taken-for-granted, providing a standard around which other actors can coalesce. Building critical mass around such a standard can set off quasi-autonomous processes of ‘accumulation’ (Dorado, 2005), giving the new institution a self-reinforcing momentum. Again, an insider position within the social system is likely to enhance the required legitimacy (Greenwood and Suddaby, 2006).

##### 3.2.3. Social skills

Collective mobilization is key to aggregating, requiring entrepreneurs to negotiate, mediate and motivate the cooperation of others. Convening especially requires leadership styles capable of creating clear ‘collaborative advantage’ (Huxham and Vangen, 2005). Political skills too are important to the bargaining and sustaining of coalitions (Fligstein, 2001).

##### 3.2.4. Problems

Inter-organizational aggregation particularly faces problems of free-riding behavior and actor apathy (Garud et al., 2002; Wijen and Ansari, 2007). Non-participation also can be caused by individual interests working against collaboration. Finally, aggregation involves significant transaction costs of initiating, negotiating,
monitoring and sustaining inter-organizational arrangements (Landry and Amara, 1998).

3.3. Networking

3.3.1. Action focus
The third F.A.N. strategy is networking to obtain ideas, legitimacy and other kinds of resources from outside the local industry context, and especially from outside the national innovation system. While aggregating emphasizes the organization of an industry’s collective efforts from within, networking points to the enrolling of ideas and resources from without. Networking involves brokerage, the movement of ideas or resources from one system to another (Burt, 2005; Fligstein, 2001). Because organizational forms are usually so strongly defined by national institutions, movement between systems internationally is particularly important (Tempel and Walgenbach, 2007). A prominent example is French chefs taking ideas from Japan to develop Nouvelle Cuisine (Rao et al., 2003).

3.3.2. Basic resources
For networking, a key resource for institutional entrepreneurs is some kind of pluralistic identity, endowing them with ‘the strength of weak ties’ (Granovetter, 1973). Strong identity with a single system closes actors off (Burt, 2005). Weak ties foster novelty by opening actors up to the ideas, knowledge, skills and other resources of alternative systems that might otherwise be dismissed as inappropriate or alien.

3.3.3. Social skills
A critical skill in networking is ‘translation’, the ability not only to move ideas and resources from a particular system but also to adapt them into appropriate forms for the receiving system (Lawrence and Sudaby, 2006). Translation implies skills in negotiation, as institutional entrepreneurs reach compromises in order to win local acceptance of outside practices (Fligstein, 2001).

3.3.4. Problems
A major challenge for institutional entrepreneurs is finding the right balance of embeddedness in different systems. Marginality in a system may facilitate bridging with other systems, but centrality is important to the legitimacy for framing and aggregating (Greenwood and Sudaby, 2006). There are opportunity costs too from turning attention away from the home system to a more distant one.

3.4. Summary: the F.A.N. framework
Given the appropriate skills and resources, institutional entrepreneurs can thus use framing, aggregating and networking strategies to secure the inspiration, legitimacy and other forms of support necessary for new form creation. These F.A.N. strategies are analytically distinct, but they are also practically interconnected. Aggregating requires entrepreneurs to frame their endeavors in ways that convince others. Innovative framing is facilitated by external ideas drawn from cross-system networking. Successful aggregation reinforces the legitimacy of an initial framing. These three kinds of strategies come together as a social tool-set, which institutional entrepreneurs draw upon according to the exigencies of the immediate situation. While these strategies are very unlikely to have been understood by focal actors so schematically, the following sections will explore how at least some Taiwanese IT firms sought to establish a new professional form through framing, aggregating and networking.

4. Research method
The basic methodology used for this study is a naturalistic inquiry approach (Lincoln and Guba, 1985). The research is based on more than 160 formal interviews with IT firm managers, sector journalists and technical experts conducted between 1993 and 2007, as well as extensive archival materials such as company annual reports, analysts’ coverage and articles from the specialized and more general business press. Our research was not originally designed to understand specific strategies of institutional entrepreneurship or form creation, but rather to examine Taiwanese IT firms’ growth more generally. However, the significant change in organizational form we saw – from the familial to the professional – prompted a sharpening of focus as the research progressed. We were able to develop and test our emergent ideas both through the later interviews and through numerous class discussions with executive-MBA students working in Taiwanese high-tech, the specialization of the first author’s university.

Thus data analysis and conceptualization moved iteratively between empirical evidence and theoretical constructs. We abandoned or modified tentative categories and retained those that recurred in the growing body of data. Eventually, we identified the three F.A.N. strategies and mapped them according to the stages of general S-curve models of institutionalization processes: that is, first ‘innovation’, then ‘diffusion’ of that innovation, and finally ‘legitimation’, the full acceptance of the original innovation (Lawrence et al., 2001). We shall analyze the Taiwanese IT industry’s evolution according to three broad stages, therefore: innovating against the family model, roughly 1980–1990; diffusing the new professionalized form, roughly 1991–1997; and legitimating professionalism, roughly 1998–2007. For each of the stages, we analyze the entrepreneurial engagement with F.A.N. strategies, both effective and ineffective. We then turn to a cross-stage analysis and comparison, resulting in a dynamic model of institutional entrepreneurship that articulates the evolution from introversion to extraversion over time. We now introduce the two ‘ideal types’ of organizational form, differentiating them according to characteristic patterns of ownership, managerial practices, strategies and target markets (Lewin et al., 1999; Rao and Singh, 2001). We also indicate how our various entrepreneurial firms fitted, and evolved, along these dimensions.

