

The 26th STAG Board Meeting

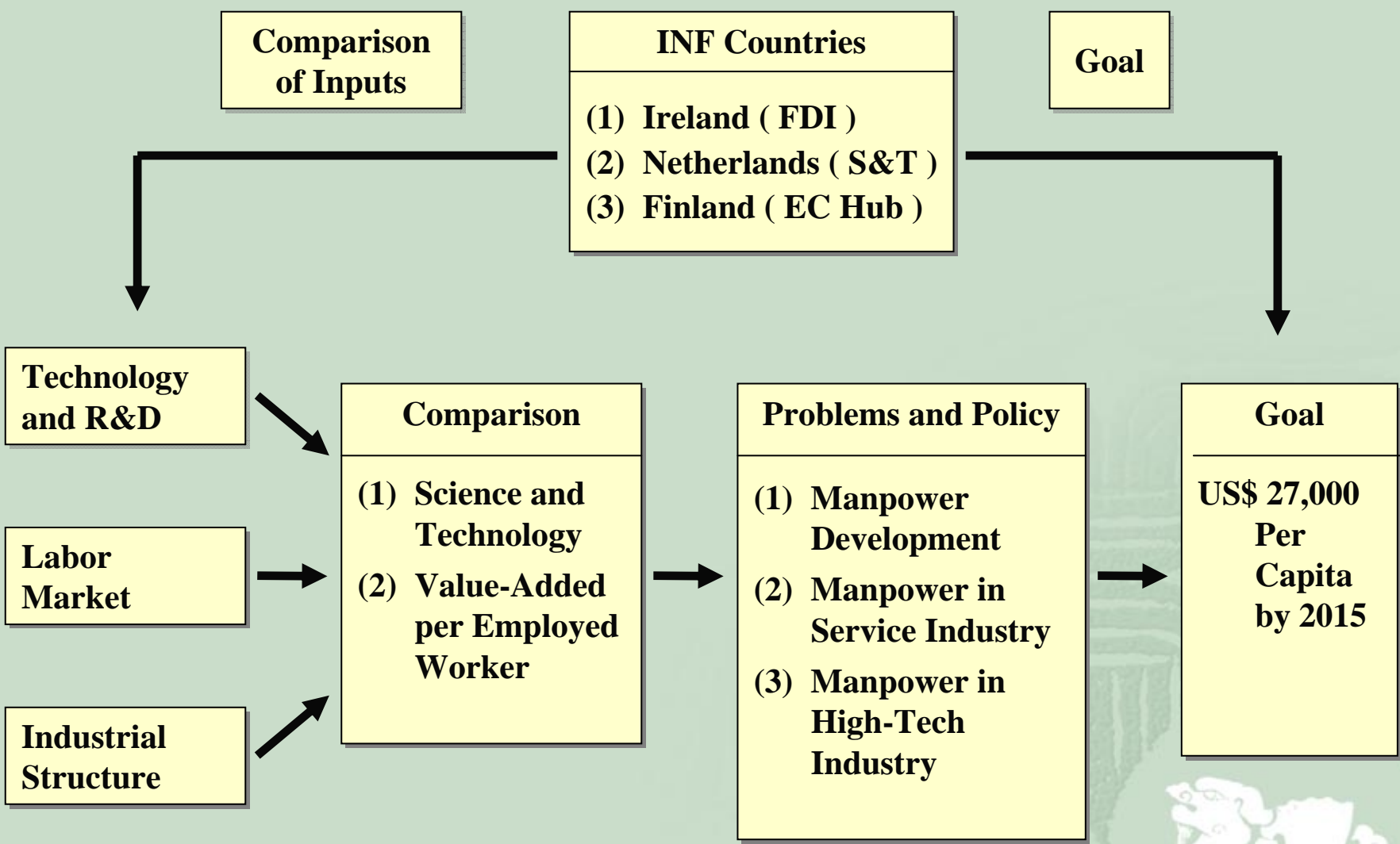
**Topic 2 : Strengthening Professional Manpower Resources to Ensure
Industrial Sci/Tech Competitiveness**

Establishing a Sound and Competitive Labor Market to Cope with Taiwan's Economic Development in 2015

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Research Structure



Presentation Outlines

1. **Taiwan's Economic Development Goals in 2015**
2. **National Development Strategies for INF**
3. **Comparison between Taiwan and INF in Technology and R&D Inputs**
4. **Comparison between Taiwan and INF for Various Performance Indices**
5. **Policy Implications for Taiwan to Achieve Her Economic Development Goals in 2015**



Table 1.1 Major National Economic Indicators (Economic)

Item	Unit	Current (2004)	Goal	
			2008	2015
Macroeconomics				
1. Per Capita GDP	US\$	13,524	18,000*	27,000*
Industry				
1. R&D / Total Sales	%	1.2 (2002)	1.8	—
2. No. of Employed				
⊙ Employed No.	1000	2,400 (first half of 2004)	2,500	2,500
⊙ Skilled Workers / Total Employed	%	13.7 (first half of 2004)	16.1	17.3
3. Manufacturing				
a. by Industrial Technology Intensity				
⊙ High	%	50.6	55	65
⊙ Medium	%	40.5	35	25
⊙ Low	%	8.9	10	10
Services				
1. Value Added (to GDP Ratios)	%	68.7**	71.4	—
2. Employment Ratios	%	58.3**	60.0	—

Source: *National Development Plan for 2005 to 2008 and its Projection for 2015*, CEPD, Executive Yuan.

