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Global technology development by colocating R&D and manufacturing: The case of Swedish manufacturing MNEs

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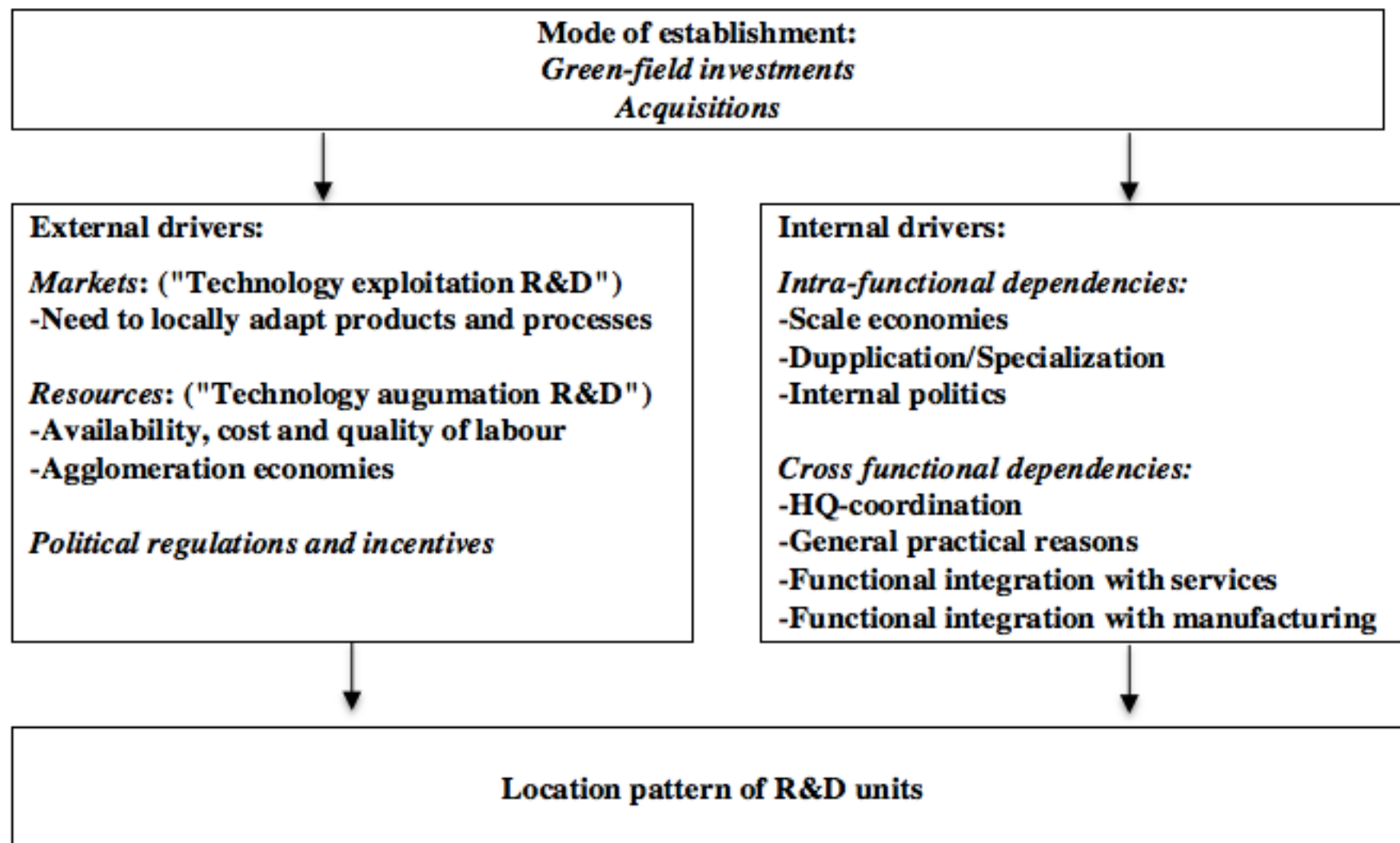
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Location determinants for R&D units



Primary data collected October 2012 - March 2013:

- Interviews at HQs/major R&D units of the 17 largest manufacturing MNEs in Sweden
- Respondents = Senior managers within Group R&D, e.g CTOs.
- R&D unit = Separate administrative unit, dedicated to R&D
- Type of location:
 - Colocation = R&D and manufacturing unit located in the same premises/city + Functionally integrated
 - Stand alone unit = All other R&D units
- Type of R&D (product and process)
 - Development of new technology
 - Adaption of existing technology ("techn. exploitation")
- Geographical scope of responsibility:
 - Local - Regional - Global

Swedish manufacturing MNEs included in the study

Table 1. Key characteristics of the companies included in the study, 2012 figures (world wide).

