Technology Transfer and Hong Kong's Telecommunications Equipment Manufacturing Sector

John Ure[1]
director of the Telecommunications Research Project
Centre of Asian Studies and School of Business
University of Hong Kong

The brief was simple. Go forth and examine how much technology transfer is taking place in Hong Kong's manufacturing of telecommunications components and equipment. Then come back with an article for the December issue of the bulletin. I had been pleased to accept the invitation to join the Telecoms Advisory Panel of the HKITC, and willing to undertake public service to help identify the issues that will become increasingly important to Hong Kong's future. My special focus over recent years had been on networks and services, policies and regulations, not on the equipment manufacturing or supply side. This seemed like a challenge that could not, should not, be turned down. But in such a short time, how to collect the data, do the interviews, achieve the perspective? The result, inevitably, is no more than a first-cut at an important subject. It is an appeal for help, for assistance from the industry in helping me, and the HKITC, and other bodies, to continue this research. What follows is a short summary of a small survey of a tiny part of Hong Kong's industry; but from small acorns large oak trees grow.

Telecommunications Manufacturing in Hong Kong

Hong Kong is a small place, so even heavy usage of telecommunications within Hong Kong would not be sufficient to create a substantial market for components and equipment, yet in 1995 Hong Kong exports of telecommunication were around US$4 billion, or 8 per cent of Hong Kong's total electronics industry exports. This is not small, and has the potential to be much larger. Cordless and mobile telephone handsets are the largest item on the list as the following table makes clear. But wired telecoms equipment also represents a substantial export volume and revenue.

Table 1

Product	***Proportion of exports***
Cordless and mobile telephones	39%
Corded telephones	19%
Parts for corded phones and other wired communications equipment	14%
Fax machines	9%
Modems	6%

[1] For their assistance with this research I wish to thank my research students, Mr Kwok Man Wa and Ms Jade Tam, and research officer Ms Jenny Wan.

TV cameras	4%
Radar and remote control for TVs and video cassette recorders	3%
Pagers	3%
Others	3%
Total	100%

Source: *TTC News* (Sept. 1996) Telecommunications Technology Centre

Hong Kong has seen its own markets boom. In June-July 1996 the number of cellular mobile telephones in use in Hong Kong passed the one million mark, a compound annual growth rate of over fifty-five per cent for the past five years. The number of pagers in use has doubled over the past five years, now standing at well over one million. Hongkong Telecom connected around 100,000 faxline in 1990 and now supplies three times that number, with many more telephone lines having fax machines attached. Across the border China has already reached nearly eight million cellular mobile telephones in use, and has raised the Ninth Five Year Plan target for 2000 from 18 million to 25 million. China forecasts 67 million pagers by 2000 and 123 million telephone sets in use. As in Hong Kong, all these forecasts are likely to be under-estimates.

These growth rates are being replicated throughout Asia, North and South America, East and West Europe and the Middle East. Only Africa, with its own problems, is being left behind, although in the new South Africa the demand is there. However, the speed at which the technology changes in both substance and design puts a premium upon creative, flexible and innovative manufacturing. Hong Kong's potential to benefit is enormous, yet according to the Telecommunications Technology Centre only 42 establishments registered in Hong Kong are manufacturing telecommunications equipment, employing 2,171 people within the territory - and many more on the Mainland. This may under-estimate because some companies could be producing communications equipment while their main activity places them in a different category of the electronics industry. According to the Electronics Industry Association's figures 58 establishments in 1994 produced television receivers and communications equipment, another 41 produced radio equipment. Excluding electronic watches and clocks, there were 803 establishments in the electronics industry recorded under the Hong Kong's Standard Industrial Classification (HSIC). One of the first tasks of future research is therefore to identify more accurately the nature and range of the telecommunications equipment segment within this sector.

The Survey

Initially thirty-six small and medium-sized (50 - 400 employees) telecommunications equipment manufacturers were identified. Each was mailed a seven question questionnaire. The questions asked the firms to classify themselves according to activity (manufacturing, product design, and research and development) and whether or not they had introduced innovations over the previous eighteen months. They were then asked the source of the innovation by means of acquisition (inhouse, bought-in, joint venture, inclusive licence, franchise, distribution agent) and by partnership (foreign, Hong Kong

or China company). [2] The firms were then asked to name the innovations, name their principle business activity, the number of employees in Hong Kong and China, and the proportion of their total revenue that derived from telecommunications products.

