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CONTENTS

Sr. No.	TITLE & NAME OF THE AUTHOR (S)	Page No.
1.	WOMEN IN LOCAL GOVERNANCE: A STUDY OF PRIS IN GANJAM DISTRICT <i>DR. URMALA DAS & SARBANI SANKAR PANIGRAHI</i>	1
2.	MICRO-CREDIT THROUGH REGIONAL RURAL BANKS (RRBs)-A CASE STUDY OF SAPTAGIRI GRAMEENA BANK WITH FOCUS ON CHITTOOR DISTRICT <i>K. RAMANAMMA & DR. P. MOHAN REDDY</i>	6
3.	ROLE OF PUBLIC PRIVATE PARTNERSHIP IN URBAN INFRASTRUCTURE: A CASE STUDY ON WEST BENGAL STATE IN INDIA <i>DR. MANAS CHAKRABARTI</i>	10
4.	INNOVATIONS AND TECHNOLOGY TRANSFER AS SOURCES OF EMPLOYMENT STRUCTURE TRANSFORMATION BASED ON THE EXAMPLE OF THE VOLVO GROUP <i>DR. JOANNA PRYSTROM & DR. KATARZYNA WIERZBICKA</i>	16
5.	A FACTOR ANALYSIS OF PRODUCT ELEMENTS FOR CONSUMER BUYING PATTERN OF MALE GROOMING PRODUCTS IN SURAT CITY <i>TANVI B. BHALALA & GAUTAM DUA</i>	24
6.	RISK MANAGEMENT IN THE BANKS: AN ANALYSIS <i>KAJLEEN KAUR</i>	29
7.	PASSENGER EXPECTATIONS ON DOMESTIC AIRLINE SERVICES: AN ANALYSIS <i>DR. P. BABY</i>	39
8.	INNOVATIVE LEARNING PEDAGOGY IN BUSINESS SCHOOLS <i>RESHMA K. TIWARI</i>	44
9.	APPRAISAL OF INDIA'S LUXURY MARKET <i>AAKRITI CHAUDHRY</i>	48
10.	ROLE OF MICRO FINANCE IN OVERALL DEVELOPMENT OF SHGs <i>DR. K. EKAMBARAM & DR. JMJ.VINODINI</i>	53
11.	CUSTOMERS PERCEPTION TOWARDS HOUSING LOAN: A STUDY WITH REFERENCE TO STATE BANK OF INDIA IN MAYILADUTHURAI TOWN <i>DR. K. KALIDOSS & A. RAVIKUMAR</i>	62
12.	A COMPARATIVE STUDY OF RISK AND RETURN: A CASE STUDY WITH REFERENCE TO IT, TELECOM & AUTO SECTOR COMPANIES <i>NEERAJ GUPTA & DR. DEEPIKA SINGH TOMAR</i>	65
13.	PERFORMANCE OF LAND PURCHASE PROGRAMME IN KARNATAKA: WITH SPECIAL REFERENCE TO SC's AND ST's <i>DR. RAJAMMA .N</i>	72
14.	GLOBALISATION AND RURAL WOMEN IN INDIA: A CRITICAL EVALUATION <i>ABDUL SAAD KHAN & MOHAMMAD ZIA</i>	75
15.	WEBSITE USAGE FOR IMPROVED GREEN MARKETING COMMUNICATION <i>PRASHANT KUMAR</i>	77
	REQUEST FOR FEEDBACK & DISCLAIMER	83

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INNOVATIONS AND TECHNOLOGY TRANSFER AS SOURCES OF EMPLOYMENT STRUCTURE TRANSFORMATION BASED ON THE EXAMPLE OF THE VOLVO GROUP

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ABSTRACT

Technology transfer appears to constitute a crucial determinant which shapes and defines the character of demand for work. It consists of a few phases related to research and development work, defining and monitoring continuous fluctuations observable on the market, and changes in customers' expectations, creating prototypes or assessing the accuracy of an invention designed. Such transfer leads to a multilateral cooperation between business and science, and obviously has an impact on the employment level in many spheres of life. Each phase listed requires various types of employees with a wide range of skills and expertise. Moreover, favorable results of the R&D activity and efficient technology transfer allow a company to start a new production or develop the existing one, thereby enable sales increase, which is naturally followed by employment increase. Innovation clearly determines competitiveness of a domestic economy. At present, innovations along with advanced technologies serve as the basis for the functioning and development of both the greatest world economies, as well as countries characterized by strong competitive foothold and dynamically developing enterprises. Nevertheless, it should be noted that innovation activity may result in the development of any entity that pursues such type of business. This in turn enables companies to create new jobs. Changes in products and product manufacturing processes that become innovation are followed by quality increase or cost reduction. Thus, they improve a company's financial standing, while higher quality boosts competitive advantage of a given entity. In the case of competitiveness of the domestic economy, a bigger number of innovative enterprises translate into an increase of innovative potential of the entire country. Innovations that enable a company to reduce costs related to product manufacturing (product and process innovations) or overhead costs (organizational innovations) may increase its current or future competitiveness. (Świtalski 2005) On the other hand, an increased competition of domestic business entities exerts positive effects on domestic and foreign markets, and yields higher profits from export and multiplies government receipts. Implementation of innovative solutions may produce stable sales increase followed by a surging demand for local raw materials, which is connected with an increased demand for workforce and employment. (Ibidem) Innovation activity provides companies with opportunities to develop, enter new markets or expand into the existing ones, which consequently results in the necessity to create new jobs and determines economic development.