5. Organizational forms in Taiwan: familism and professionalism

Chinese familism is central to the traditional Taiwanese organizational form, and indeed is the original foundation for the
country’s economic success (Hamilton and Kao, 1990; Whitley, 1992, pp. 53–63). The major goal of Chinese family business is to protect familial interests and independence, usually through highly concentrated ownership structures. Top management is mostly recruited by the family patriarch or through family connections. Formal hierarchies and control procedures are ineffective and professional managers have little autonomy or discretion. Employee commitment relies on family loyalties, and personal relationships and family membership are the main bases for authority. Personal ownership and a desire to maintain control restricts collaboration and investment in R&D, brands and distribution. Business is typically characterized by original equipment manufacturing (OEM) subcontracts for export, with strategy focusing on cost competition, niche markets and rapid response to opportunities. There is a strong propensity to imitate Western products, and intellectual property rights are not deeply respected. This independent-minded familial form has evolved in a context of limited state intervention, by comparison with Korea, and weak banks, by comparison with Japan (Whitley, 1992).

Both PC-firm Acer originally and the HDD manufacturers exemplified many of these characteristics. Acer had been founded (as Multitech) in 1976 by Stan Shih, three friends (who soon moved on) and his wifeCarolyn Yeh. Funding came from his mother and other family members. Early sales came from distribution of Western products, OEM subcontracting and Apple II clones. Acer’s original opportunism was summed up by Stan Shih’s (1996) claim: ‘we would sell anything except our wives’. The company ruthlessly focused on costs, Shih telling his employees that their products were like the duck-eggs his mother sold, with shell-thin margins. The HDD manufacturers had familial origins too. The first HDD venture was launched in 1982 as a contract manufacturer for a US company by Tatung, a large family-managed conglomerate with interests ranging from industrial switchgear to manufacturer for a US company by Tatung, a large family-managed conglomerate with interests ranging from industrial switchgear to domestic appliances (Noble, 2006). Tatung rapidly failed, but the three other local ventures, all founded in 1989, also shared this pattern of support by personally controlled diversified businesses. Magtron was founded by entrepreneurial Cheng-Hong Chemicals, active in agricultural pesticides; Greenery was launched by a family with a large Toyota franchise; and Zentek was the joint-product of entrepreneurially-owned Longshine, a small electronics manufacturer, and the family-owned Universal Scientific Industries company, a mid-sized producer of electronic parts and packaging for autos and computers. All three companies relied on externally supplied HDD designs, with only Zentek attempting some of its own design.

By the early-2000s, however, many Taiwanese firms had moved from this traditional Chinese family form to a sharply contrasting professionalized form (see Table 2). In terms of ownership, Taiwanese entrepreneurs became more open to external ownership and focused increasingly on shareholder value as against narrow family interests. After about 100 initial public offerings in the whole period 1961–1985, the Taiwanese stock exchange has averaged 30 IPOs annually in recent years (Liu et al., 2006). The workforce is more professional, with the proportion of skilled-workers, experts and professionals rising from 11.2% to 25.6% between 1992 and 2007. The number of MBAs produced in Taiwan increased from 1818 in 1998 to 9381 in 2006 (Lee, 2007). After IPO, firms were more likely to have professional CEOs, without kinship or friendship links to the founder (Liu et al., 2006). Inter-firm cooperation through joint ventures and alliances became common, together with a greater willingness to fund large acquisitions. Taiwanese IT firms relied more on their own R&D resources, rather than simply relying on the low-cost manufacture of ‘me-too’ products. R&D expenditure as a proportion of GDP rose from 0.91% in 1981 to 2.77% in 2008, equal to US levels. Product innovation and customer service took precedence over manufacturing or engineering skills. Firms increasingly developed global strategies based on overseas investment, original designs and own-branding. In the 1980s, Taiwan’s outward foreign direct investment averaged $145m annually; between 1990 and 2007, it averaged $2.988m annually. Taiwanese companies such HTC in cell-phones and Asus (Eee-PC) in notebooks are now recognized internationally as innovative brands in their own right.

A good deal of this professionalization has been supported by an increasingly interventionist and modernizing state (Chang and Shih, 2004; Yeung, 2000). The 1980s saw a move for democratization and ‘Taiwanization’ on the part of the Mainland Kuomintang regime. Engagement with successful international firms helped legitimate the regime and compensate for its diplo-

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**Table 2**

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<th>Ownership</th>
<th>Family-controlled business</th>
<th>Professionalized IT business</th>
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<tr>
<td>Personal and independent.</td>
<td>Acer's husband-and-wife team; HDD family conglomerates</td>
<td>Diffuse and open. Acer's employee ownership; Philips' participation in TSMC.</td>
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<tr>
<td>Management</td>
<td>Informal, family-connections; low degree of managerial discretion. Stan Shih, Carolyn Yeh and friends as in initial managing and owning team</td>
<td>Formal, more systematic; relatively high degree of managerial discretion. Shih’s ban on employing his own children; Acer’s hiring of IBM’s Leonard.</td>
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<tr>
<td>Strategy</td>
<td>Imitation, opportunism, minimal investment. Acer to sell everything except wives; Acer’s Apple II clones</td>
<td>High investments in innovation, marketing and service. Acer’s leadership with 386 micro-processor and investment in US Aspire brand; TSMC’s investment in R&amp;D (CMOST leadership).</td>
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<tr>
<td>Markets</td>
<td>Cost-based niche-subcontracts for export, Tatung’s HDD subcontracting</td>
<td>Global designs and brands and foreign direct investment. Acer’s McDonald’s vision.</td>
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3 Data are from Ministry of Economic Affairs (http://www.moeaic.gov.tw/system_external/home.html).
matic isolation. The Taiwanese state set up R&D institutes and consortia, fostered the education of scientists and engineers, established important incubators and science parks and promoted a growing venture capital industry. However, state policy, particularly with regard to China, was not always consistent with the IT industry’s interests and, as in the hard disk drive sector, state connections would not be enough to secure success in any case. Our analysis, therefore, emphasizes the agency of entrepreneurial firms rather than just the state. It required firm-level action to create the new professionalized organizational form.