Twelve of these thirty-six questionnaires were returned. Additional questionnaires were then sent to a further thirty-two firms, although it appeared that most of these were vendors rather than manufacturers. Three returns were received from this second mailing. One additional questionnaire was completed by telephone. Thus the total number of returns was sixteen from sixty-eight mailed out. Follow-up telephone calls were then made to six of the companies returning questionnaires, but only one was successful.[3] Finally, a number of other interviews took place of people involved with the industry.

Seven of the sixteen returns had not innovated over the past eighteen months, and these returns were discarded. Also discarded was one 'did not know'- the one obtained by telephone. Eight returns were valid and indicated innovation over the past eighteen months.

Summary of Findings

The findings are summarized in the following Charts 1 to 10. Obvious though it is, it needs to be stated explicitly that the sample size does not permit any hard and fast conclusions to be drawn about the nature of technology transfer, of the process itself or the conditions under which it takes place and the influences upon it. The data cannot be more than suggestive, throwing up some questions for further research.

Chart 1 shows the breakdown by activity of the companies answering the questionnaire. Nine (47 per cent) were involved in all three areas (manufacturing, product design and R&D) and clearly research and development is the least undertaken activity, although over sixty per cent of the sample claimed to be involved. Another finding was that companies engaged in all three activities have introduced innovations in at least one of the three areas: product research, product design and product manufacturing.

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[2] The questionnaire was kept to a minimum to increase the likelihood of it being answered and returned. Ideally, a wider range of questions need to be investigated, but interviews may prove to be more effective.

[3] The other respondents were all out of Hong Kong during the telephoning period. The major constraint was the time available before the deadline for this article.