*The conversion is also based on the average exchange rates in December 2004.

**From *Taiwan Statistical Data Book*, (2005), CEPD.

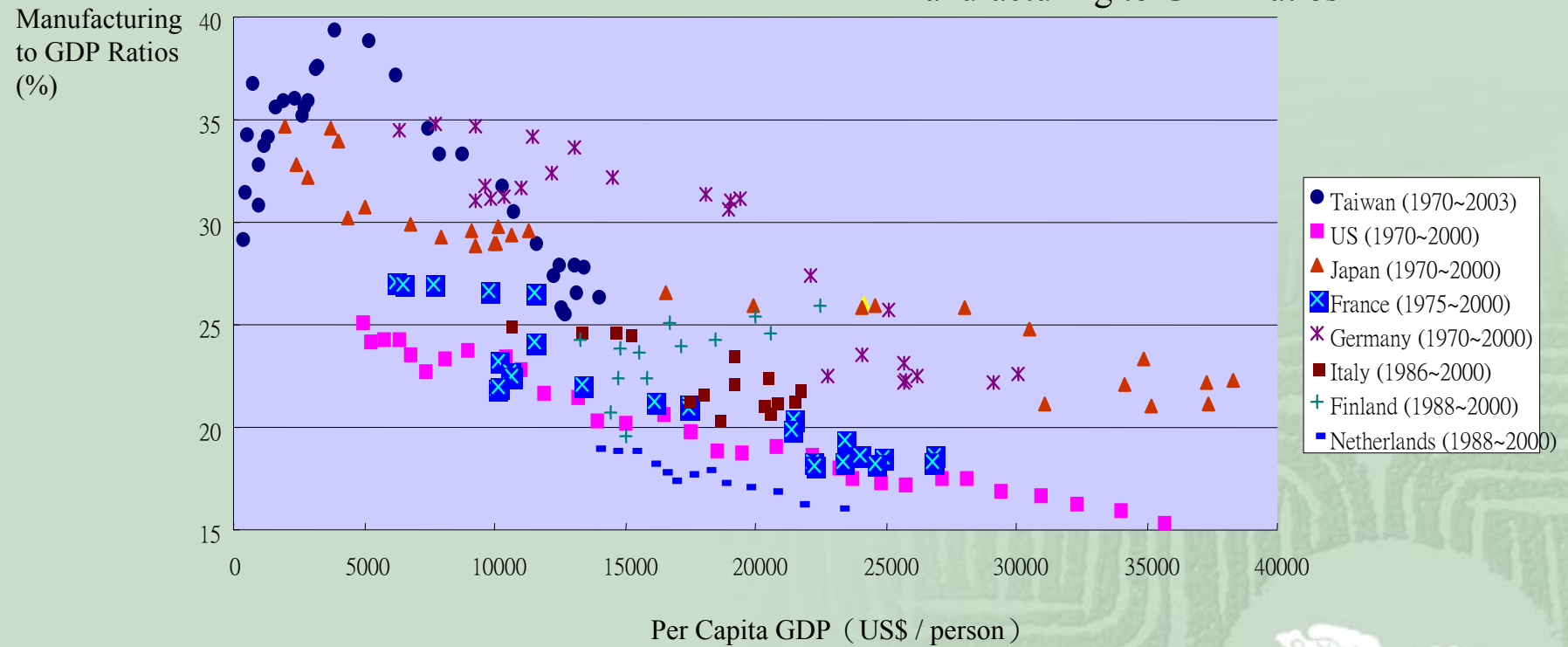
Table 1.2 Major National Economic Indicators (Science and Manpower)

Item	Unit	Current (2004)	Goal	
			2008	2015
Technology				
1. National R&D Expenditure / GDP	%	2.5 (1979SNA)*	3.17	—
2. No. of R&D Personnel Per 10,000 Employed (FTE)	person	74*	69.7	—
3. No. of SCI Papers Per Million Population	paper	572*	574	—
4. No. of EI Papers Per Million Population	paper	485*	265	—
5. No. of SSCI Papers Per Million Population	paper	19 (2002)	33	—
6. Cases of Patent Applications Out of Government Research Grants	case	149 (2002)	330	—
7. No. of Technology Transfer Cases Out of Government Grants	case	492 (2002)	1,200	—
Labor Market				
1. Labor Force Participation	%	57.6	58.2	59.0
2. Unemployment Rate	%	4.5	4.0	4.0
3. Employment Structure				
⊙ Agriculture	%	6.6	5.7	5.0
⊙ Industry	%	35.2	34.2	32.7
Manufacturing	%	27.3	26.6	25.9
⊙ Services	%	58.3	60.0	62.3

Source: *National Development Plan for 2005 to 2008 and its Projection for 2015*, CEPD, the Executive Yuan.