Here influential pioneers were TSMC in semiconductors and the evolving Acer in PCs. TSMC was established in 1986 by the Taiwanese government (48.3%), the Dutch multinational Philips (27.5%) and Taiwanese private investors most of the rest. Its founding chief executive, Morris Chang, had been born and bred in China and then spent 36 years working in the United States, including doing a PhD at Stanford and working at Texas Instruments. Chang’s personal shareholding in 1994 was only 0.84% and his family was kept apart: Chang’s only child did charity work in the United States. TSMC committed heavily to its own R&D, with expenditure growing from $20m in 1992 to $616m in 2009. In 2002, TSMC was the first company globally to produce a fully functional SRAM chip using 90-nm CMOS technology. It was also the world’s leader in the capital and technology-intensive foundry business.

Acer too rapidly evolved towards a professional model, prompted by Shih’s early experience of working in a failed subsidiary of a family conglomerate. In terms of strategy, Shih believed in developing his own products and in 1986, Acer beat IBM to be the second company in the world to launch a PC based on Intel’s latest 386 chips. In 1987, Acer made its first significant investment in the United States, buying the PC manufacturer Countertop. In 1995, the company launched the heavily marketed Aspire model into the United States, a product characterized by deliberately high design values. Shih (1996) declared his ambition to be the McDonald’s of PCs, with a strong brand and standardized quality worldwide. As for management, Shih banned his three children from employment in the business and hired a senior manager from IBM, Dr Leonard Liu, as his company president in 1989. Acer launched Taiwan’s first employee stock incentive programme as early as 1984 and went public in 1988: by 1995, the company was 30% employee-owned. For Shih (1996), ‘it was better to lose control but make money’. When he retired in 2004, Shih and his wife owned about 6% of the business (Shiung, 2004). Acer was the fourth largest PC vendor in the world.

6. Framing, aggregating and networking strategies in Taiwanese IT

In the space of two decades of so, entrepreneurs such as Stan Shih and Morris Chang created in their own companies a new organizational form, one that influenced the whole Taiwanese national innovation system. However, in the initial Taiwanese context, this success was by no means assured. Acer’s ambitious overseas investments inflicted three successive years of losses that nearly drove it out of business in the early 1990s. Chang was warned by his friend, Intel’s Gordon Moore, that his strategy was deeply flawed (Fuller, 2002). This section examines the evolving framing, aggregating and networking strategies by which they finally succeeded, and contrasts them with the failed strategies of the hard disk drive manufacturers. Table 3 summarizes the F.A.N. strategies over time, highlighting their impact on professionalization.

6.1. Innovating against the family model, 1980–1990

In the early years, the dominant organizational form available to Taiwanese entrepreneurs was still the family-owned business. This was a model to which the hard disk drive producers were fatally attached and one that Acer’s Stan Shih quickly left behind. It was not one likely to attract an American-trained manager such as Morris Chang. As both Shih and Chang worked towards a new organizational form, they had formidable tasks in terms of framing, aggregating and networking. In doing so, they made skilled use of the local legitimacy and international connections afforded by their social positions.

6.1.1. Acer in PCs

Acer’s Stan Shih was well-positioned to act as an institutional entrepreneur, highly legitimate within the Taiwanese system and with growing access to the world outside. In a culture with strong technical values (a quarter of bachelors degrees are in engineering), Shih had graduated top of his engineering class from National Chiao Tung University, one of Taiwan’s oldest and highly reputed in electronics. Shih then gained his Masters degree and won national recognition as the creator of Taiwan’s first desktop calculator in 1971. In 1976, Shih had been elected by the Taiwanese government as one of ‘Ten Outstanding Young Persons’. He maintained a strong engineering identity through his career, being described by Paul Otellini (2006), CEO of Intel, as a ‘mild-mannered engineer’. As a native Taiwanese, Shih would also benefit from the government’s Taiwaneseization policy. However, Shih also had links outside the Taiwanese system. He had started his business as Taiwan’s primary distributor of Texas Instruments’ innovative semiconductors. He demonstrated an openness to the world by always using his English first name, Stan, even in Taiwan. Shih had collaboration and translation skills, at least according to his own description of himself as a ‘broker and facilitator’ (Mathews and Snow, 1998, p. 66). In developing a new organizational form, without the backing of an established business group, Shih would make full use of all three strategies of (in our terms) framing, aggregating and networking.

Stan Shih framed Acer’s professionalization in terms of a three wave model of Taiwanese development: the first wave was of trademark and patent piracy; the second was of clone-making; and the ‘third wave’ (the name of a subsidiary Shih set up in 1981) was of technological innovation (Gasbarre and Culligan, 2002). In 1986, he drew on Taiwanese nationalistic images to proclaim a ‘Rampaging Dragon Ten Year Plan’ of aggressive international expansion. Shih promoted these framings vigorously, claiming to have given more public speeches than anybody else in Taiwan except the government’s own press bureau (Chen, 1996). Shih was active in aggregating local supporters too. His first factory was on the Hsin-Chu Science Park, Taiwan’s centre for high-tech enterprises. This location helped Shih set up the Taipei Computer Association (TCA), which he chaired from 1984 to 1989. The TCA worked hard on settling copyright infringement disputes and cleaning up Taiwan’s controversial cloning business. Without support from the government or an established business group, Shih also aggregated through joint ventures with regional distributers to expand his national coverage. He framed this joint venture strategy as bringing together the ‘commoners’ to combat the ‘nobles’, i.e. more powerful local firms (Bartlett and George, 1998). Short of home-grown professionals to manage his rapid growth, Shih’s networking concentrated on importing overseas managers and experts (resented by existing employees as ‘paratroopers’). The 1989 arrival of Dr Leonard Liu from IBM

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4 Data are from Taiwan Economic Journal (http://www.tej.com.tw/twsite/).
5 Data are from company annual reports.
Table 3
Professionalization of Taiwanese IT: framing, aggregating and networking strategies.