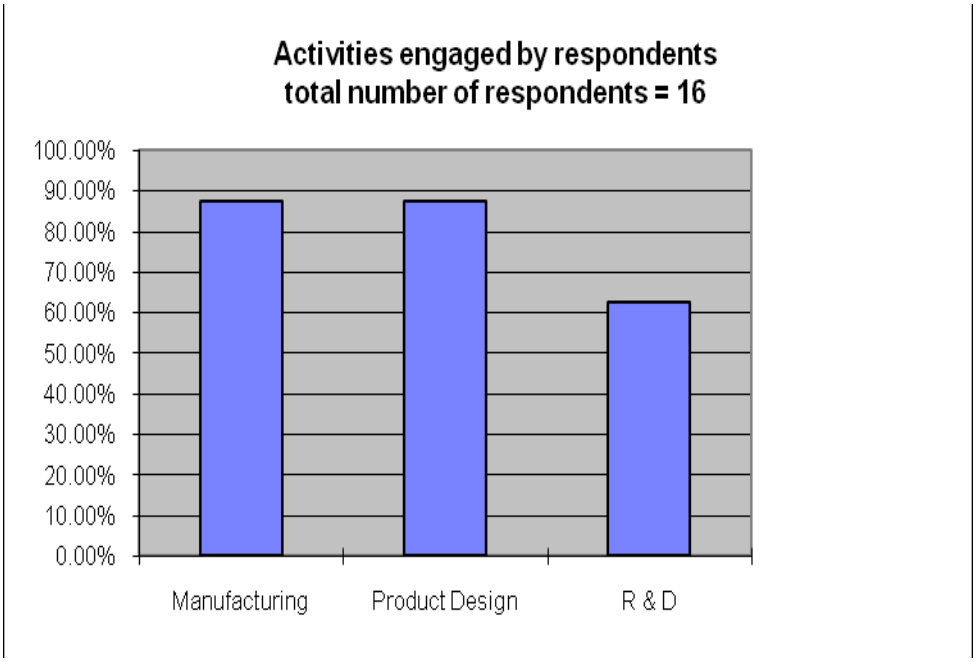
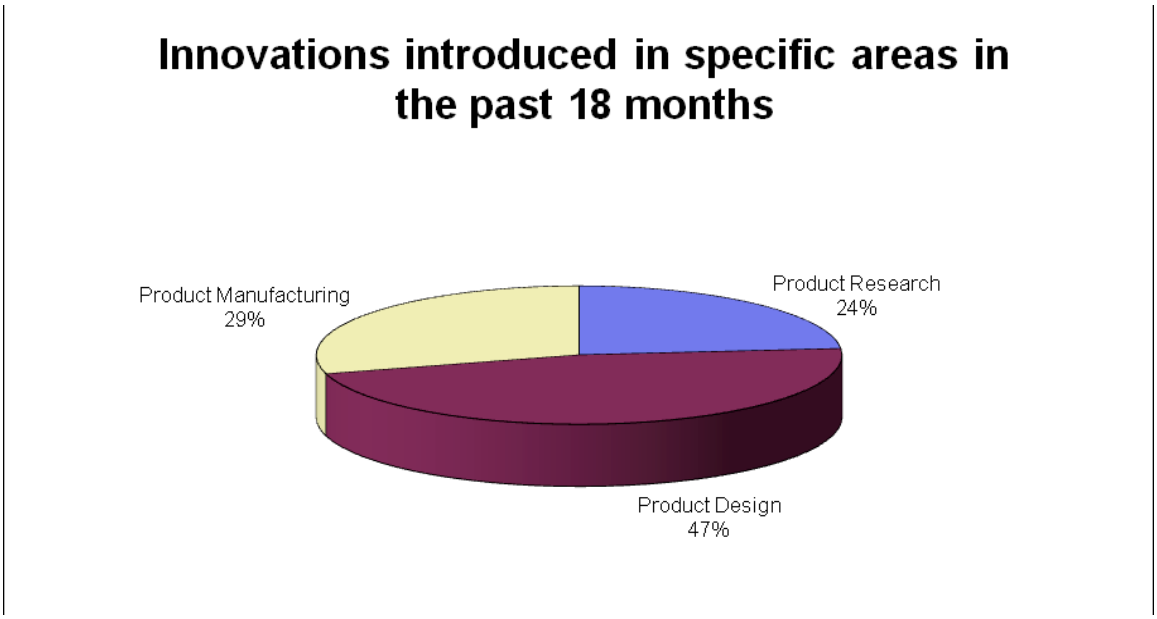
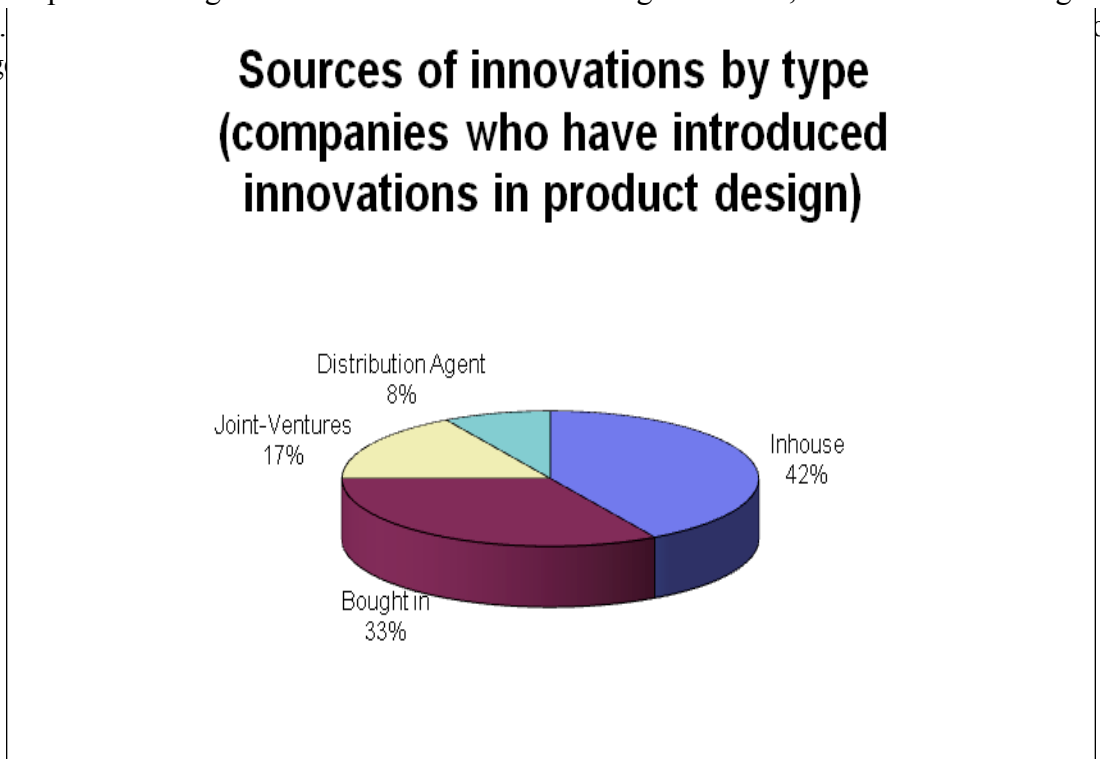


