

**Delocalization of R&D
– Development to follow the production trend?**

Arthur D Little

Study including Automotive, Manufacturing and Aerospace & Defense industries

September 2005 – March 2006

Agenda

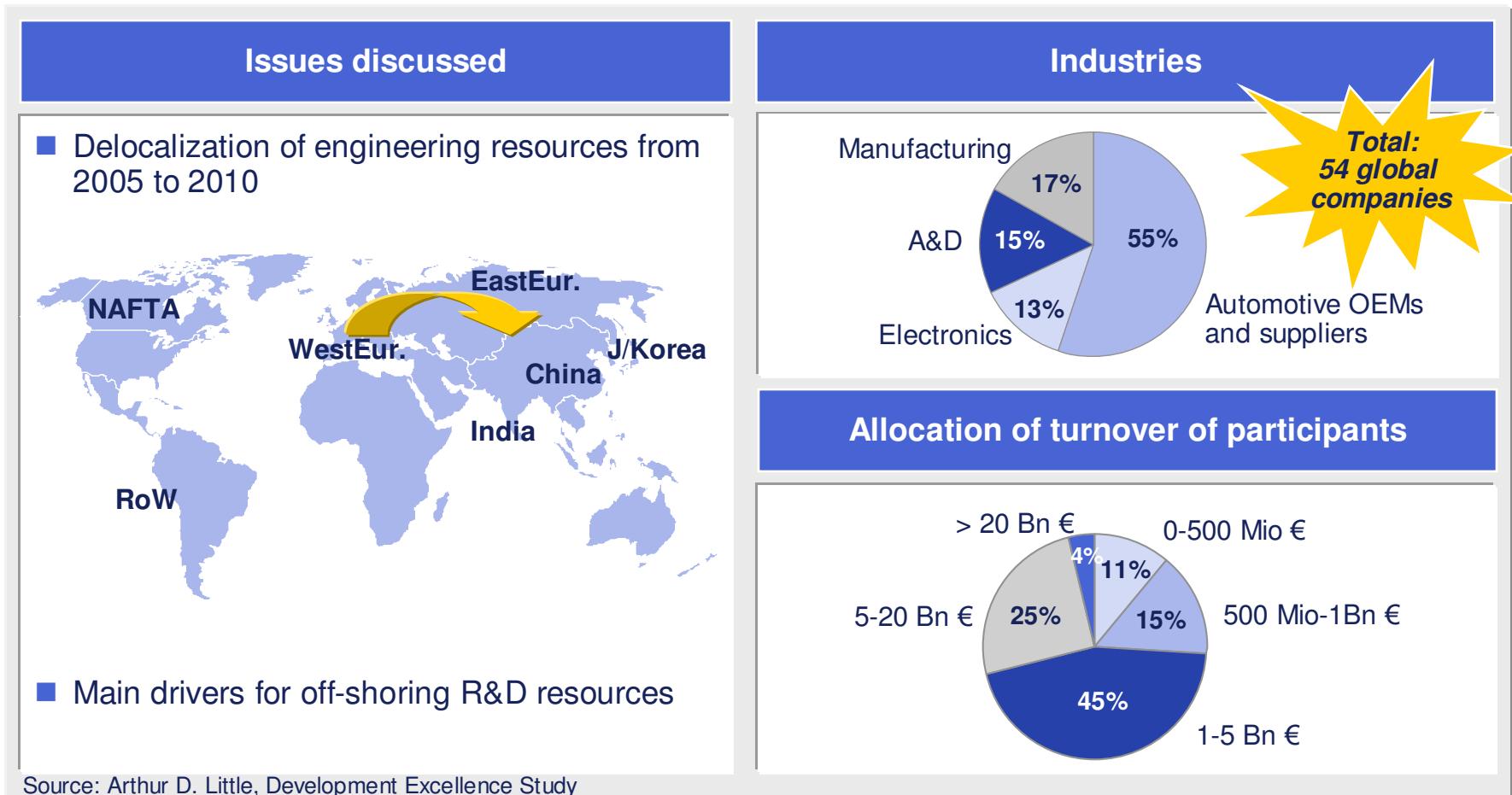
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Development to follow the production trend?