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<td>Acer’s ‘third wave’ concept highlights a shift towards a professional model of independent technological innovation.</td>
<td>Acer adopts a Western ‘fast food’ model: to be a McDonalds in terms of global reach, branding and quality standards.</td>
<td>Shih proposes the ‘Smiling Curve’ model of economic development, justifying investment in marketing and R&amp;D rather than traditional assembly.</td>
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<td>TSMC proposes an innovative disintegrated model, on the analogy of advanced Western hardware and software firms in the PC industry.</td>
<td>TSMC develops its ‘virtual fab’ concept, to justify long-term and close relationships with customers.</td>
<td>Chang promotes relationship marketing – ‘marriage’ – as against opportunistic arms-length sales. He also promotes ‘independent professional managers’ in media.</td>
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<td></td>
<td>The hard disk drive companies’ notion of ‘full-settism’ finds little local acceptance and is dropped for traditional subcontracting overseas.</td>
<td>TSMC proposes steep learning curve in DRAMs to justify high initial capital investment.</td>
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<tr>
<td>Aggregating</td>
<td>Acer leads the creation of the Taipei Computer Association to manage copyright and cloning issues.</td>
<td>Shih is the founding chairman of BIPA, aimed at developing and defending Taiwanese brands.</td>
<td>Acer and UMC unite to create display giant AUO as a model of the ‘cooperative merger’.</td>
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<td></td>
<td>TSMC’s Chang holds simultaneous leadership positions in ITRI, the state innovation body, and UMC, Taiwan’s other top semiconductor company.</td>
<td>Taiwanese semiconductor industry forms TSAI to promote cooperation and innovation.</td>
<td>TSIA accuses the Americans of dumping DRAMs.</td>
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<td></td>
<td>The hard disk drive companies resist cooperation and merger in favour of traditional independence.</td>
<td>Chang leads Taiwanese consortium to buy Wyse Technologies in the USA.</td>
<td>Collective lobbying against state policy of ‘avoiding China’ for overseas investment.</td>
</tr>
<tr>
<td>Networking</td>
<td>Magtron locates apart. Acer hires senior IBM executive Leonard Liu, together with other ‘paratroopers’ from the USA.</td>
<td>Acer launches ‘21-in-21’ strategy in order to access overseas management and capital.</td>
<td>Shih is replaced by Italian professional Gianfranco Lanci.</td>
</tr>
<tr>
<td></td>
<td>TSMC hires GE’s James E. Dyke and develops close links with Philips and Intel.</td>
<td>TSMC joins the international Competitive Semiconductor Manufacturing project and the VSI Alliance.</td>
<td>Shih focuses on the Aspire Academy and iD Soft Capital to spread new practices in Taiwan.</td>
</tr>
<tr>
<td></td>
<td>The hard disk drive companies adopt traditional technology followership strategy via links to weak companies overseas.</td>
<td>TSMC hires TI’s Don Brook as president.</td>
<td>TSMC hires Thurov, Porter and Fiorina to main board.</td>
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</table>

USA helped Acer to learn new managerial practices (e.g. the IBM way and profit centers) and build new relationships internationally.