Chart 2 shows that innovation in product design is by far the most prevalent type of innovation in Hong Kong, while innovation in R&D is less common.

CHART 2



Most product design innovation is inhouse according to Chart 3, but one-third is bought-in. [illegible] on ag



Bought-in becomes more important as a source of innovation in manufacturing, as shown in Chart 4, and joint ventures are more important than in the other two activities.

CHART 4

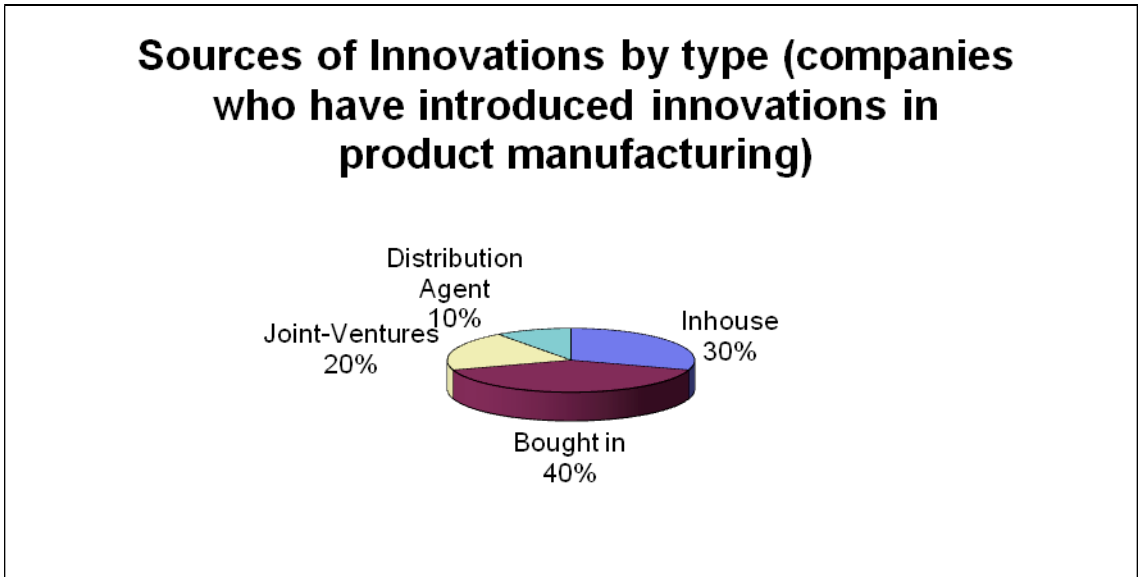


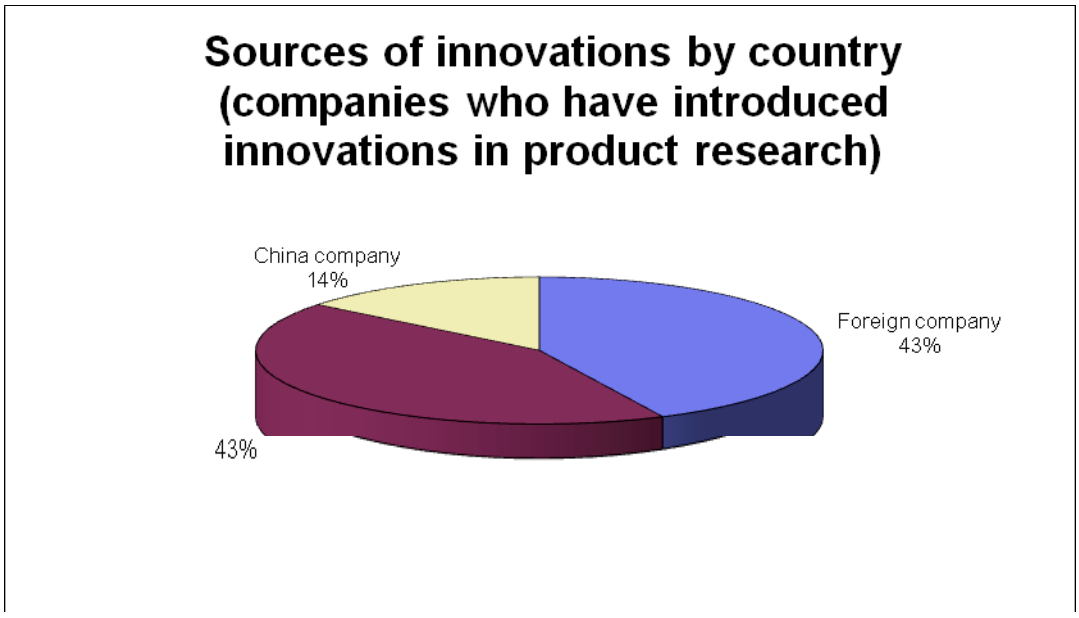
Chart 5 indicates that in-house is the dominant source of product research, and again bought-in is important. Distribution agency is also more important here than in the other two cases. Research, like manufacturing, can be at the high-tech end, and where it is it is

intuitive to assume that buy-in or agency arrangements would dominate. Lower-end research, which involves less finance and less commitment of human capital, may well be in-house. Further research would need to define more clearly these categories. At this stage it is guesswork and speculation.