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Off-shoring of development resources
– A few pieces of advice by Arthur D. Little

The survey has been conducted across 54 global companies in the Aerospace & Defense, Automotive, Manufacturing and Electronics industry



Discussion of the development footprint is omnipresent in western media ...

Quotes from the press ...

"Großunternehmen tätigen FuE-Investitionen im Ausland zu 66 Prozent in Ergänzung ihrer Produktionsstandorte im Ausland."
Dr. Axel Nitschke (Chefvolkswirt DIHK)

"R&D always to follow the production"
Heinrich von Pierer, 2005

"Honeywell International Inc. is planning to move 5.000 aerospace division jobs offshore over the next five years."
Washington Alliance of Technology Worker, 09.12.2004

"We will pauperize if we try to get Asian"
Wendelin Wiedeking, 2005

"Auch die Entwicklung wandert – zum Teil auf den Spuren und auf Wunsch der Kunden, zum Teil kostengetrieben – nach Osteuropa, China oder Mexiko."
Manfred Wennemer (VV Continental), FAZ, 26.11.2005

"No technology transfer without control"
Thomas Enders, 2005

"Localising R&D will solidify our top brand position, ... tly we have four R&D centres in China, including the telecom R&D centre in Beijing. We intend to develop facilities there to become our global centers."
Yoon-Woo Lee (CEO of Samsung Electronics), Prism 2/2005

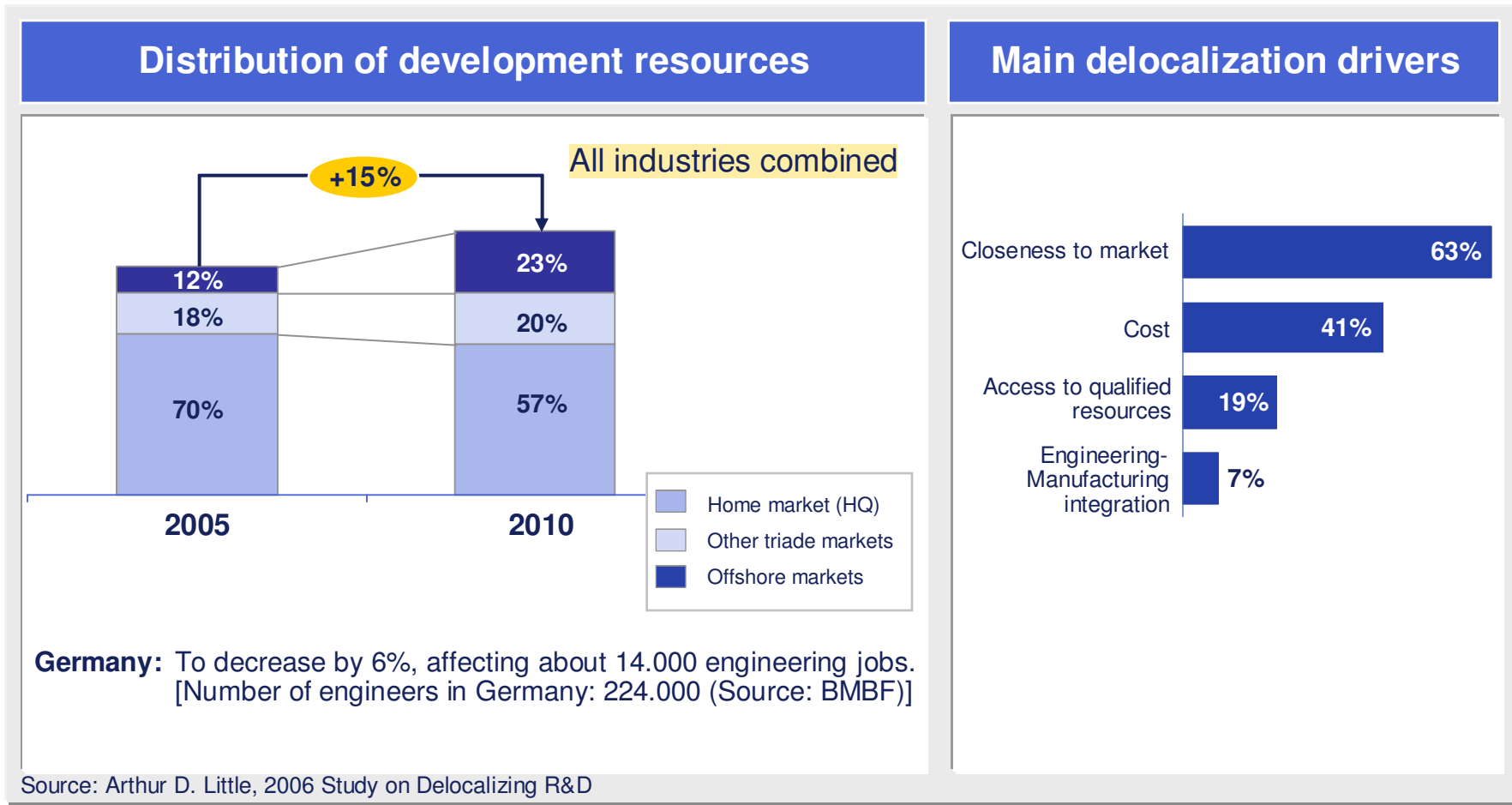
"Für den Lohn eines deutschen Ingenieurs bekomme ich sechs chinesische Ingenieure. Aber während der deutsche 1600 Stunden im Jahr arbeitet, arbeiten die Chinesen jeweils 2000 Stunden. Und die sind nicht schlechter ausgebildet als die deutschen Ingenieure."
Heinrich von Pierer (Aufsichtsratsvorsitzender Siemens AG), 18.11.2005