**Yearbook of Science and Technology, Taiwan, ROC, 2005*, National Science Council, R.O.C..

Figure 1.1 GDP Per Capita and Value-Added in Manufacturing to GDP Ratios



Source: Taiwan Institute of Economic Research (TIER), 2004.



Table 1.3 Nations with GDP Per Capita Around
US\$ 27,000 in 2003-2004

	2003	2004
Australia	21,960	26,900
Belgium	25,760	31,030
Canada	24,470	28,390
Finland	24,060	30,090
Germany	25,270	30,120
Ireland	27,020	34,280
Italy	21,570	26,120
Netherlands	26,240	31,700
Sweden	28,910	35,770
UK	28,320	33,940

Source: the World Bank



2. National Development Strategies for Ireland, the Netherlands and Finland (INF)

2.1 Ireland Model: Attracting High-Tech FDI

2.2 Netherlands Model: Hub for EC

2.3 Finland Model: Science and Technology

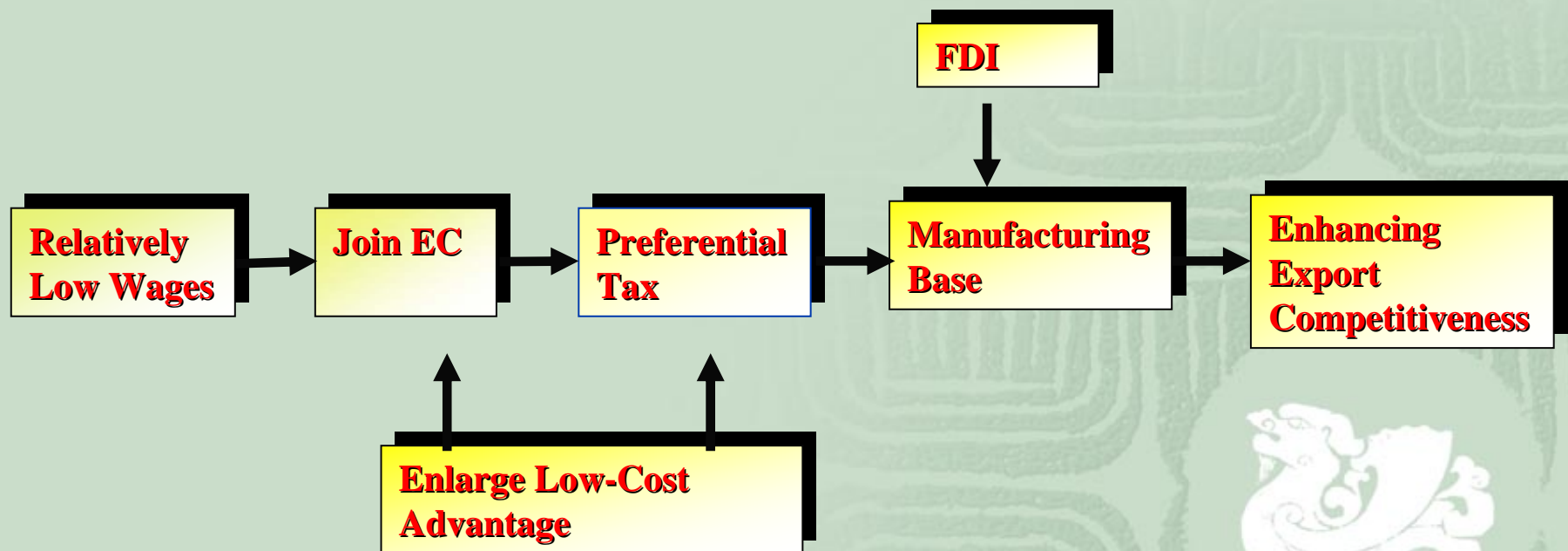


2.1 Ireland Model (Attracting High-Tech Investments)

Strength: **Foreign High-Tech Investment**

