R&D Services and Global Production Networks: A Taiwanese Perspective

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1. Introduction

- **IT manufacturing is often considered to be high value-added, but this can be misleading, given the sector's vulnerability to sharp declines in price and narrowing profit margins. This can be particularly significant in light of the formation of global production networks. Hence, manufacturing muscle alone may no longer be deemed a sustainable comparative advantage. Such a perspective highlights the importance of intangible assets and their role in the knowledge-intensification of industry.**

- **The current paper examines the role of R&D services in the global production network in an international context. As a starting point, it is worth noting that, with only a few exceptions, the relevant literature remains country-centric despite the trend of R&D internationalization.**

- **We explore, from Taiwan's perspective, R&D network relationships in conjunction with the global production network. Our specific focus is on the international aspects of Taiwan's national innovation system. We aim to determine in what ways and to what extent the R&D facilities of MNCs in Taiwan and the overseas R&D of Taiwan-based firms interact with Taiwan's indigenous innovation capabilities in the broadly-defined IT industry. What do they mean to the global production network?**

- **The paper draws on two of our earlier research projects. The first concerns the R&D efforts of MNCs in Taiwan and the second addresses the R&D deployment, within China, of Taiwan-based firms. China is significant to this study because it has become the major host country for outward investment by Taiwanese IT firms. We argue that driven by the emergence of the global production network, R&D services have become essential to Taiwan's economic development, which means more than simply local R&D and innovation capabilities, but also the ability to leverage international R&D networks.**

2. R&D Globalization and the Developing World

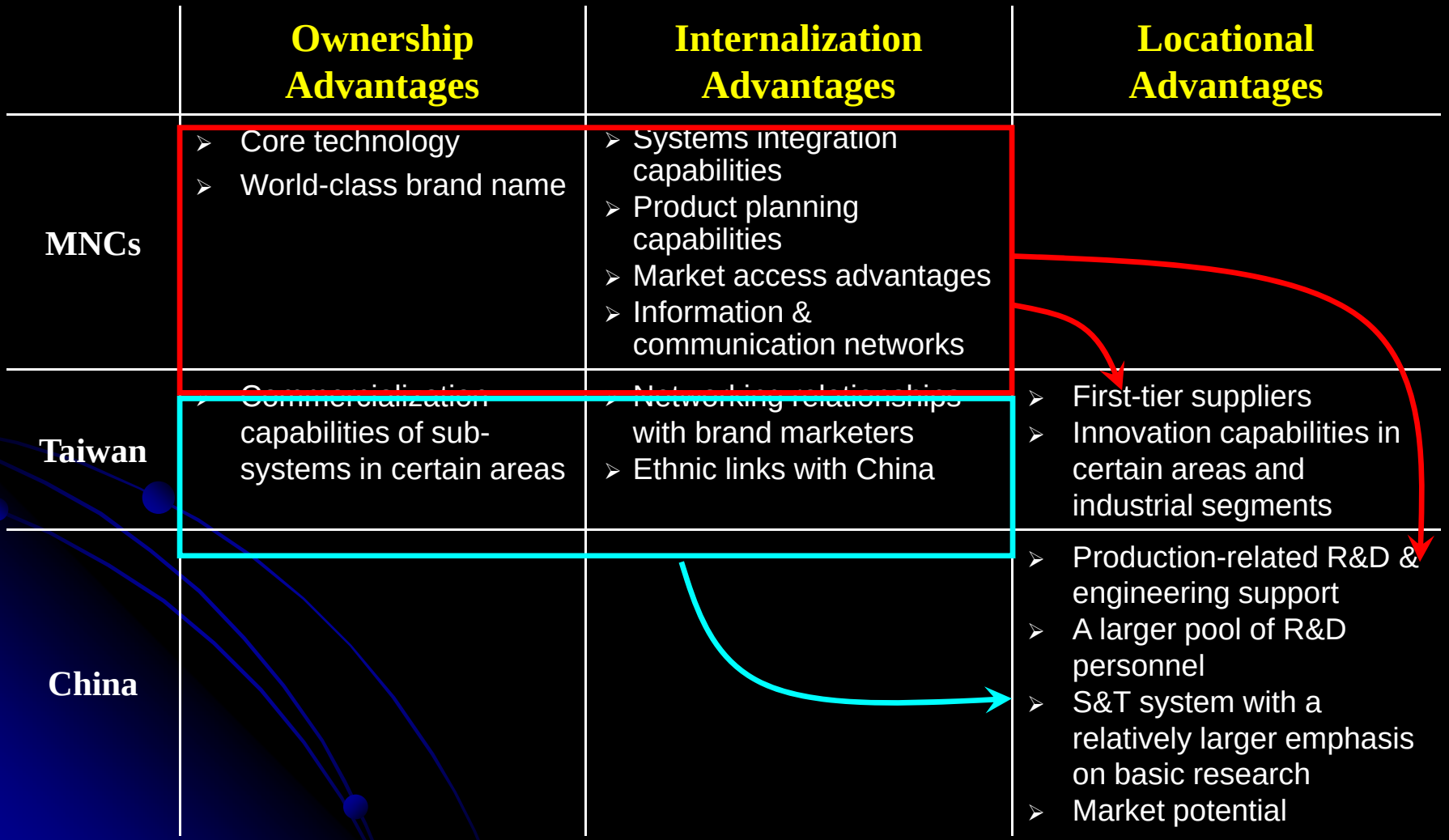
- **Technology and R&D are becoming increasingly globalized, bringing about the restructuring of the global innovation system and the global technology landscape.**