"The new company reflects the quality of engineering in India, and illustrates how Rolls-Royce is investing in engineering capability around the world."
Sir John Rose (Chief Executive Rolls Royce), Rolls Royce 25.11.2005

"Cisco Systems plans to invest US \$1,1 billion in India over the next three years and to triple its staff in India over that period."
John Chamblers, Reuters 20.10.2005

Sources: Pressclippings

Across all industries the study confirms that most of the R&D headcount growth in the next 5 years (~15%) will occur off-shore



China remains the major focus region with growth rates of 27% CAGR until 2010

Off-shoring destinations	Rationales
<p>China</p> <p>+ 27% p.a.</p>	<ul style="list-style-type: none"> ■ Delocalization mainly driven by Automotive companies due to high market potential and -growth ■ Almost 40% of university students study engineering related topics ■ Flexible work legislation
<p>Eastern Europe</p> <p>+ 16% p.a.</p>	<ul style="list-style-type: none"> ■ Delocalization mainly driven by lower cost structure, highly skilled workers inherited from the Soviet Union ■ International recognition of skills, E.g. 75.000 graduated engineers/ IT developers in Russia each year ■ Geographic proximity with Europe, flexible work legislation
<p>India</p> <p>+ 13% p.a.</p>	<ul style="list-style-type: none"> ■ Mainly embedded systems development, testing and FEM analysis activities delocalized there ■ International recognition of degrees, more than 80.000 graduated engineers/ IT developers per year, however, some shortage currently ■ Federal and regional proactive policies for engineering/ IT development ■ Costs are lower by 45-50% compared to Europe or the US ■ English widespread, much closer cultural proximity than China

Source: Arthur D. Little, 2006 Study on Delocalizing R&D

Japan tries to counter the delocalization trend through extensive networking and providing an attractive framework for engineering

Example of R&D locations

BOSCH

- Funabashi
- Higashi-Matsuyama
- Hiroshima
- Kawawoto
- Musashi
- Nagoya
- Nasu
- Ohra
- Ojima
- Shiki
- Takasaki
- Takayama
- Wakamatsu
- Yokohama
- Yorii
- Izumazaki
- Odawara City

APPLIED MATERIALS

- Tokyo
- Chiba

IBM

- Tokyo

CISCO SYSTEMS

- Tokyo

Continental

- Tokyo
- Asashi
- Hamakita
- Hiroshima
- Monbetsu

TEVES

- Tokyo (Headquarter)
- Yokohama
- Sapporo

ERICSSON

- Tokyo
- Nagoya

Pfizer

- Tokyo
- Nagoya

Webasto

- Tokyo
- Hiroshima

Japanese success factors

- Strong innovation driven industries with strong home based production and R&D → attraction of suppliers
- Highly educated staff available → 70% of all Japanese have a university degree or comparable
- Very good infrastructure → known as gate to Asia
- China as important trade partner → changed a trade gap (€623 Mio) '02 to a surplus (€467 Mio)
- Clear legislation in intellectual properties
- Strong network-mindset → cooperation between multinational companies with universities and labs
- Support by governmental activities (Jetro, Invest Japan Support Centers [IBSC], ...)