Major Market: **EC and UK**

Advantage: **Low Production Cost**



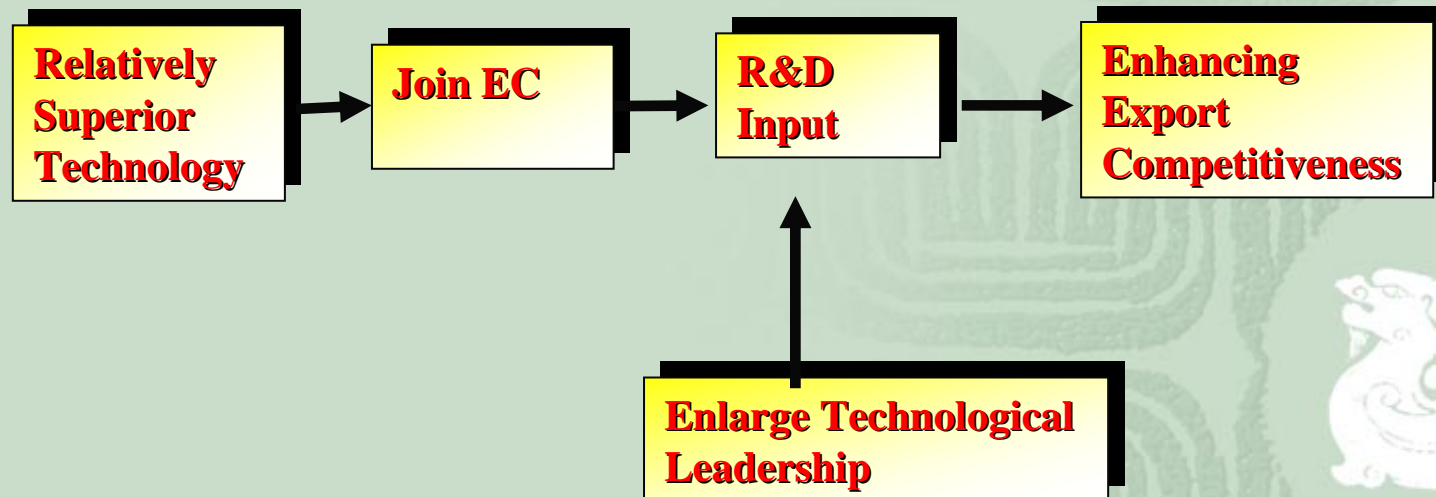
Source: TIER (2004)

2.2 Finland Model (Science and Technology)

Strength: **R&D**

Major Market: **EC**

Advantage: **Technology**



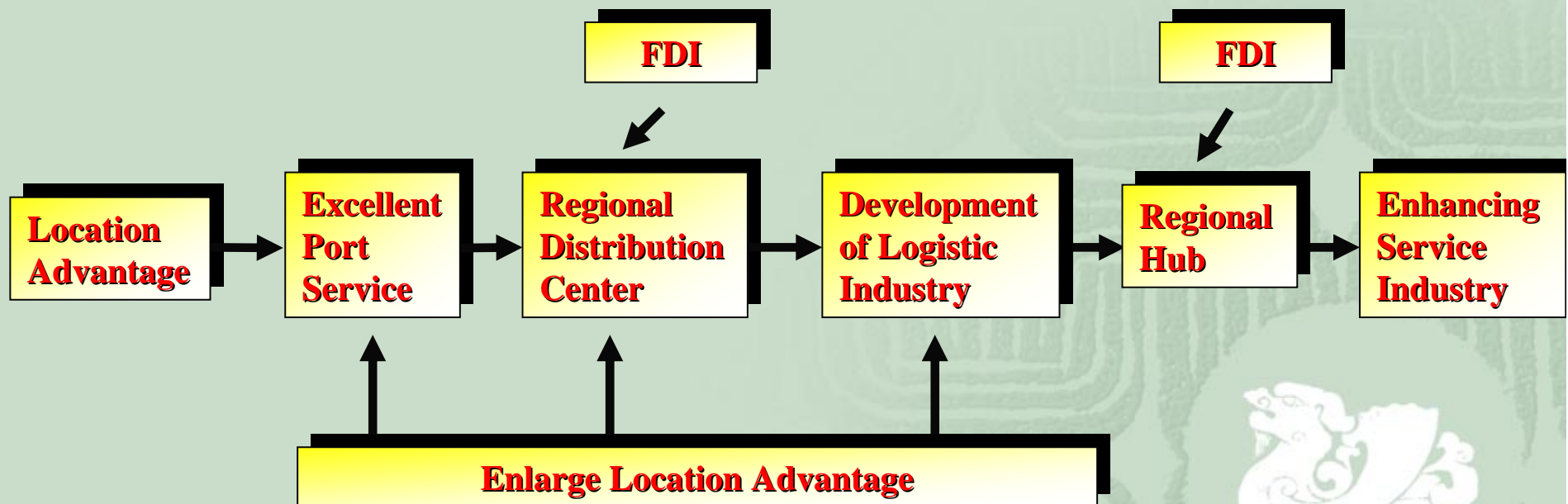
Source: TIER (2004)

2.3 Netherlands Model (Hub for EC)

Strength: **FDI**; Major Area: **Service**

Major Market: **EC**

Advantage: **Location**



Source: TIER (2004)

3. Comparison between Taiwan and INF in Technology and R&D Inputs

3.1 On R&D: Technology

3.2 On Labor Market: Labor

3.3 On FDI: Capital

3.4 On Industrial Structure

3.5 Summary



3. Comparison between Taiwan and INF in Technology and R&D Inputs

3.1 On the R&D Input

- (1) The statistics on various R&D indices show that Taiwan ranks only next to Finland as the second highest R&D investing country.