- **MNCs' R&D operations in the developing world are on the rise. MNCs face an increasing need to monitor and learn the new global trends and hence to engage in multi-sourcing of technology inputs, because of rising R&D costs, increasing demand for R&D personnel, and a shortage of R&D personnel in industrialized countries. Conversely, some developing countries have an abundant supply of R&D personnel or skills, particularly in 'non-core' R&D areas. This match of supply and demand has been facilitated by factors such as improved information and communication technologies, the flexibility of new technologies which allows de-linking of manufacturing and R&D, and the comparative advantages of developing host countries.**

- **For Taiwan, the essence of R&D globalization relates to such issues as how to tap and leverage the international knowledge pool.**

- **Our conceptual framework is based on Dunning's eclectic paradigm, with a strong flavor of the evolutionary approach to technology, while in some cases, allowing leap-frogging competition.**
- **Dunning's paradigm can be useful for analyzing the offshore R&D activities of MNCs if one interprets ownership, internalization, and locational advantages in the context of R&D, with these advantages being related mainly to the technological routines and trajectories of the firms and the host economies.**
- **The essence of our framework is that R&D globalization may be better understood in a 'multilateral', rather than simply a 'bilateral', context. This implies that R&D undertaken by three parties in separate locations may, to some extent, interact, resulting in complicated networking relationships.**

Figure 1: R&D-related advantages of MNCs, Taiwan, and China in the context of Dunning's eclectic paradigm