R&D expenses per head (in US\$)

Country	R&D expenses per head (in US\$)
Japan	2.981
US	2.921
Germany	2.800
Korea	1.573
China	1.087

Sources: www.outdoorjapan.com; die Zeit – Japan ist wieder da; Jetro – Invest Japan

According to the German Ministry of Research and Education, the number of German automotive R&D engineers is 85.000

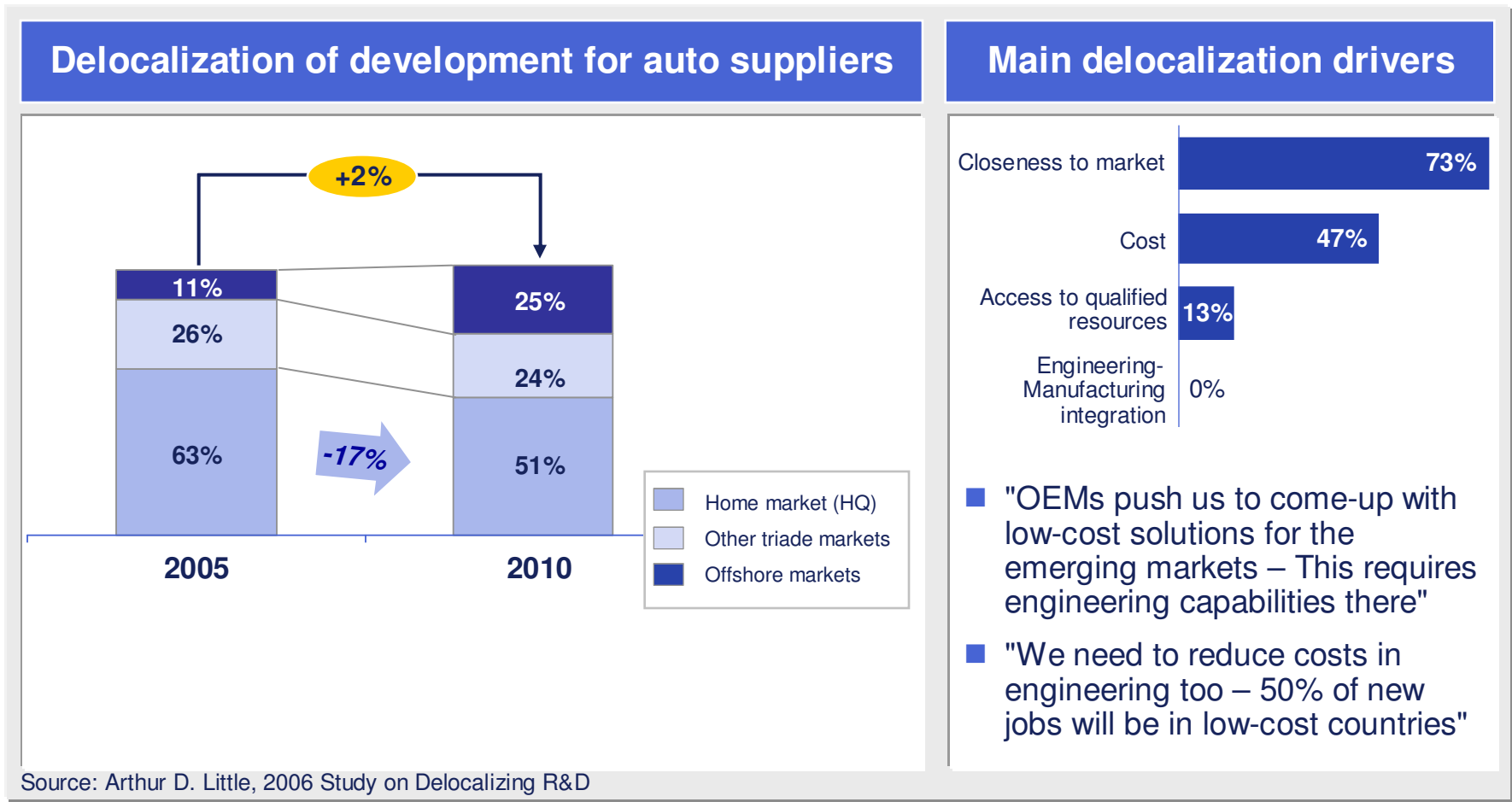
Is 85.000 R&D engineers in the German automotive industry a reasonable figure?