CHART 5

According to Chart 6, the country origins of product research innovations split evenly between Hong Kong and foreign companies, inhouse presumably belonging to the former and the bought-in, joint ventures and agency arrangements primarily involving the latter. One in seven originate with China companies.

CHARTS 6



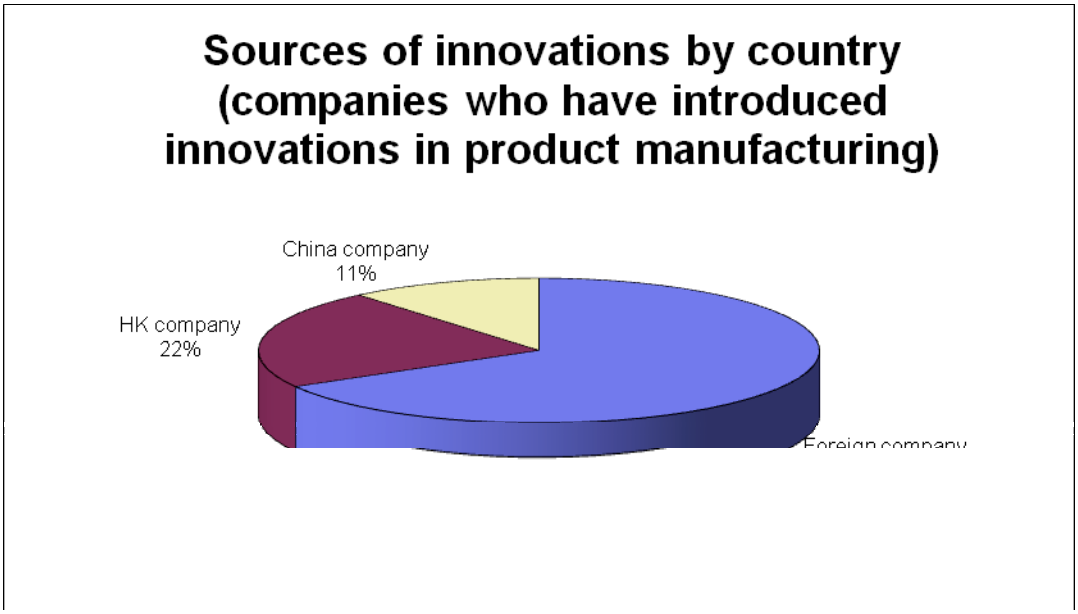
By contrast, Chart 7 shows that foreign companies are more heavily involved in product design innovation, nearly sixty per cent. If this evidence is sustained by further research, one explanation may be that most R&D in markets for items such as cellular handsets in done in Europe, Japan or North America and is protected. This could explain why distribution agency is slightly higher in the case of product research (14 per cent) than in manufacturing (10 per cent) or product design (8 per cent) - see Chart 3-5 above.