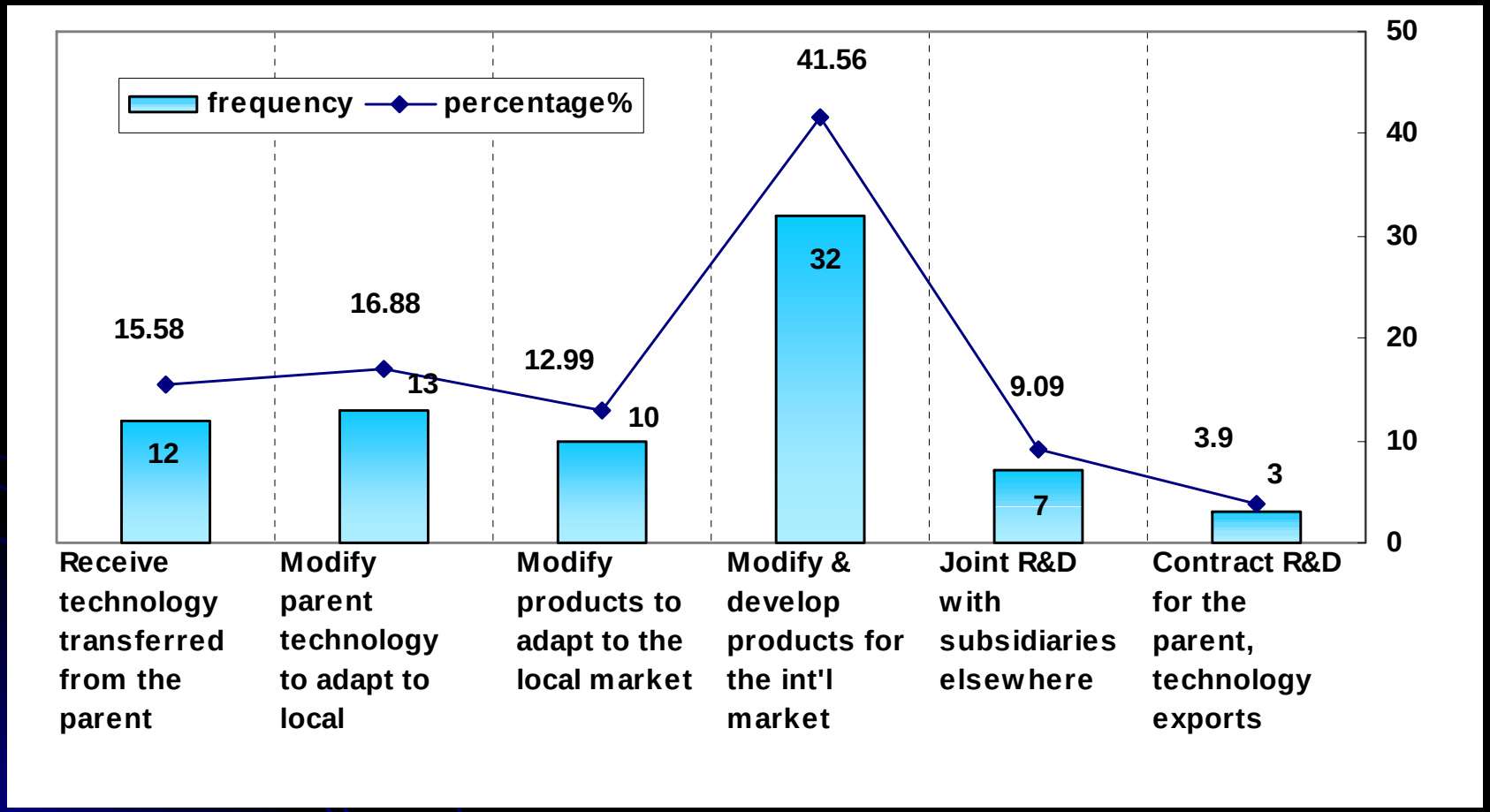


3. R&D Undertaken by MNCs in Taiwan

- **According to panel data, the estimated R&D intensity of foreign-owned subsidiaries in Taiwan was 1.94% for the period 1996-1998, while the intensity level of the electronics and electrical appliances industry was 2.36%.**

- **By using Tobit regression analysis, we are able to show that foreign-owned subsidiaries with higher R&D intensity have a higher export propensity and a higher degree of localization in terms of sourcing both production materials and capital goods. This may suggest that Taiwan has a first-tier supplier advantage for attracting offshore R&D for MNCs.**

Figure 2: The Highest Level of R&D Activity Conducted by MNCs in Taiwan



Source: Liu, Chen, and Lin (2002)

Figure 3: Taiwan's strengths in R&D operations according to MNCs with operations in Taiwan