- Headcount of German automotive industry is 780.000 ('04)
- R&D staff to total staff ratio is $85.000/780.000 = 10,9\%$
- To justify this figure, we calculated the R&D staff to total staff ratio for several German suppliers and one OEM (based on Development Excellence Study interview data¹⁾
 - Thyssen Krupp $4.000/42.000 = 9,5\%$
 - Webasto $800/6.400 = 12,5\%$
 - Edscha $300/4.200 = 7,0\%$
 - Eberspächer $200/5.200 = 4,0\%$
 - Hella $2.000/23.000 = 9,0\%$
 - Knorr Bremse $750/7.000 = 11,0\%$
 - MCG $6.000/105.000 = 6,0\%$
 - Overall $14.350/192.800 = 7,5\%$

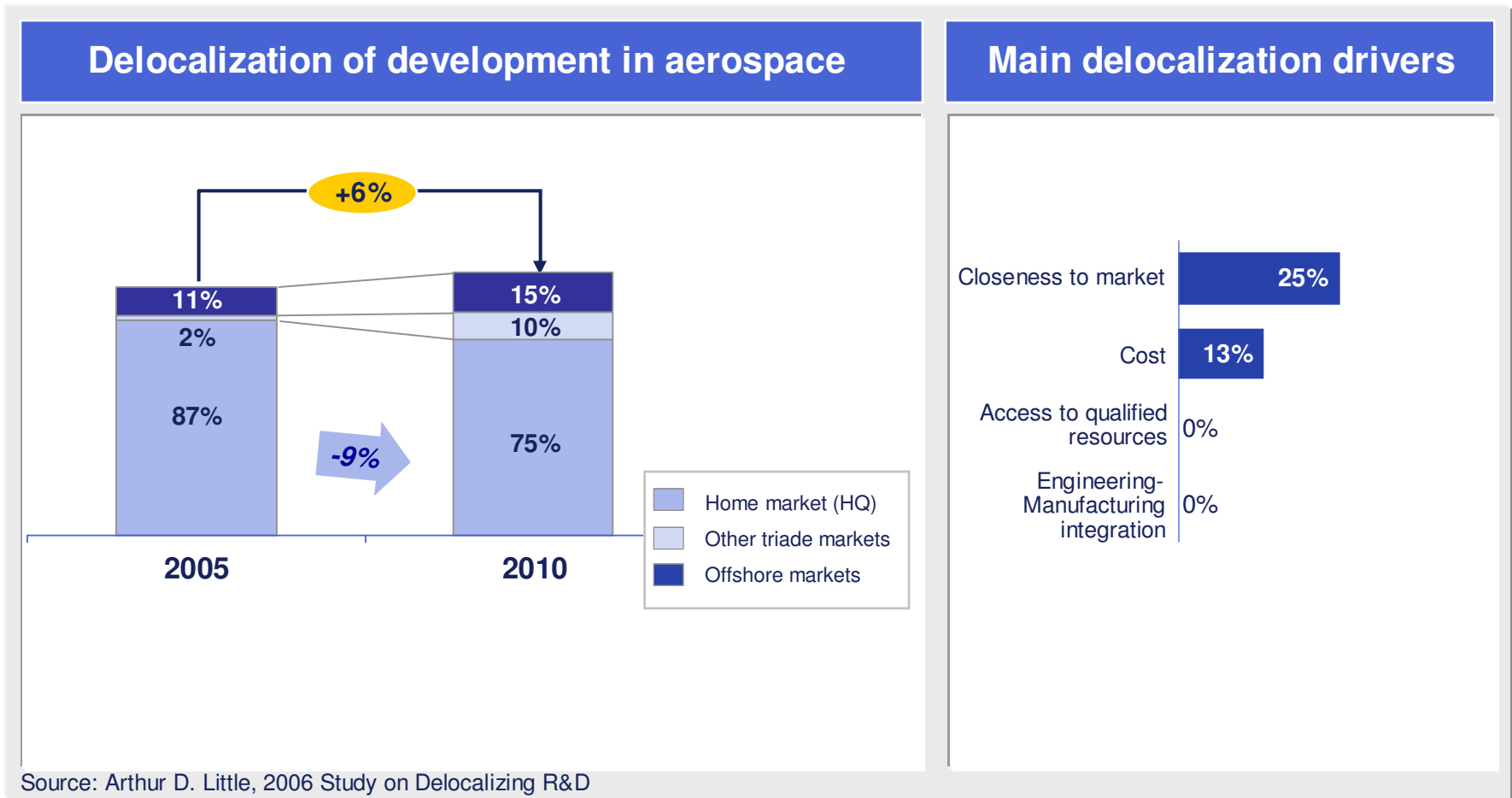
➔ Conclusion: 85.000 seems to be rather too large than too small