6.1.2. TSMC in the semiconductor sector
With his Stanford education and American career, TSMC’s founder Morris Chang was well-positioned to access ideas and resources from the wider world. However, he also acquired strong legitimacy in Taiwan itself. He had impeccable engineering credentials and, indeed, the Taiwanese government had originally invited him from America to take leadership roles in the key Industrial Technology Research Institute (ITRI), where he was president (1985–1988) and chairman (1988–1994). Chang’s trusted position is reflected in his frequent reference to the Confucian ideal of fidelity embodied in his original Chinese name and a 2004 survey of Taiwanese business people placed him highest in the country for personal integrity (Ip, 2008). In terms of skills, Chang is widely regarded as a good communicator with a commanding presence (he is known as ‘Marshall Chang’) (Yang, 1998). None the less, Taiwan’s traditional business groups refused to support the early TSMC with long-term capital investment, and the government took a smaller stake than in the integrated semiconductor company, UMC. Chang compensated through, in our terms, framing, aggregating and networking.
Shih or Chang. Overseas experience; and none had the engineering credentials of part of traditional personally controlled conglomerates; none had entrepreneurial track-record since leaving Mitac, a prominent com- degree in electrical engineering from a Taiwanese university and an placed was probably Zentek's Chien-Tou Tseng, with a Masters. However, his business background was car dealership. The best- adjunct professorship position at National Tsing Hua University. Chang was connected by marriage to the Taiwanese President's in pesticides rather than high-technology. Greenery's Yu-Cheng wan's HDD manufacturers. The heads of the three major local firms elaborated work with Intel's engineers, in 1988 TSMC won Intel as its first major customer. 6.1.3. Failures in hard disk drives (HDDs) Less successful in overcoming institutional constraints were Tai- wan's HDD manufacturers. The heads of the three major local firms were generally not as well-positioned institutionally as Acer's Shih and TSMC’s Chang. Magtron’s Chairman, Cheng-jie Lou, had fin- ished his education at junior high school and his business group was in pesticides rather than high-technology. Greenery's Yu-Cheng Chang was connected by marriage to the Taiwanese President’s family and, with an engineering background, he would gain an adjunct professorship position at National Tsing Hua University. However, his business background was car dealership. The best- placed was probably Zentek’s Chien-Tou Tseng, with a Masters degree in electrical engineering from a Taiwanese university and an entrepreneurial track-record since leaving Mitac, a prominent com- puter company, in the early 1980s. All three entrepreneurs were part of traditional personally controlled conglomerates; none had overseas experience; and none had the engineering credentials of Shih or Chang. Framing for Taiwan's hard disk drive sector relied heavily on the Taiwanese government’s notion of ‘full-settism’ (Fuller, 2002). Tai- wan was successful in PCs, monitors and key-boards; full-settism implied that Taiwan should complete the set by also leading in hard disk drives. HDDs accounted for around one third of the cost of a PC and imports were soaring. The government’s ITRI provided substantial technological support to completing the full-set, with at one point a team of 80 working on HDDs. But the leading Taiwanese PC firms were not persuaded; almost all Taiwan’s HDDs would go for export. Aggregation strategies were no more successful. Zentek’s Tseng served on the board of the Taiwanese Computer Association and both Greenery and Zentek located in the Hsin-Chu Science Park. Magtron, however, located on a remote, cheap industrial park. ITRI tried to aggregate the emergent firms through first an industry club and then an alliance, but both failed because of perceived conflicts of interests. The government then offered incentives for Magtron, Greenery and Zentek to merge in order to achieve necessary scale, but the family owners preferred independence. This same prefer- ence for independence was demonstrated through the early 1990s when, as the pioneers closed down, investors chose to launch entirely new ventures rather than take over old facilities at dis- count prices. Networking overseas was unfortunate too. Magtron acquired technology from Century Data, an IBM spin-out which failed soon after, and then from Orca Technology, which failed in 1994. Zentek worked with Orca too, though it also attempted its own designs. Greenery teamed up with Rodime, which was forced out of the business in 1991. Magtron closed HDD production in 1992, Greenery in 1993 and, despite state aid, Zentek in 1994. Meanwhile, the major American HDD firms were investing in Singapore, where the government was not focused on creating an autonomous industry of its own. Only two minor American players, Piam and Microscience, operated in Taiwan, and they were weakly integrated into the Taiwanese IT industry. By the early 1990s, Singa- pore accounted for 40–50% of HDD world production (McKendrick et al., 2000). 6.2. Diffusing the professionalized form, 1991–1997 During the 1990s, both Acer and TSMC continued to grow, while their influence diffused throughout the Taiwanese IT industry as they generated imitators and spin-offs. Framing, aggregating and networking all remained important. 6.2.1. Expansion in PCs In this period, Shih framed Acer’s strategy in terms of the ‘fast-food’ model – cheap, standardized and branded. Shih insisted though that his products were ‘fresh’, making use of the latest technologies. He also framed the company as a national champion, a Taiwanese IBM or Sony. As such, the firm’s 300 compulsory redundancies of 1991 required careful treatment, as they offended traditional Taiwanese norms of personal loyalty. Acer presented itself in the garments of the new organizational form, framing these redundancies in the professionalized language of corporate ‘re-engineering’ and best practice ‘benchmarking’. In professional mode, Shih even offered his own resignation to his board. These framing strategies helped win political resources: for example, a government-owned bank intervened during the financial crisis of the early 1990s, and two Acer-related companies were approved for floating on the state-controlled stock-market in 1996. Acer’s aggregating strategies helped spread the new professionalized model through the Taiwanese PC sector and into the adjacent scanner sector. As founding chairman of ‘Brand Interna- tional Promotion Association’ (BIPA) in 1989, Stan Shih promoted own-branding by domestic players, rather than traditional OEM contracting. BIPA’s encouragement of branding extended beyond the PC makers, for example, to the Taiwanese scanner sector whose 20 companies had a global market share of 70% by 1997. Umax, a leading scanner firm, introduced its own-brand of Macintosh-compatible PCs in 1996 (Dedrick and Frazer, 1998). The commitment to a new image was also seen in BIPA’s collective actions against Tandy (a US PC firm) for its misleading advertise- ments about Taiwan-made PCs. BIPA led too in defending against ‘name-jacking’ by Chinese firms, which were borrowing increas- ingly respected Taiwanese brand-names for use in their domestic markets. Acer’s managerial professionalism was increasingly imi- tated, most prominently by Asus, the notebook pioneer founded by four former Acer R&D engineers in 1990 which became Taiwan’s top global brand by 2007. Many of Asus’s practices followed those of Acer: for example, managerial appointments based on perfor- mance rather than seniority and the adoption of an employee stock bonus plan. Acer’s networking strategy confirmed the company’s open- ness to external capital and managerial resources. In 1994, Shih launched the ‘21-in-21’ strategy: i.e. 21 partly owned-subsidiaries by the 21st Century. International distributors were compared to fast-food franchisees and encouraged to take equity stakes in regional business units. These in turn were encouraged to assemble
6.2.2. Growth of semiconductor foundries and entry into DRAM production

During the early-to-mid 1990s, the Taiwanese semiconductor producers were making heavy investments in both semiconductor foundry and related DRAM (memory) capacity. In a context where high investment had traditionally been suspect, these investments needed justification. Chang was able to frame the new DRAM business as simultaneously a way to match the needs of Taiwan’s PC firms and as a natural extension of TSMC’s effectiveness in capital intensive, high-reliability operations. According to him, the DRAM sector demanded large up-front investments on account of its 70% learning curve (a doubling of volume drops costs by 30%). TSMC also gave its disintegrated model a contemporary air with the concept of the ‘virtual fab’. This framing confirmed TSMC as more than a traditional subcontractor: it would be as responsive and confidential a fabrication facility as a customers’ own.

In terms of aggregating, the clustering of semiconductor businesses from various fields – including packaging, testing, and design – in Hsin-Chu facilitated cooperation and alliances. 1996 saw the creation of the Taiwan Semiconductor Industry Association (TSIA), which Morris Chang would later chair between 2001 and 2004. The growing willingness to cooperate under Chang’s leadership was seen when he led a consortium of Taiwanese firms in the acquisition of Wyse Technologies, a Silicon Valley computer terminal firm: Chang then served as chairman of the jointly owned acquisition.