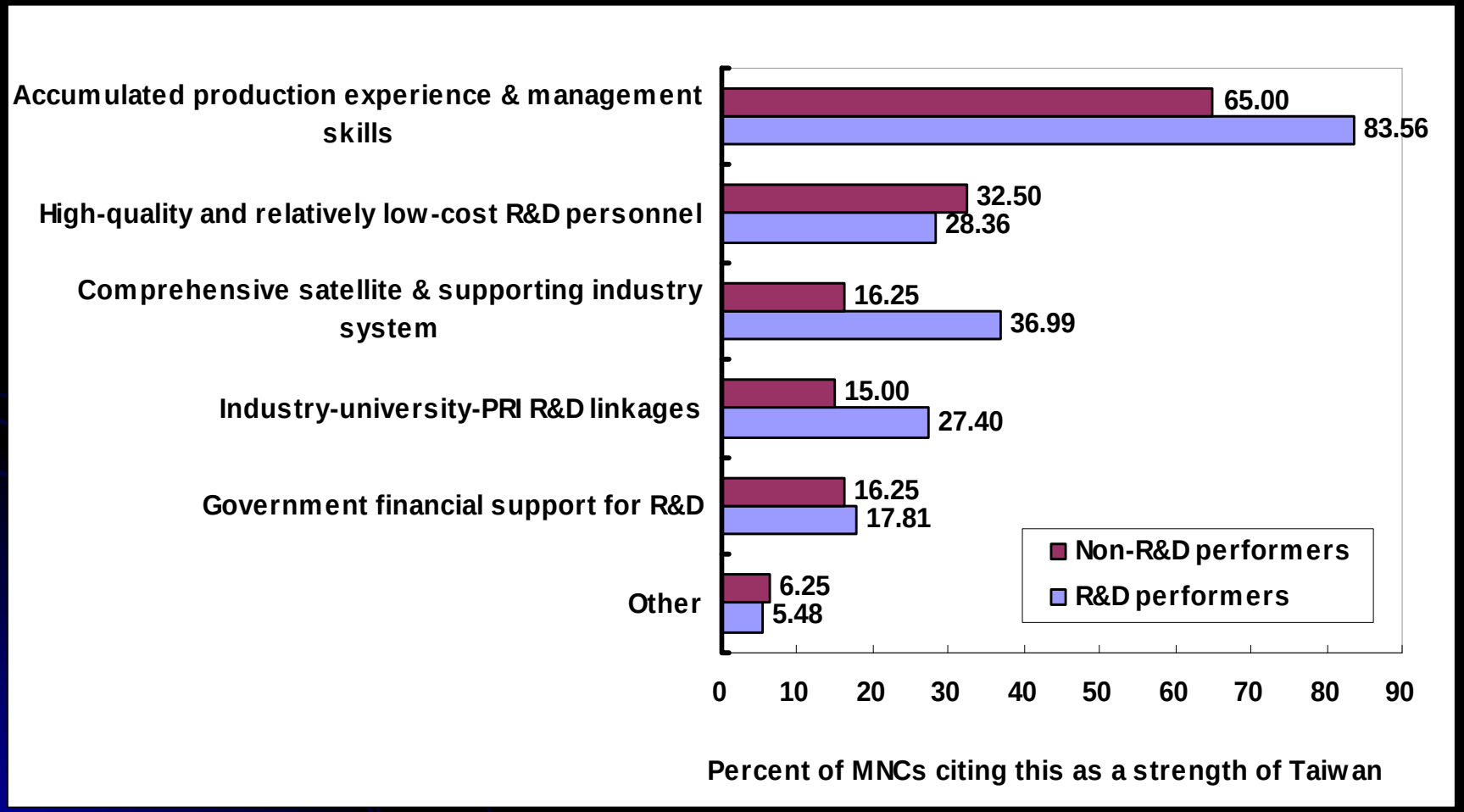