1) Assumption: global distribution of engineering staff equals the distribution of regular staff
Source: Arthur D. Little Development Excellence Study


Automotive suppliers showed the strongest tendency to delocalize R&D resources, mainly triggered by the need to be close to their new markets



For Aerospace companies, on the other hand, the home market remains by far the most important development region



In the Aerospace & Defense industry off-shoring is still in its infancy, however evidence points at an increase of this trend over the next years

<p>1 Growth scenario with Increasing cost pressure</p>	<ul style="list-style-type: none">■ Growth shift from traditional trade markets to global markets■ Aerospace & Defense budgets in home markets to shrink, lack of follow-up project■ Cost pressure mainly at cost of the supplier side – Need for consolidation of the fragmented industry
<p>2 Break up of classical value chain</p>	<ul style="list-style-type: none">■ Break up of classical value added structures force local presence at customer site. E.g. "power by the hour" models integrating service & maintenance■ Innovation to take place increasingly at the interface supplier – customer – Local presence required■ High percentage of country-specific contracts with local content requirements
<p> Aerospace is reluctant to change since R&D in this industry is typically considered as a national treasure – However, delocalization dynamics will increase</p>	

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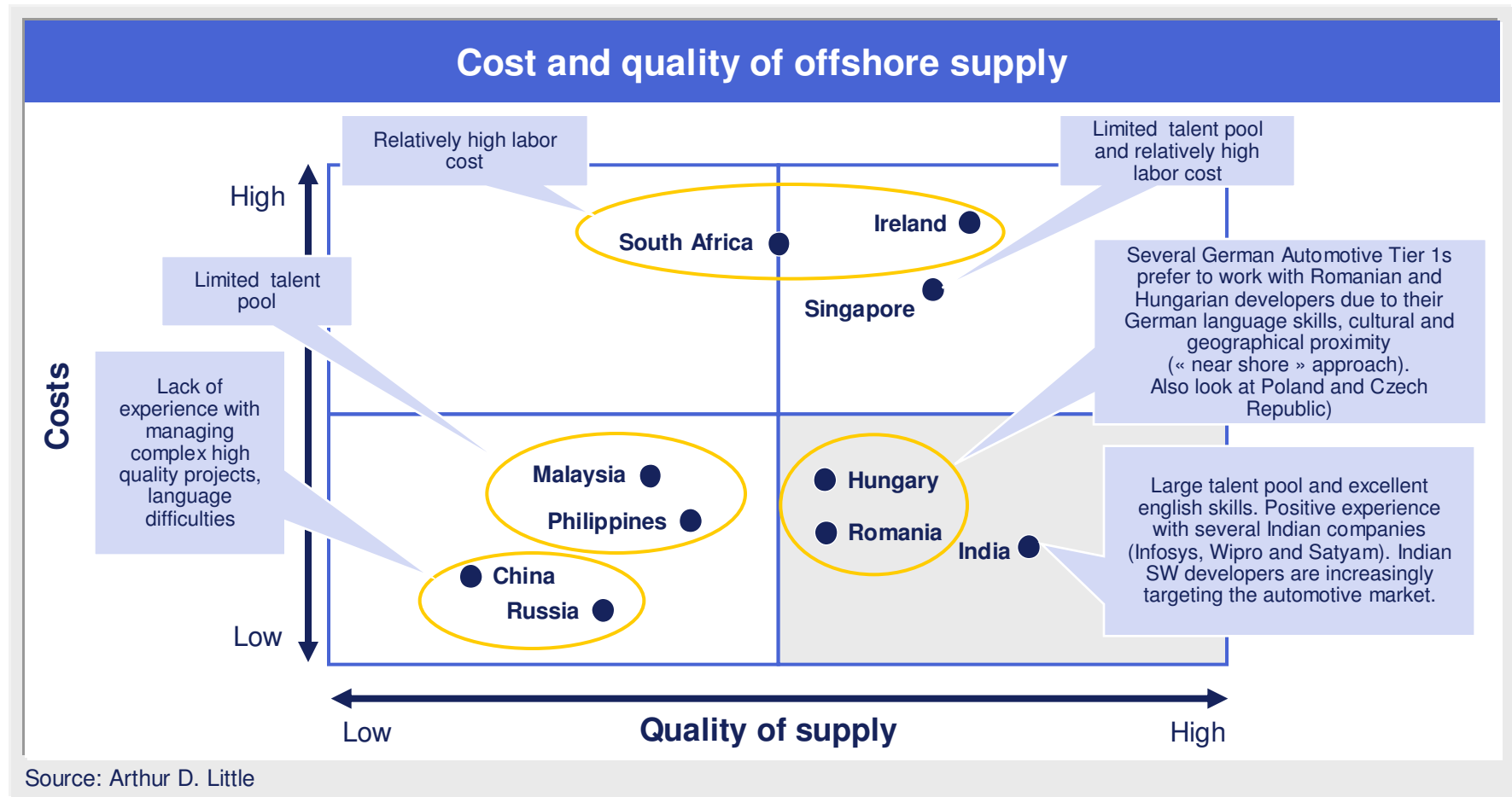
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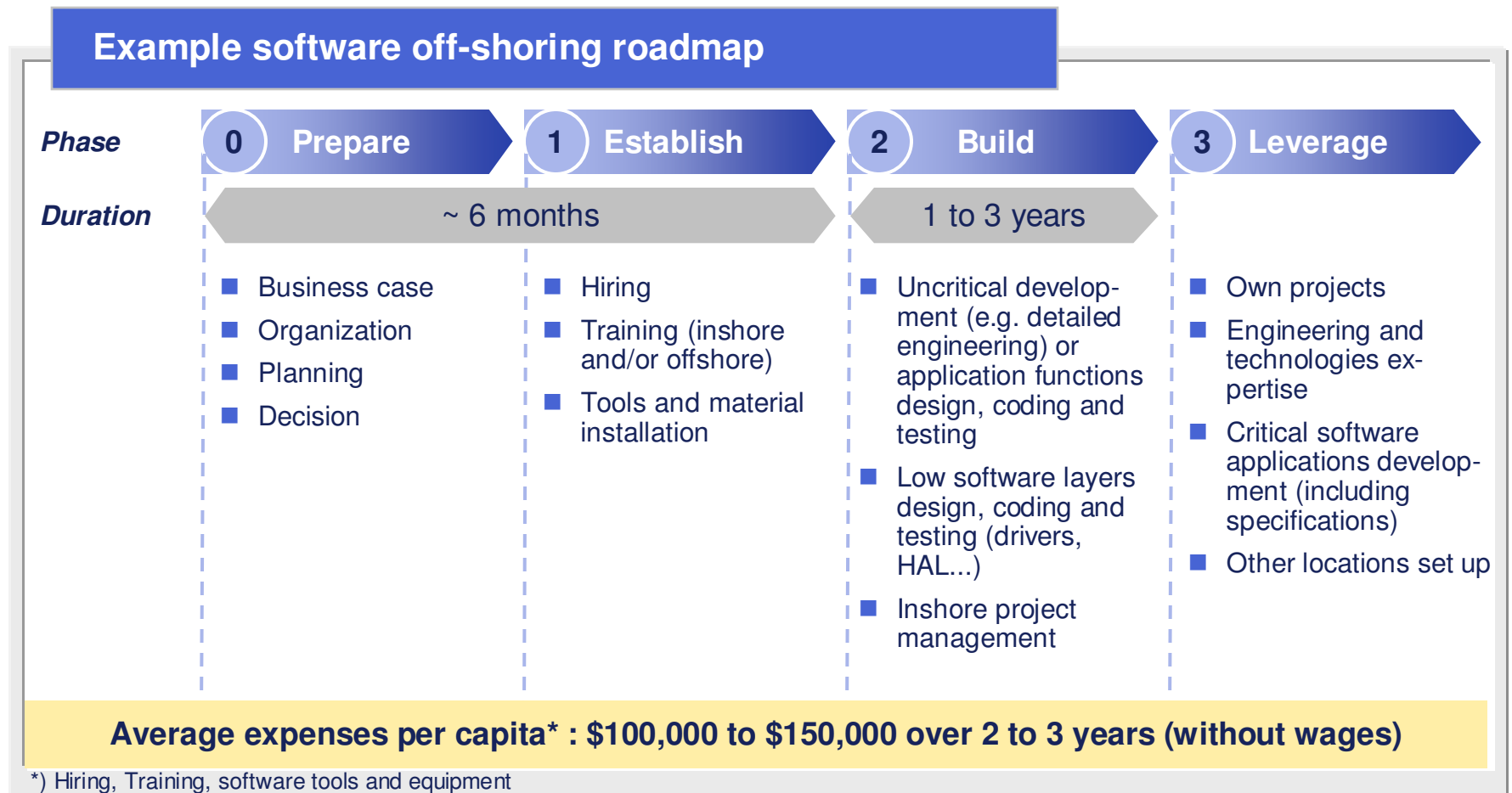
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**Off-shoring of development resources
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With quality of supply and cost as the main decision criteria, India and Eastern Europe are cited as the preferred locations for "best-shoring"