CHARTS 7 HERE

Chart 8 suggests that foreign companies are even more the source of manufacturing innovations, sixty-seven per cent. If we search for explanations that sound logical then we may speculate that manufacturing makes intensive use of sunk capital, something that Hong Kong manufacturers cannot afford to do or to risk. It would make sense for Hong

Kong's SMEs to rely heavily upon foreign companies with whom they have commercial agreements to be their source of manufacturing innovation.

CHARTS 8



Overall, inhouse (36 per cent) is the major single source of innovation in this small - and not representative - sample, followed by bought-in (29 per cent) as shown in Chart 9, but one-third of innovations come from joint ventures and distribution agency arrangements. In aggregate it therefore seems that *over sixty per cent of innovations were technology transfer.*

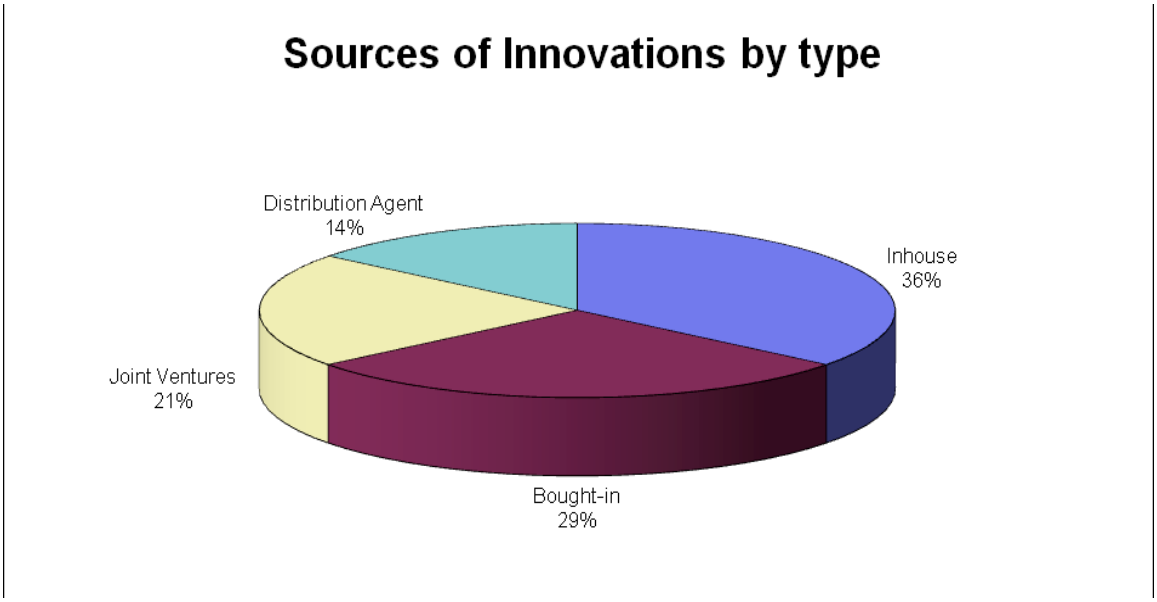
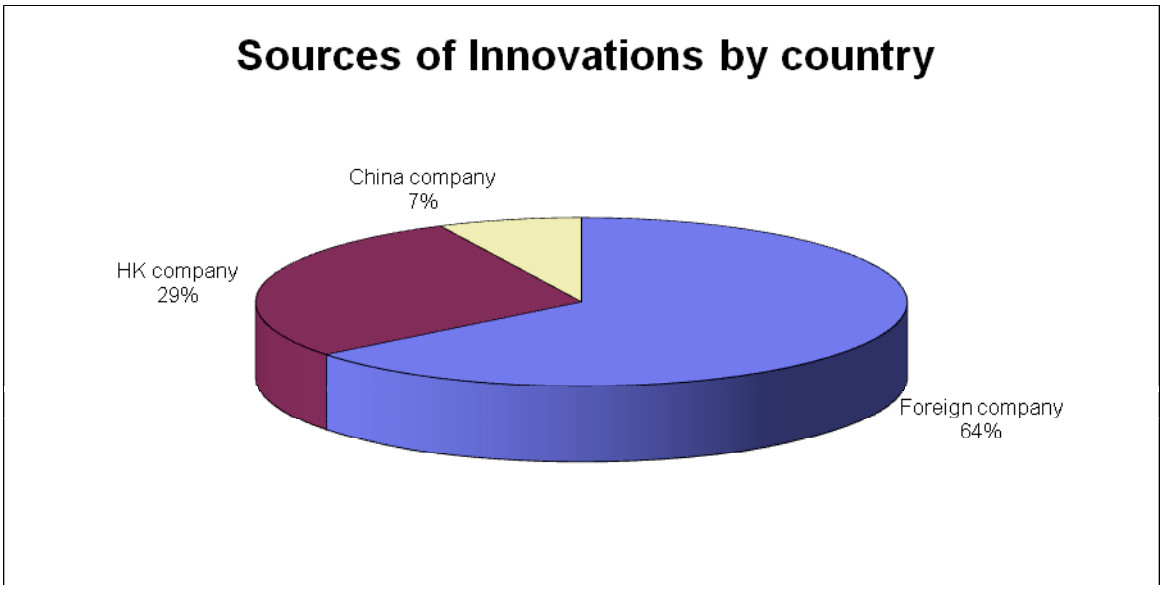