The semiconductor firms continued to network with global leaders for access to leading technologies and management. For example, membership of such international technology alliances as the Competitive Semiconductor Manufacturing project and the VSI Alliance (virtual socket interface: research consortium) provided TSMC with access to world-class best-practices (Mathews and Cho, 2000). Networking in the form of technology transfer agreements with Oki Electric of Japan and Siemens of Germany helped Mosel (a DRAM producer) float 37% of its Asia-Pacific distribution business on the Singapore stock exchange.


By the late 1990s, the professional organizational form was widely diffused in both the PC and semiconductor sectors. As professionalism became the dominant model in a successful IT industry, its influence spread more widely. Thus framing, aggregating and networking strategies not only entrenched the form within its home sectors, but legitimated it within the Taiwanese innovation system as a whole.

6.3.1. PCs and the extension of professionalism

From the late 1990s, Taiwanese computer and peripheral manufacturers increasingly asserted their national identity in terms of technological advance and marketing sophistication, rather than the traditional focus on assembly. Thus Acer’s Stan Shih framed the declining importance of assembly and the increasing importance of technology and marketing in terms of a ‘Smiling Curve’: this curve showed the value-added to a product at each part of the value chain, with high value-added in the initial R&D, low value-added in the middle-part of assembly, and again high value-added in the final activities of marketing and distribution. Shih’s ‘Smiling Curve’ model was widely adopted within Taiwanese business to justify an accelerating shift from assembly (Chen, 2004). In 2000, Acer spun off its manufacturing into the separate Wistron Corporation.

Aggregating in order to build critical mass remained important too. Notable examples included Elitegroup’s acquisitions of the notebook producer Alpha-top, the computer division of Tatung and the notebook subcontractor Uniwill, and the acquisition by Foxcom of four computer peripherals firms, including a spin-off of Acer. Acer itself undertook an innovative merger in 2001 between its display business and UMC’s in order to create AUO, the world’s second largest manufacturer. Robert Tsao, UMC’s chairman – and, like Shih, a graduate of National Chiao Tung University – described AUO as a ‘cooperative merger’, with neither partner having overall control and top management positions shared between the senior managers of the two original companies. This kind of merger by exchange of shares was very unusual in the Taiwanese context and was an option that the HDD players had resisted even under extreme duress. Tsao proposed such cooperation, as against individualistic competition, as a new model for Taiwanese business in the future (China Times, 14 March, 2001, p. 1). Acer built scale in America too: having bought TI’s notebook division in 1997, Acer spent $710m. on Gateway in 2007. Acer’s networking combined both continuity and significant change. The company’s new strategy of ‘3-One and 3-Multiple’ extended aspects of its ‘21-in-21’ strategy. ‘3-One’ refers to one company, one brand and one global team, whereas ‘3-Multiple’ refers to multiple vendors, multiple products and multiple channels. As before, Acer was harnessing the resources of many international partners, but now trying to achieve greater coherence in marketing worldwide. Acer was still bringing in professional managers from overseas and Stan Shih’s retirement in 2004 brought the promotion to company president of an Italian, Gianfranco Lanci, originally from TI. Shih’s retirement marked a significant new orientation. Shih explained it in outward-looking terms, as an opportunity to ’leverag[e] all of my experience, not limited to Acer and not limited to Taiwan’ (Business Week, 2004, p. 62). Shih was particularly concerned to spread his professional model. He had already created the Aspire Academy, an open college for executive training, and had been a policy adviser to the Taiwanese president from 2000. In 2004, Shih established iD SoftCapital, an investment and consulting firm, which he encouraged many of the other Acer senior managers of his generation to join. He also became a close adviser of Yu-Lon Motor, a traditional family-owned business group, in its transformation into an own-brand manufacturer. Shih’s networking was no longer focused on his own business, but aimed at shaping other industries in the Taiwanese innovation system.

6.3.2. The spreading influence of semiconductors

Now a dominant player, TSMC increasingly framed the pure-play foundry business in terms of relationship marketing rather
than Taiwan’s traditional focus on manufacture. Receiving the Fabless Semiconductor Association’s 1999 Exemplary Leadership award in California, Morris Chang told the industry that the relationship between fabless designers and foundries should be ‘a marriage made in heaven’ (Murphy, 1999). Chang also offered his experience at TSMC as a model of managerial professionalism. For example, in 2007, he edited a special issue of the leading Taiwanese business magazine where he introduced the concept of ‘independent professional managers’, emphasizing not only professionalism but also autonomy from owners (Chang, 2007). More widely, the growing Taiwanese semiconductor design industry increasingly used its own technology road-mapping to frame its future. Thus Mediatek exemplified this new technological and professional self-confidence with its roadmap of turnkey solutions for partners in the wireless handset industry, especially Chinese vendors, all dressed up in the fashionable frame of ‘disruptive innovation’.

In terms of aggregating, in 1999 TSMC had acquired WSMC (Worldwide Semiconductor Manufacturing Corporation) and TI-Acer Semiconductors in order to accelerate the building of critical mass. Cooperative aggregation also remained important in contests with international rivals over alleged predatory practices. For example, the Taiwanese cooperated under the TSIA to fight a case of dumping DRAM chips brought by the US chip-maker Micron in 1997. In 1999, the TSIA reversed the usual order by suing the Americans for dumping DRAMs in Taiwan. The semiconductor firms also aggregated to resist domestic political pressures. In the area of overseas investment, for example, TSMC and other large firms organized to contest the state’s policy of ‘avoiding China’, resulting in the building of an 8-inch wafer foundry in China in 2002. This collective success in influencing government agencies confirmed the professional semiconductor firms as a force to be reckoned with, far from simple clients of the state.