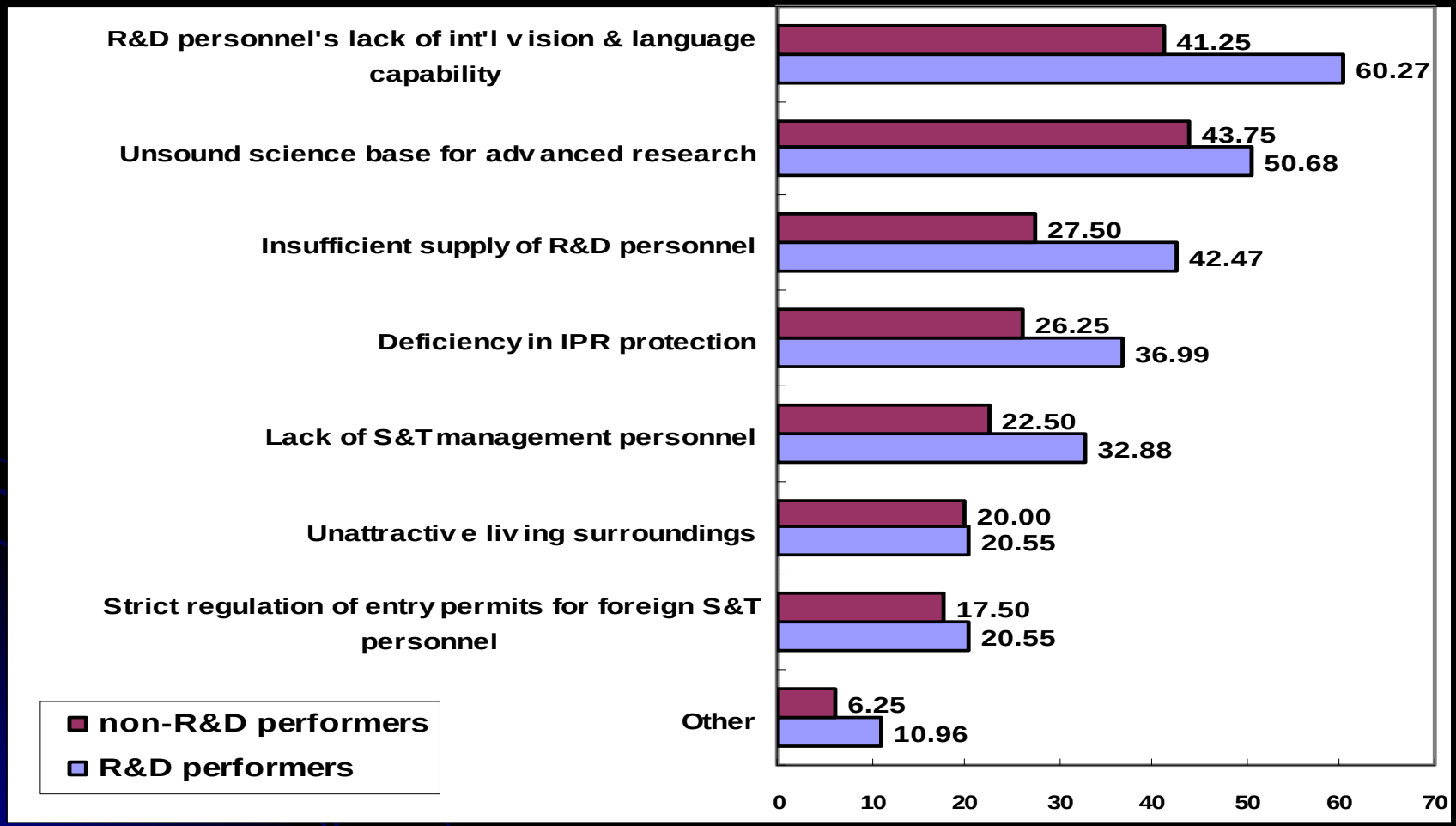