Chart 10 indicates a high degree of dependency upon foreign companies as sources of innovation, which further underscores the value in investigating the character of technology transfer. This supposition is supported by Charts 2, 3 and 7 which suggest that proportionally product design was the area of most innovation (47 per cent), that technology transfer was the most important source of innovation (58 per cent) and that foreign companies (excluding Chinese) were the key sources (59 per cent).

CHARTS 10



It would be helpful to be able to classify the nature of the innovations to see how far Hong Kong is developing a capability to generate its own high value-added products and to what extent it is dependent upon foreign companies and in which particular product or process areas.

It is perhaps not surprising that China is not generally the source of technology transfer, but as Chart 6 indicates China is the source of fourteen per cent of product research innovation. Speculation may suggest this reflects China's comparative strength in engineering research and development work, and in particular China is placing priority on building its capability in telecommunications products and technologies.

Enabling Innovation

Innovation is the life-blood of an industrial sector such as telecommunications. The technologies develop and shift so rapidly that the product cycle in sectors such as mobile telephones is often too short to secure a return on capital. Business and consumer markets are also evolving rapidly so that tastes and fashions change almost with the season. Innovations are required to cut costs - manufacturing or process innovation - to create new products - R&D - and secure markets - product design.

Hong Kong's approach to encouraging innovation and technology transfer is through bodies such as the Applied Research Council (ARC), the Telecommunications Technology Centre (part of the Productivity Council), the Industry and Technology Development Council (ITDC), the Vocational Training Council, the Trade Development Council, the University Grants Committee, the Quality Assurance Agency, the Industry Support Fund of the Industry Department, and of course the Hong Kong Industrial Technology Centre (HKITC). This is not an exhaustive list, and each of these bodies overlaps with the problem in different ways.

One of the interview findings was the problem of sources of capital to finance. This raises a question about the role of venture capital and the availability of funds generally. Some of the bodies mentioned above, for example the ARC, the TTC and the HKITC all have funds to assist, often providing up to seventy-five per cent of upfront R&D money. Systematic research is needed to look into these areas in greater depth.

Finally, the co-ordination of efforts and messages of these many bodies may also be an issue worthy of research. Individually they are actively promoting their services through seminars, workshops, exhibit opportunities, newsletters, and so on, and they have many successful cases to advertise, but do they form a critical mass? Is their message getting through? From the other side of the street, who are the would-be innovators among the small and medium-sized enterprises? What are their needs and what are the obstacles they face? Can those obstacles be removed through policy, or are they totally market issues?

Conclusions

From this very small survey it seems that technology transfer is indeed the major source of innovation in the telecommunications equipment manufacturing sector in Hong Kong. Interview evidence also suggests that sources of capital to finance innovations The small sample leaves unanswered the prior question: how much innovation really is taking place? The answer to this question is almost certainly fundamental to the long-term vitality of the sector, and to the service trades that are auxiliary to it - component suppliers, designers, packagers, and so on. The limited research outlined above is to be treated as a pilot project, and it is planned that the research can be taken a step further.