However, companies shouldn't forget off-shoring takes time & money depending on both the geographical and the business-cultural proximity



Internal process maturity together with effective people management and transfer of responsibility ensure successful delocalization

Key success factors	Quotes
Standardize and improve process maturity	<i>“You absolutely have to restructure the development process, receive the top management support, set up and specify methods and fixed interfaces before going there”, a US supplier.</i>
Effectively manage offshore employees	<i>“Show them the value added for the company, treat them like your colleagues in Germany and strengthen their self confidence. Give them clear goals; accept their work package estimations”, a German supplier</i>
Ensure competence and responsibility transfer	<i>“You need to generate a sense of responsibility and progressively delegate high value added work to them”, a German supplier.</i>
Have a long-term vision and footprint	<i>“We plan to go there for 10 to 15 years not for 5 years, so you need to have a long-term worldwide footprint vision and strategy as well as a rigorous planning and organization before going”, US supplier.</i>
Manage communication at the top management level	<i>“Clear and positive top management communication must go with such an operation”, a German Supplier.</i>
Choose the right Electronics to offshore	<i>“Hopefully we need to hire new people. We had big problems the first Electronics we did decide to offshore software development when our company was not making money. The best Electronics to do such things is during growth periods“, a US supplier.</i>

Source: Arthur D. Little, 2006 Study on Delocalizing R&D

Development delocalization also exhibits some risks, among which employee retention and communication issues are the most critical

Key risks & pitfalls	Quotes
Employee retention	<p><i>“In the beginning there was a turnover rate in India of about 20% to 25%. This means that colleagues were trained and then left the company, for example to the USA”, a German supplier.</i></p> <p><i>“Locally hired personnel does not feel committed and even linked to the company, and quit rapidly”, a German supplier.</i></p>
Language miscommunication	<p><i>“Language is a real problem we have with our east-European units. English is a must”, a German supplier</i></p>
Workload fluctuations	<p><i>“You need to maintain a high occupation rate (more than 80%) to make it economically positive”, a German supplier</i></p>
Losing know-how	<p><i>“If you exceed the ratio of 2 internal SW employees to 1 offshore colleague, you must install your own development organizations independent of the home locations. E.g. some business is done completely in offshore countries (acquisition, design, development and production) and with this you have to transfer 100% of know-how to the offshore locations without having a backup “at home””, a German supplier</i></p>
Automotive technologies know-how	<p><i>“At the beginning there were problems because the colleagues in Romania never had seen or used a central door locking system, but they are expected to develop such things”, a German supplier.</i></p>
Responsiveness	<p><i>“Some Electronics things (specifications) change so quickly, our Indian colleagues’ response Electronics have not always been satisfactory”, a US supplier</i></p>

Source: Arthur D. Little, 2006 Study on Delocalizing R&D