Figure 4: Taiwan's weaknesses in R&D operations according to MNCs with operations in Taiwan



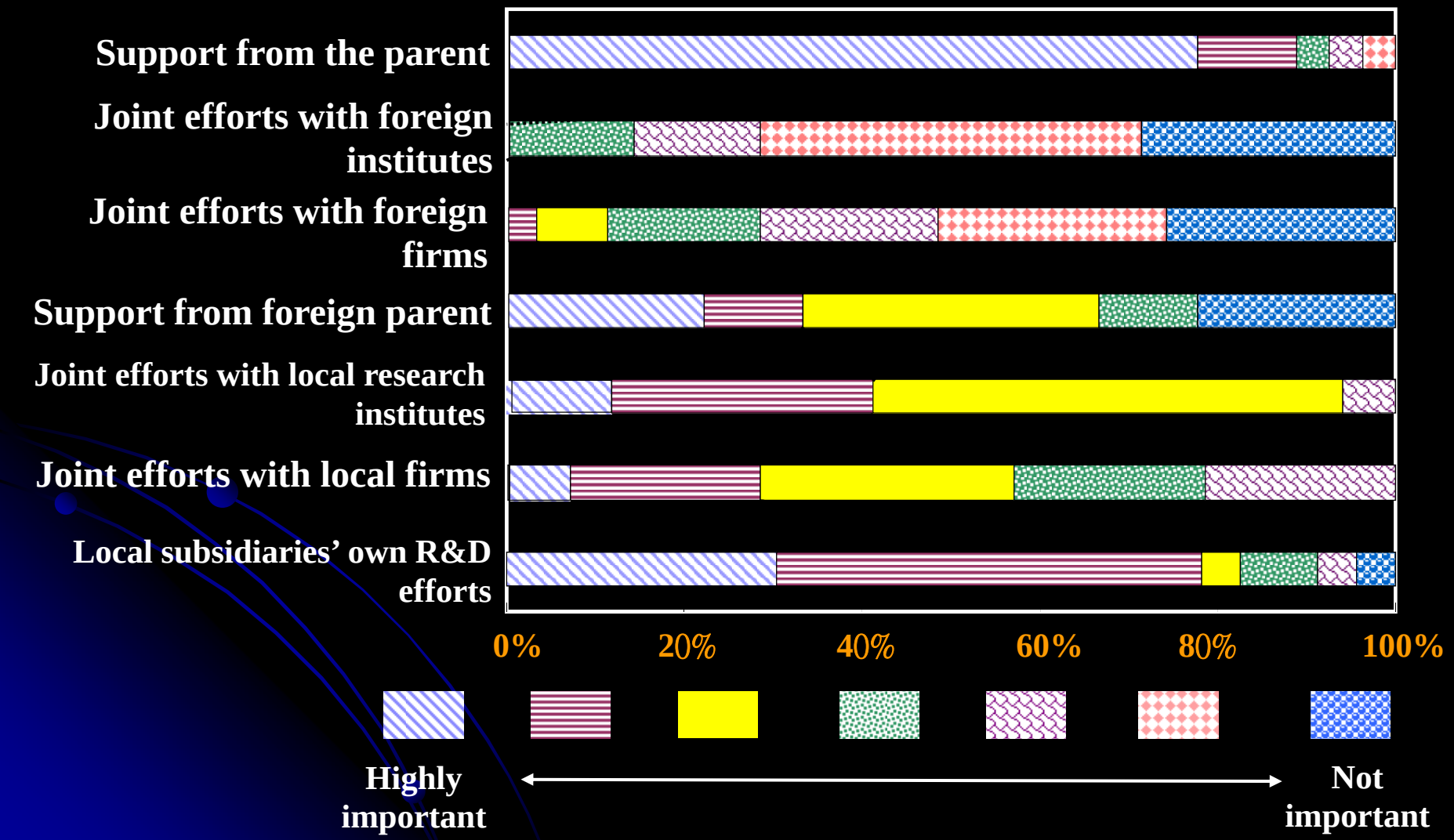
4. Taiwan-based Firms' Cross-Strait R&D Deployment

- **A new phase of cross-strait industrial interaction began recently. The emerging geographical concentration of investment in China's Long River Delta by Taiwan-based firms suggests that Taiwanese outward investment to China is becoming more technology- and capital-intensive.**
- **The China operations of Taiwan-based firms have gone beyond manufacturing, increasingly moving into R&D. In a separate research project, we found that 47.56% of respondents had conducted R&D activities in China. In other words, China had become the major target for these Taiwanese firms' offshore R&D in quantitative, though not necessarily qualitative, terms.**