Semiconductor firms continued to network by bringing in business professionals from around the world to reinforce the new organizational form. TSMC’s board of directors and supervisors included Sir Peter L. Bonfield (former CEO of British Telecommunications), Lester Thurow of MIT, Michael Porter of Harvard, and Carleton Fiorina, former chairman of HP. Other firms that followed TSMC in introducing external board members from overseas included Acton (a computer peripherals maker), EDTC (a display firm) and HTC (a cell-phone maker). Again, networking was increasingly about influence beyond the boundaries of semiconductors. Thus Morris Chang joined the board of Yuan Ze University, which was created and owned by the Far Eastern family business group, and was also a policy adviser to the Taiwanese president from 2000.

7. Discussion

This paper addresses how entrepreneurs can transcend the institutional constraints of their national innovation systems in order to create new organizational forms. Our case analysis has shown that the Taiwanese PC and semiconductor firms proactively used a mix of F.A.N. strategies to inspire, legitimate and resource their adoption of the professionalized organizational form, a transformation with increasing implications for the national innovation system at large. The success of Taiwanese PC and semiconductor firms required not only economic and technological initiatives, but cognitive and social strategies through the shaping of new frames, the aggregation of local players and external networking to access new ideas and resources, particularly from overseas.

The contrasting failure of the HDD players underlines the importance of institutional resources and skilful agency in the creation of successful new organizational forms. Acer’s Stan Shih (creator of the first Taiwanese calculator) and TSMC’s Morris Chang (Stanford PhD and TI veteran) had high levels of engineering credibility that the heads of these HDD firms could not match. Each was well-placed to translate between the American and Taiwanese systems. Chang had headed the government’s ITRI, while continuing links with the American industry; Shih had enduring links with American firms such as TI, while also being celebrated as one of Taiwan’s ‘Ten Outstanding Young Persons’. Both had the social skills required to engender cooperation, mild-mannered Shih as a self-declared broker and facilitator and Chang combining communication skills with a high reputation for personal integrity. Chang through his American career, and Shih through experience of Taiwanese family business failure, were equally committed to developing a new model of business. By comparison, the leaders of the HDD firms appeared less well-resourced, less skilled and less committed to change. Their F.A.N. strategies suffered characteristic problems. In terms of framing, their ‘full-settism’ found no resonance with the local market. Aggregation was undermined by the personal interests of each individual firm. The HDD firms embeddedness in the traditional Taiwanese system reinforced their networking with weak international players. Here state intervention and political connections did not compensate.

The differential outcomes of framing, aggregating and networking in the PC, semiconductor and HDD sectors lead us to our initial baseline proposition:

Proposition 1. Institutional entrepreneurs that skillfully use a mix of framing, aggregating and networking strategies are more likely to create new organizational forms within their national innovation system.

The remainder of this section develops from this baseline a number of focused propositions that together provide a more dynamic model of framing, aggregating and networking capable of informing future research and policy-making.

Our account suggests that new organizational forms such as Taiwan’s professionalized IT emerge, diffuse and become legitimated over long periods of time. In this timeframe, the Taiwanese experience indicates that the character of F.A.N. strategies is liable to shift – notably from introversion to extraversion, from inward-looking to increasingly outward-looking (see Table 4).

Thus framing in the Taiwanese case appears to move from the defensive justification of new ventures towards increasing generalization of successes beyond original contexts. For example, Stan Shih’s framing dropped the patriotic heroics of the Rampaging Dragon, instead increasingly emphasizing the general model of economic development, relevant even outside Taiwan, embodied in the notion of the ‘Smiling Curve’. Likewise, industry statesman Morris Chang conceived the relationship between international fabless design companies and their foundry suppliers as a ‘marriage’, and urged his model of ‘independent professional managers’ on compatriots. On the basis of this experience, we offer the following general proposition:

Proposition 2. In addressing problems of institutional constraints and form innovation, over time framing moves from the justification of personal ventures to generalization beyond the specific context or system.

Aggregating similarly seems to shift from a remedial strategy (i.e., to compensate for the lack of resources at the beginning of firm development) to a more proactive, externally reaching one (e.g. to eliminate rivalry, extend market control and influence national policy). For example, lacking sufficient resources on their own, both Acer and TSMC in their early years relied heavily on such inter-firm linkages as local trade associations (e.g. TCA and TSIA), joint ventures and geographical clusters. Thus Acer aggregated ‘companions’ versus ‘nobles’, while TSMC’s Morris Chang held leadership positions in ITRI and UMC as well. Aggregation became increasingly proactive: for example, the semiconductor firms challenged
Table 4
A dynamic model of F.A.N. strategies.

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<thead>
<tr>
<th>Stage</th>
<th>Innovation</th>
<th>Diffusion</th>
<th>Legitimation</th>
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<tr>
<td>Evolving</td>
<td>from introversion to extraversion</td>
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<td>Focus of</td>
<td></td>
<td>from justification to generalization</td>
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<tr>
<td>F.A.N.</td>
<td></td>
<td>from remediation to proactiveness</td>
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<td>Networking</td>
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<td>from import to export</td>
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American rivals over dumping and the government over China policy. Both the Taiwanese PC and semiconductor firms also moved increasingly to aggregate through mergers and acquisitions, especially abroad. Accordingly, we offer our third proposition:

**Proposition 3.** In addressing problems of institutional constraints and form innovation, over time aggregating moves from a remedial strategy to a more proactive, externally reaching one.