	Taiwan	Finland	Netherlands	Ireland
R&D Exp. / GDP (%)	2.20 (2002)	3.44 (2002)	1.80 (2002)	1.12 (2002)
R&D Exp. / Industrial Value-Added (%)	1.95 (2003)	3.55 (2002)	1.54 (2002)	1.02 (2001)
R&D Exp. / Value-Added (manufacturing) (%)	1.82 (2003)	2.75 (2002)	1.17 (2002)	0.71 (2001)
R&D per employed persons (US\$)	1,295 (2002)	2,088 (2002)	1,095 (2002)	819 (2002)
	Ranking: Finland > Taiwan > Netherlands > Ireland			

3. Comparison between Taiwan and INF in Technology and R&D Inputs

3.1 On the R&D Input

- (2) In terms of total R&D expenditure, or R&D to GDP ratios, Taiwan ranks higher than the Netherlands.
- (3) Relevant statistics also show that Taiwan has higher ratios than the Netherlands in terms of the number of Research Personnel per thousand (per million) employed workers (population).

	Taiwan	Finland	Netherlands	Ireland
Total R&D Expenditure (billion ppp US\$)	12.24 (2002)	4.99 (2002)	8.70 (2002)	1.43 (2002)
R&D exp. / GDP (%)	2.20 (2002)	3.44 (2002)	1.80 (2002)	1.12 (2002)
	Ranking: Taiwan > Netherlands			

3. Comparison between Taiwan and INF in Technology and R&D Inputs

3.1 On the R&D Input

- (4) In addition, in terms of the ratios of college students to the total number of enrolled students, Finland has the highest ranking, followed by Taiwan, the Netherlands and Ireland.

	Taiwan	Finland	Netherlands	Ireland
No. of R&D personnel per 1,000 employed	7.1 (2003)	16.4 (2002)	5.5 (2001)	5.1 (2001)
No. of R&D personnel per million population	3,990 (2001)	7,110 (2001)	2,826 (2001)	2,315 (2001)
College students / Total students (%)	62.96 (2001)	85.66 (2001)	56.97 (2001)	49.89 (2001)
	Ranking: Finland > Taiwan > Netherlands > Ireland			

3. Comparison between Taiwan and INF in Technology and R&D Inputs

3.2 On the Labor Market

- (1) In terms of the size of the labor force, Taiwan is much bigger than Ireland and Finland, but in terms of the total value of GDP created, Taiwan is far behind all INF countries.

	Taiwan	Finland	Netherlands	Ireland
Labor Force ('000)	10,076 (2003)	2,582 (2003)	7,472 (2003)	1,711 (2003)
Ranking: Taiwan > Netherlands > Finland > Ireland				
GDP (Billion ppp US\$)	299.79 (2003)	161.88 (2003)	511.50 (2003)	153.72 (2003)
Ranking: Netherlands > Taiwan > Finland > Ireland				

3. Comparison between Taiwan and INF in Technology and R&D Inputs

3.2 On the Labor Market

- (2) As for the Labor Force Participation Rate (LFPR), Taiwan has the lowest among the 4 countries. In addition, there is a significant gap for female workers between Taiwan and the Netherlands.

	Taiwan	Finland	Netherlands	Ireland
Labor Force Participation Rate (LFPR) (%)	57.66 (2004)	65.20 (2004)	68.60 (2004)	58.83 (2004)
Male LFPR (%)	67.78 (2004)	..	78.20 (2004)	70.92 (2004)
Female LFPR (%)	47.71 (2004)	..	58.70 (2004)	47.07 (2004)
	Ranking: Netherlands > Ireland ≥ Taiwan			

3. Comparison between Taiwan and INF in Technology and R&D Inputs

3.2 On the Labor Market

- (3) Finland and Taiwan have the highest ratios for college-educated employed workers, followed by the Netherlands and Ireland.
- (4) In sum, Taiwan's labor quality is no inferior to that of the INF countries. However, there does exist a significant gap in LFPRs for both genders. More flexible labor market regulations would be advisable.

	Taiwan	Finland	Netherlands	Ireland
% of Employed with College Education	28.46 (2001)	31.60 (2001)	23.50 (2001)	25.80 (2001)
	Ranking: Finland > Taiwan > Ireland > Netherlands			

3. Comparison between Taiwan and INF in Technology and R&D Inputs

3.2 On the Labor Market

- (5) Taiwan's unemployment rate is about the same as that of Ireland and much lower than that of Finland. However, the ratio of the college-educated unemployed for Taiwan is much higher than that for Finland.