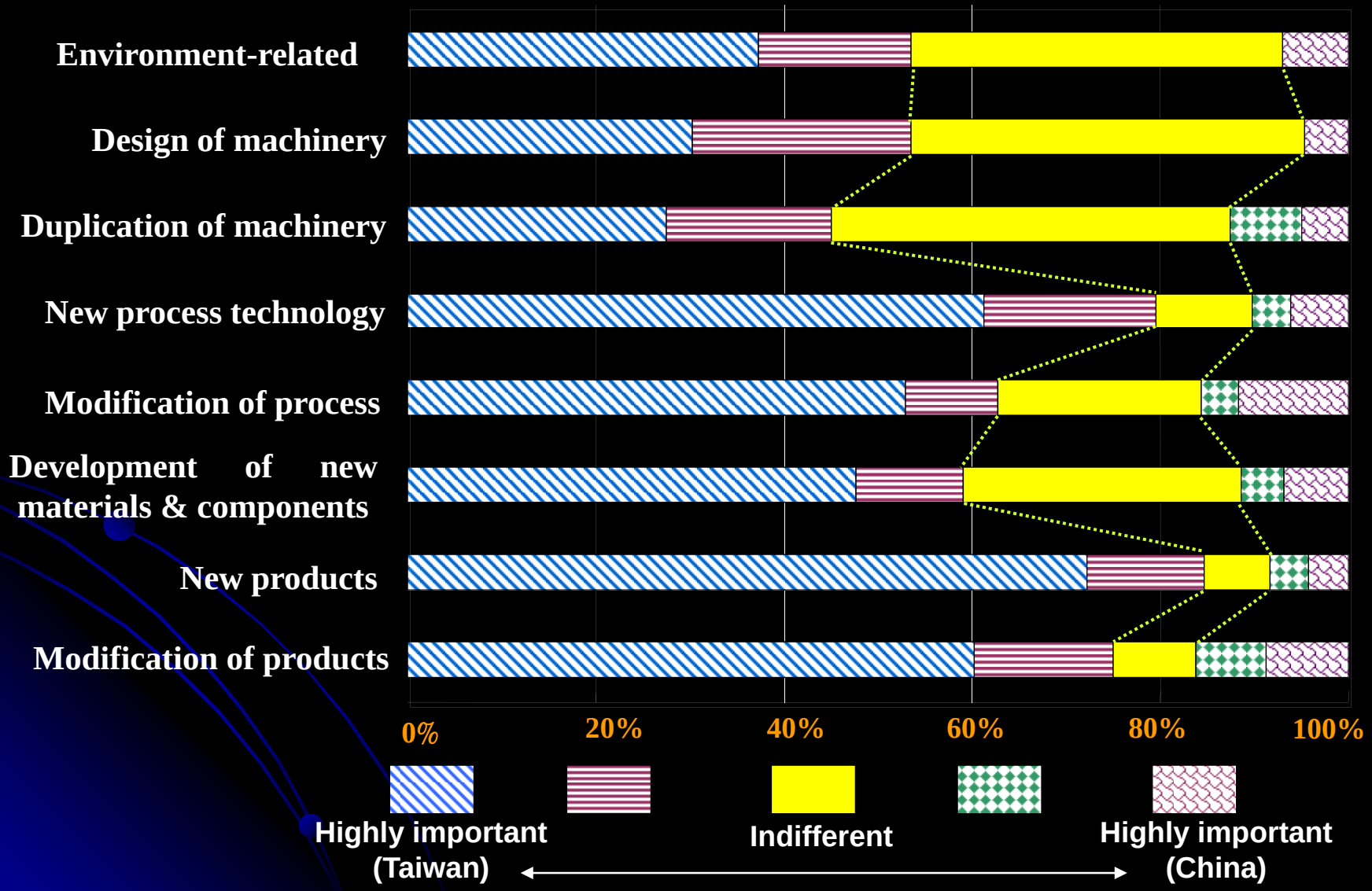
Table 3: Cross-Strait R&D deployment by Taiwan-based firms

		Taiwan	China
Product Characteristics	Type	Peripherals	System-related
	Market	International market	Domestic market
	Life Cycle	Development stage	Mature stage
Attributes of R&D or Technology	Software & Hardware	Hardware	Software
	R&D Process	Product & process R&D	Basic research、verification and fine-tuning of process

Technology sources of Taiwanese IT firms' subsidiaries in China



Relative significance of cross-strait R&D by Taiwan's electronics firms



Cross-border production network in the PC hardware industry