Company	Products	Sales SEK Bn	Emp- loy- ment	No. of countries with ope- rations	Starting year abroad	major acqui- sitions	R&D intensity ^p	No. of R&D personnel	No. of R&D units	Leading innovator ^q
Volvo AB	Commercial transport solutions	303	98 000	190	1928	^a	5.0	9 000	7	Yes
ABB	Power and automation technologies	271	146 000	100	1911	25 ^b	3.4	7 500	10	Yes
Ericsson	Telecommunications equipment and services	227	110 000	100	1882	15 ^c	15.5	22 000	23	Yes
AstraZeneca	Biopharmaceuticals	189	52 000	100	1934	nd	12.6	10 000	14	Yes
Electrolux	Household and professional appliances	110	61 000	150	1919	200 ^e	1.9	1 600	9	Yes
Sandvik	Tools for metal cutting, mining and construction	97	49 000	130	1914	86 ^g	2.5	2 300	11	Yes
Atlas Copco	Compressors, mining/construction equipments	90	39 000	170	1916	105 ^h	2.3	2 500	13	Yes
Stora Enso	Packaging, paper and wood products	87	29 000	35	1929	10 ^f	<1	400	4	
SCA	Personal care, tissues, packaging, forest products	85	34 000	100	1947	80 ^d	<1	400	6	Yes
Scania	Heavy trucks, buses, industrial/marine engines	80	39 000	100	1957	nd	4.5	3 400	3	Yes
SKF	Rolling bearings, seals, mechatronics	65	47 000	130	1911	80 ⁱ	2.0	1 700	16	Yes
Autoliv	Automotive safety systems	54	42 000	30	1982	15 ^j	5.0	4 400	20	Yes
Assa Abloy	Locks and security products	47	43 000	70	n.a	150 ^l	2.8	1 300	10	Yes
SSAB	High strength steel	44	6 000	50	1966	k	<1	200	4	
Husqvarna	Lawn movers and other outdoor power products	31	15 000	100	1913	12 ^m	2.6	1 100	6	Yes
Alfa Laval	Heat transfer, separation, fluid handling	30	16 000	100	1883	30 ^o	2.5	500	14	Yes
Trelleborg	Polymer products for sealing, damping, protecting	21	17 000	50	1951	80 ⁿ	2.0	300	5	Yes

Table 2.
Geographical locations of foreign R&D units in Swedish MNEs 2012

Country/Region	No of R&D units	No of MNEs
<i>Leading countries:</i>		
USA	24	14
China	22	13
Germany	12	10
India	12	9
France	11	7
Brazil	6	6
Japan	6	6
UK	6	4
Italy	5	5
Finland	4	4
Poland	4	4
Denmark	4	2
Other	30	11
<i>By world regions:</i>		
Western Europe ^a	54 (37%)	15
Asia/Pacific	48 (33%)	15
North America	28 (19%)	14
East Europe	10 (7%)	5
South America	6 (4%)	7
<i>By market type:</i>		
Developed markets ^b	88 (60%)	17
Emerging markets ^c	58 (40%)	16
Total	146	17

Geographical locations of the R&D units:

- 60% in Developed countries
- 40% in Emerging markets

Mode of entry:

- 66% Acquisitions (mainly developed countries)
- 34% Greenfield (mainly emerging markets)

Most R&D units where colocated with manufacturing plants

- **71% where colocated, 29% where stand alone**
- **Nine MNEs exclusively had colocated R&D units**
- **Six MNEs had mainly colocated R&D units + a few (1-2) stand-alone units.**
- **Only two companies (AstraZeneca and Ericsson), mainly had stand-alone units**
- **Excluding AZ and Ericsson, almost 90% of the other MNEs' R&D units were colocated**
- **Colocation dominates among green field (60% colocated) and acquired units (78% colocated)**
- **Colocation dominates both in developed countries and emerging markets**

**Most R&D units, both colocated and stand-alone,
mainly developed new technology, a few mainly adapted existing technology**

Table 3. Major types of R&D carried out by Swedish-based MNEs, among colocated and stand-alone R&D units. Percent of foreign located units 2013.

Major type of R&D	Colocated units (<i>N</i> = 104)	Stand-alone units (<i>N</i> = 42)	All R&D units (<i>N</i> = 146)
New global technology	42	76	52
New local/regional technology	46	21	39
Local adaptation of existing technology	12	2	9
Total	100	100	100

Colocation is part of MNEs' global R&D strategy:

- **Specialization between R&D units**
- **Centralization of strategically decision-making of R&D to Group level R&D committees**
- **Worldwide technical standards in both products and processes**
- **R&D carried out in global projects with defined objectives and special budgets**

Why colocation of R&D and manufacturing plants ?

- **Inherited location pattern through acquisitions**
- **Importance of business-to-business relations and co-development with key local customers**
- **The growth of “mid-market” segments in China and other emerging markets**
- **Increasing complexity in product and process technology, especially in engineering industries characterized by high-cost products and systems (CoPS):**

Product development and innovation in CoPS :

- **Built on close interaction between R&D and manufacturing personnel**
- **Complex, unpredictable, and detailed information-sharing**
- **Information transferred through feedback loops and face-to-face interaction**
- **Knowledge often tacit, hence difficult to codify and standardize**
- **Product design and process methods strongly affect each other**

Stand alone or colocation: The role of knowledge interdependence and modularity

Knowledge interdependence

High

Process dependent product development

Colocation essential:

- product design and manufacturing processes strongly affects each other
- information on product development and manufacturing difficult to separate

Partly independent product development

Colocation or stand alone units possible:

- product design and manufacturing processes strongly affects each other
- information on product development and manufacturing can be separated

Low

Partly independent product development

Colocation or stand alone units possible:

- product design and manufacturing processes weakly affects each other
- information on product development and manufacturing difficult to separate

Independent product development

Stand alone units possible:

- product design and manufacturing processes weakly affects each other
- information on product development and manufacturing can be separated

Low

High

Knowledge modularity

Atlas Copco

**The importance of colocation:
Moving the R&D office 400m at
Atlas Copco Rock Drills AB,
Örebro, Sweden**



Our publications on Colocation of R&D and manufacturing:

Ivarsson, I., Alvstam, C.G, and Vahlne, J-E., (2017) Global technology development by collocating R&D and manufacturing: the case of Swedish manufacturing MNEs. *Industrial and Corporate Change*, Vol. 26, No. 1, 149–168

Ivarsson, I., and Alvstam C.G (2017) New Technology development by Swedish MNEs in emerging markets: the role of colocation of R&D and manufacturing. *Asian Business and Management*, DOI 10.1057/s41291-016-0013-z