Finally, entrepreneurial networking strategies appear to move from predominantly the import of technologies, ideas and talent to a greater emphasis on export to the rest of the national innovation system. For example, in the early stage, access to such resource-rich organizations as ITRI and Philips and such professional managers as Liu, Lanci and Brook helped Acer and TSMC go beyond the limitations of their immediate institutional context and introduce new ways of managing. Once successfully established, however, both Acer and TSMC became models for others to follow. Thus Stan Shih established iD SoftCapital and helped the family business Yu-Lon with branding; TSMC’s professionalized finance model (e.g. the issue of ADRs) spread throughout the Taiwanese IT industry; and both Stan Shih and Morris Chang became policy advisers to the state. Our fourth proposition therefore is:

**Proposition 4.** In addressing problems of institutional constraints and form innovation, over time networking moves from predominantly the import of ideas and resources to increasing export to the rest of the national innovation system.

8. Conclusion

This paper began with the challenge of transcending the limits of self-reinforcing national innovation systems. It is easy for firms to get trapped by local fit into globally uncompetitive positions. We have introduced the notion of institutional entrepreneurship in order to incorporate within the national innovation systems perspective the potential for agency in the form of endogenously driven change. Institutional entrepreneurship helps explain the professionalization of the Taiwanese PC and semiconductor sectors by placing the focus on the framing, aggregating and networking strategies of well-positioned and socially skilled entrepreneurs such as Stan Shih of Acer and Morris Chang of TSMC. As these strategies evolved over time from introversion to extraversion, the influence of such entrepreneurs contributed to the professionalization of the national innovation system as a whole.

The emphasis here is on the skilled and creative agency of entrepreneurial firms. Far from fitting established templates, Acer and TSMC pursued risky strategies that ran against key aspects of the traditional national innovation system. Acer experienced 3 years of losses, while TSMC faced the skepticism of Gordon Moore. The state was often supportive of these strategies, but this was not the decisive factor. Policy was sometimes inconsistent with sectoral interests (as in the case of ‘avoiding China’) and state initiatives were not sufficient on their own, especially where firms clung to the old model of independent family business (as in the case of HDDs). Without the choices and energy of institutional entrepreneurs, Taiwan’s IT industry could easily have stuck with the traditional familial organizational form, just as Hong Kong’s industry more or less chose to do.

This incorporation of institutional entrepreneurship helps resolve Lundvall’s (2007) structuralist problem of insufficient agency within the national systems of innovation perspective. Institutional entrepreneurship recognizes the non-trivial constraints exerted by national systems, as exemplified by the HDD sector. However, it brings as well an appreciation of how entrepreneurs such as Stan Shih and Morris Chang can make skillful use of plural institutional resources in order to re-structure the systems in which they are engaged. Both Shih and Chang drew resources from the Taiwanese innovation system in which they were embedded, at the same time as battling its constraints and translating new ideas and resources from outside. In short, the concept of institutional entrepreneurship carries a respect for domestic institutions entirely consistent with the national innovations systems framework, but extends that framework by recognizing both the potential for skilled agency on the part of certain actors and the plurality of the institutional resources on which they may draw.

Institutional entrepreneurship can also extend the policy repertoire for those working from within a national innovation systems
perspective. Institutional entrepreneurs promise a double benefit: not only the transformation of their own industries but by imitation, spin-outs, personnel movements and advice—the reshaping of other parts of the national innovation system as well.

For government policy-makers wishing to transcend national system constraints, the entrepreneurial capacity for system-breaking change should move centre stage. Here we spell out four specific implications of the F.A.N. strategy framework. First, policy is not simply economic and technological but also cognitive and social. If they are to persuasively re-frame what is possible within a system, institutional entrepreneurs should be encouraged to use the media and public platforms in order to disseminate their new models and assemble support: Stan Shih is a model for this. Second, aggregation strategies require support in order to achieve early the self-reinforcing momentum of critical mass. In particular, where markets are already dominated by large overseas players, domestic competition concerns may need to be relaxed: such multiple roles as Morris Chang’s can be an advantage. Third, cosmopolitan network strategies should not be smothered by nationalistic insularity. Governments should seek out precisely those entrepreneurs with loose ties, and value their willingness to import foreign models, employ foreign managers and form international alliances. Finally, policy-makers should harness the potential for endogenous change to extend beyond the specific industries in which it originates. Institutional entrepreneurs such as Stan Shih and Morris Chang can be enrolled as agents and models of change with influence throughout the innovation systems in which they are embedded.

It is important to recognize that our analysis is subject to the limits of a single case study, albeit one with internal comparison. As a relatively small, culturally integrated and politically centralized state, Taiwan is also a particular, and tough, environment for endogenous change. Moreover, the IT industry is a highly dynamic one, where, although slow-movers can easily be left behind, at least pressures for change are highly visible. Our findings are therefore unlikely to generalize in simple fashion to larger, more pluralistic countries or to less dynamic industries. We need more research on other industries and nations, focusing specifically on the entrepreneurial strategies involved in transcending self-reinforcing national innovation systems; equally, we need research on government policies facilitating such strategies. Particularly instructive will be more cases of failure to set alongside particular instructive will be more cases of failure to set alongside more pluralistic countries or to less dynamic industries. We need more research on other industries and nations, focusing specifically on the entrepreneurial strategies involved in transcending self-reinforcing national innovation systems; equally, we need research on government policies facilitating such strategies. Particularly instructive will be more cases of failure to set alongside more pluralistic countries or to less dynamic industries. We need more research on other industries and nations, focusing specifically on the entrepreneurial strategies involved in transcending self-reinforcing national innovation systems; equally, we need research on government policies facilitating such strategies. Particularly instructive will be more cases of failure to set alongside.

To conclude, the incorporation of institutional entrepreneurship can break the circularity of national innovation systems. We propose that framing, aggregating and networking strategies can help both entrepreneurs and policy-makers transcend their institutional constraints and create new, more effective organizational forms. In the hands of skilled well-organized, institutions can enable as well as constrain system change.

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