	Taiwan	Finland	Netherlands	Ireland
Unemployment Rate (%)	4.44 ^c (2004)	9.00 ^b (2002)	3.10 ^a (2002)	4.20 ^a (2002)
	Ranking: Finland > Taiwan > Ireland > Netherlands			
% of Unemployed with College Education	23.11 ^c (2001)	16.0 ^b (2001)	13.2 ^a (2001)	NA
	Ranking: Taiwan > Finland > Netherlands			

3. Comparison between Taiwan and INF in Technology and R&D Inputs

3.3 On Attracting FDI

- (1) In terms of the Inward FDI Potential index ranking, in the period 2001-2003, Taiwan ranked far below all the INF countries.

	Taiwan	Finland	Netherlands	Ireland
Inward FDI Potential index (Ranks) (2001-2003)	21	13	11	10
	Ranking: Ireland > Netherlands > Finland > Taiwan			



3. Comparison between Taiwan and INF in Technology and R&D Inputs

3.3 On Attracting FDI

- (2) Between 2000-2004, the average ratio of inward FDI flow to total capital formation for Taiwan is as low as 4.29%, which is far behind the same ratios for the INF.

(%)	2000	2001	2002	2003	2004	2000-2004 Ave.
Taiwan	6.79	7.79	2.89	0.91	3.09	4.29
Finland	37.23	15.04	31.67	11.30	13.42	21.73
Ireland	110.51	39.86	106.25	74.88	20.12	70.32
Netherlands	77.91	62.48	28.74	18.69	(-3.89)	36.79
Average Ranking 2000-2004	Ranking: Ireland > Netherlands > Finland > Taiwan					



3. Comparison between Taiwan and INF in Technology and R&D Inputs

3.4 On the Industrial Structure

- (1) In 2004, the Netherlands had the highest service to GDP ratio, while Taiwan had the lowest ratio for service workers.
- (2) In contrast, Taiwan had the highest share of manufacturing workers.

	Taiwan	Finland	Netherlands	Ireland
Services to GDP Ratio (%)	72.73 (2004)	66.60 (2004)	73.96 (2004)	50.80 (2004)
	Netherlands > Taiwan > Finland > Ireland			
Employment Share for Services Industry (%)	58.20 (2004)	69.67 (2004)	76.70 (2002)	65.99 (2004)
Employment Share for Manufacturing (%)	27.30 (2004)	18.22 (2004)	13.67 (2002)	15.25 (2004)

3. Comparison between Taiwan and INF in Technology and R&D Inputs

3.5 Summary

- (1) In terms of technology and R&D inputs, Taiwan ranks among the top two of these 4 countries.
- (2) Taiwan has a very high share of college-educated workers in her labor force, but her labor force participation rates for both genders are relatively low. In addition, Taiwan has a relatively much higher ratio of unemployed workers with a college education. This deserves our attention.
- (3) Taiwan performed poorly in attracting FDI between 2000 and 2004.
- (4) In terms of future industrial structural change, it is anticipated that the share of services in GDP or of its employment share to the overall labor force will be likely to increase in the future.

4. Comparison between Taiwan and INF for Various Performance Indices

4.1 On Science and Technology

4.2 On Value-Added Per Worker

4.3 Summary



4. Comparison between Taiwan and INF for Various Performance Indices

4.1 On Science and Technology

- (1) In terms of all SCI or EI listed paper publications, and the relevant statistics, Taiwan ranked after the Netherlands and performed fairly well, but in terms of SCI and EI papers per researcher, Taiwan ranked after the Netherlands and Ireland.

	Taiwan	Finland	Netherlands	Ireland
No. of SCI Papers (1)	12,939 (2004)	7,421 (2004)	19,982 (2004)	3,151 (2004)
No. of EI Papers (2)	10,980 (2004)	2,953 (2004)	6,020 (2004)	1,075 (2004)
(1) + (2)	23,919 (2004)	10,374 (2004)	26,002 (2004)	4,226 (2004)
(1)+(2) / Total No. of Research Personnel	0.301 (2003)	0.230 (2002)	0.512 (2002)	0.373 (2002)
Ranking: Netherlands > Taiwan > Ireland > Finland				

4. Comparison between Taiwan and INF for Various Performance Indices

4.1 On Science and Technology

- (2) In 2003, Taiwan has the highest high-tech industrial export ratio.
- (3) Among the 4 countries, Ireland has the highest high-tech industry exports to R&D expenditure ratio, and Taiwan ranks second.

	Taiwan	Finland	Netherlands	Ireland
Share of High-Tech Industry to Manufacturing (%)	42.86 (2003)	23.75 (2003)	30.89 (2003)	34.47 (2003)
	Ranking: Taiwan > Ireland > Netherlands > Finland			
Export Value for High-Tech Industry / Total R&D Exp. (all in US\$)	4.55 (2002)	1.83 (2002)	3.87 (2002)	22.07 (2002)
	Ranking: Ireland > Taiwan > Netherlands > Finland			

4. Comparison between Taiwan and INF for Various Performance Indices

4.1 On Science and Technology

- (4) Taiwan obtains more patents from the US than any one of the INF countries, and in terms of US granted patents per researcher Taiwan also ranks the highest among the 4 countries.
- (5) In terms of the high-tech industry's exports per worker, Ireland has the highest ranking followed by the Netherlands, which shows the successful role of FDI in these two countries.

	Taiwan	Finland	Netherlands	Ireland
Patents Granted by the US (1)	5,431 (2002)	809 (2002)	1,391 (2002)	132 (2002)
(1) / Total No. of Research Personnel	0.078 (2003)	0.021 (2002)	0.032 (2002)	0.014 (2002)
	Ranking: Taiwan > Netherlands > Finland > Ireland			
Export Value for High-Tech Industry per No. Employed in Manufacturing (US\$)	23,812 (2003)	23,615 (2003)	30,972 (2002)	96,089 (2003)
	Ranking: Ireland > Netherlands > Taiwan ≈ Finland			

4. Comparison between Taiwan and INF for Various Performance Indices

4.1 On Science and Technology

- (6) Based on the above comparison, it is shown that Taiwan performs relatively well in terms of her high-tech industry's exports.
- (7) Since Taiwan and the Netherlands have similarly sized labor markets, when we compare the SCI or EI paper publications more closely, it is seen that these two countries have roughly the same performance. However, in terms of patents granted by the US, Taiwan's performance is clearly better than that of the Netherlands.



4. Comparison between Taiwan and INF for Various Performance Indices

4.1 On Science and Technology

- (8) Between Taiwan and the Netherlands, the statistics show that the number of researchers per thousand (million) employed (population) in Taiwan is roughly 40% higher than that in the Netherlands.
- (9) Our comparison shows that in terms of various R&D input indices, or in terms of scientific paper publications, or in terms of patents granted by the US, Taiwan is surely not inferior to the INF. Nonetheless, as compared to the Netherlands, high-tech industry export value per worker for Taiwan is much lower.



4. Comparison between Taiwan and INF for Various Performance Indices

4.2 On Value-Added Per Worker

- (1) As we can see from the Table, in terms of value-added per employed worker for both the manufacturing and service industries, Taiwan ranks the lowest. This issue surely deserves our attention.

	Taiwan	Finland	Netherlands	Ireland
Product Value per Manufacturing Worker (US\$)	26,020 (2003)	82,761 (2003)	54,973 (2002)	110,630 (2003) (Manufacturing & Construction)
Product Value per Service Sector Worker (US\$)	38,805 (2003)	65,085 (2003)	50,477 (2002)	65,868 (2003)
	Ranking: Ireland > Finland > Netherlands > Taiwan			

4. Comparison between Taiwan and INF for Various Performance Indices

4.3 Summary

- (1) Our comparison shows that in terms of academic paper publications, Taiwan performs better than Finland and Ireland.
- (2) In terms of high-tech exports per R&D expenditure in dollar terms or per employed worker, Ireland has the highest ranking which clearly shows that Ireland is very successful in attracting high-tech FDI and also very successful in developing herself as the gateway for non-EC members.



4. Comparison between Taiwan and INF for Various Performance Indices

4.3 Summary

- (3) Based on the above comparison, it is clearly shown that, as compared with INF, Taiwan does not lag behind these INF countries in its R&D or in the quality of its labor input, but rather lags behind these INF countries in its output. Therefore, the real issue is not the insufficiency in terms of relevant **inputs** but in terms of **output** performance. As such, the Netherlands' and Ireland's development strategy could serve as a very good reference for Taiwan.



5. Policy Implications for Taiwan to Achieve Her Economic Development Goals in 2015

5.1 On National Overall Development Strategies

5.2 On Manpower Upgrading policy

5.3 Manpower Upgrading for Emerging Service Industries

5.4 Manpower Upgrading for High-Tech Industry



5. Policy Implications for Taiwan to Achieve Her Economic Development Goals in 2015

5.1 On National Overall Development Strategies

- (1) Based on the above comparison, it is clear that Taiwan is not inferior to INF countries in terms of the quality of its high-tech manpower, R&D input, publications of academic papers, and certainly not in terms of patents granted by the US. As such, the problem is not really to do with insufficient inputs but rather with poor performance in terms of value-added per capita.



5. Policy Implications for Taiwan to Achieve Her Economic Development Goals in 2015

5.1 On National Overall Development Strategies

- (2) Our comparison clearly shows that regardless of the development strategies adopted by the INF, these countries have all focused on the EC market so as to strengthen their competitiveness. In addition, such a development strategy also provides a very good platform for their high-tech/high-quality manpower to demonstrate their expertise.
- (3) By contrast, Taiwan's policy in recent years has tended to shy away from the rapidly-growing mainland market which sharply contrasts with the strategies adopted by the INF in relation to the EC as well as to those adopted by neighboring countries such as Japan and Korea in regard to mainland China.

5. Policy Implications for Taiwan to Achieve Her Economic Development Goals in 2015

5.1 On National Overall Development Strategies

- (4) The poor performance in attracting FDI in recent years is also an alarming sign for Taiwan. Should Taiwan 'voluntarily' give up her strategic location advantage in Asia, it is likely that she will encounter a new wave of brain drain and this will surely hinder the country's overall competitiveness.
- (5) With regard to the Netherlands' experience, it is also advisable for the government to strengthen the R&D effort for private enterprises.
- (6) Strengthening the cooperative relationship between industry and the universities.



5. Policy Implications for Taiwan to Achieve Her Economic Development Goals in 2015

5.2 On the Manpower Upgrading Policy

- (1) When compared to INF countries, Taiwan has relatively higher ratios of college-educated workers in the labor force and, as such, it will be the quality rather than the quantity that should be emphasized in Taiwan's higher education.
- (2) Finland's higher education policy can serve as a good reference for Taiwan.
- (3) The importance of the vocational track of the secondary education has disproportionately been deemphasized in recent years and such policy should be re-examined.

5. Policy Implications for Taiwan to Achieve Her Economic Development Goals in 2015

5.2 On the Manpower Upgrading policy

- (4) Studies show that a significant increase in Taiwan's skilled workers in the 1990s is one of the most important factors in improving the overall quality of the labor force in Taiwan. Besides continuously improving the quality of labor in Taiwan, it is also suggested that foreign students should be attracted to study in Taiwan and that a relevant immigration policy can also be considered for the outstanding students.



5. Policy Implications for Taiwan to Achieve Her Economic Development Goals in 2015

5.3 Manpower Upgrading for Emerging Service Industries

- (1) It is likely that the share of employment in the manufacturing sector will decline steadily while the service sector's share will continue to rise. As such, relevant manpower training and in-service training in the service sector should be emphasized and flexibility in the labor market will be needed.



5. Policy Implications for Taiwan to Achieve Her Economic Development Goals in 2015

5.3 Manpower Upgrading for Emerging Service Industries

- (2) In addition, since the interactions among industries, such as manufacturing and services and logistics and financing are intensifying, Taiwanese firms also need to establish their own brand names in the international markets, and as such sales and marketing as well as interdisciplinary manpower will also be in great demand.
- (3) In-service training as well as the promotion of the worker's general skill training have also been shown to have a significant impact in terms of improving the quality of labor. Such efforts should be extended to the emerging services sector and the English ability of all workers should also be strengthened.

5. Policy Implications for Taiwan to Achieve Her Economic Development Goals in 2015

5.3 Manpower Upgrading for Emerging Service Industries

- (4) Studies have also shown that the implementation of the skill certification system is also critical to the improvement of the labor quality. As such, a relevant skill certification system for the service sector is also suggested.
- (5) As we mentioned before, how to encourage highly-educated females to reenter the labor market should also be considered.



5. Policy Implications for Taiwan to Achieve Her Economic Development Goals in 2015

5.4 Manpower Upgrading for High-Tech Industry

- (1) With reference to Ireland's development experience, Ireland has successfully developed herself as the gateway for non-EC member's high-tech manufacturing firms in Europe, and, consequently, this has also lead to a reverse brain drain since the late 1990s. As such, whether or not Taiwan can successfully integrate herself into the emerging Asian market will be critical to her ability to attract high-level manpower and create more value-added output.



5. Policy Implications for Taiwan to Achieve Her Economic Development Goals in 2015

5.4 Manpower Upgrading for High-Tech Industry

- (2) How to attract more foreign direct investment is also critical to the development of Taiwan's future high-tech industry. It is also important to note that how FDIs evaluate Taiwan in the Asian market is very similar to how they see the Netherlands in relation to the EC market. If Taiwan fails to meet the market's expectations, Taiwan will cease to be sufficiently attractive to FDIs.



5. Policy Implications for Taiwan to Achieve Her Economic Development Goals in 2015

5.4 Manpower Upgrading for High-Tech Industry

- (3) Studies also show that the aging of the population in Taiwan may also affect her competitiveness in the future. Careful attention to this emerging trend should be given.
- (4) It will also be advisable for the government to actively implement policies to attract suitably qualified foreigners to live and work in Taiwan on a long-term basis. As such, all the relevant infrastructure so as to foster a more pleasant international community living environment should be a clear policy goal to strive for.



**Thank you for your kind attention
and suggestions**