KEYWORDS

technology transfer, employment structure transformation.

INTRODUCTION

What we need is an entrepreneurial society in which innovation and entrepreneurship are normal, steady, and continuous. Just as management has become the specific organ of all contemporary institutions, and the integrating organ of our society of organizations, so innovation and entrepreneurship have to become an integral life-sustaining activity in our organizations, our economy, our society. (Drucker 1997)

Technology transfer is understood as a transfer of essential information that enables one entity to copy or develop work of a different entity. Such information assumes a technical form (engineering skills, scientific knowledge, rules) and a form of procedures, e.g. legal, non-disclosure agreements, patents, licenses. Technology transfer may occur between enterprises, enterprises and scientific and research institutions or scientific institutions. (Głodek & Gołębiowski 2006) Furthermore, technology transfer constitutes a process of adjusting the results of scientific research, patents or innovative ideas so as to enable their practical application at the production level. The process comprises a few phases such as research and engineering studies which are about creating models and prototypes, or monitoring the course of a given technological process. Moreover, technology transfer allows defining functional and economic features of new products or technological processes suggested, qualitative research, market analysis, and selecting the right producer as well as starting production. Each of the above-mentioned phases differs in terms of demand for workforce with diverse skills developed.

The relationship among innovation, technology transfer and employment is a crucial aspect of numerous studies on economic processes. The interdependence of the three elements is rather complex and has long been the focus of interests for economists. A number of studies and analyses (Krelle 1989, Pianta 2000, Pianta 2004) provide evidence of the tremendous significance of various types of innovation as well as structural and institutional economic factors which influence this relationship. M. Pianta, in his *Innovation and employment*, poses an important question: How, and to what extent, do innovations have a bearing on the volume, structure and quality of employment? W. Krelle discusses the impact of innovation and technological progress on the functioning of business entities, mentioning such aspects as productivity, efficiency, reduction of prices, growth of consumption, and the resultant increase in production and employment.

The purpose of this paper is to present the role innovation and technology transfer play in the employment area. The research has been based on a thorough analysis of a Swedish enterprise, the Volvo Group. Considered one of the most innovative enterprises in the world, operating on one of the most innovative world markets, the Volvo Group proved a good candidate to illustrate the notion of innovations and technology transfer.

ESSENCE OF INNOVATIONS AND TECHNOLOGY TRANSFER

The notion of innovation has been thoroughly analyzed and widely discussed. It refers to all spheres of life, from new solutions regarding the economic or social sphere to new mental and cultural trends. *Innovation* is popularly understood as something new and different from the existing solutions. It may be frequently associated with the need for changes for the better. Generally speaking, innovation is about introducing something new, is an item newly introduced, a novelty, or a reform. Such a definition is present both in the Polish terminology as well as in others. This results from a strong influence of Latin as the term *innovatio* in Latin is *innovatio*, i.e. renewal. (Prystrom 2008)

Joseph Schumpeter, who at the beginning of the 20th century promulgated the notion of innovation in economics, is considered to be the father and precursor of innovation. He presented economic development as a process of positive changes driven by innovations that takes place over a particular period. He viewed innovation as a new combination of the existing possibilities and pointed out its highly important developmental function, most of all with reference to the state of economy. (Fagerberg 2005)

As an example of innovation Schumpeter singled out the introduction of new products, modification of the existing ones, introduction of a new production method, finding sources and seizing opportunities, exploring areas and markets that have not been expanded before, or implementing new business ideas. (Schumpeter 1932)

On the other hand, the term *technology transfer* indicates that technology is inherent in this matter. From an encyclopedic perspective, technology is a domain of engineering that deals with developing and carrying out processes, such as production or processing raw materials, half-finished products and products, that would prove most beneficial in given conditions (Wielka Encyklopedia Powszechna). However, it seems that such understanding of the term *technology* is greatly narrowed as it does not include the whole of technical innovations, IT solutions or non-technical solutions such as organizational innovations. Moreover, machines, equipment and know-how also happen to be transferred. Therefore, technological and organizational knowledge and innovative solutions may all be defined as technology transfer. (Zawicki 2006)

In the case of business entities, technology transfer means above all acquiring and implementing innovations. This means that a project which includes information necessary for practical application of technological ideas and solutions, which make up a given technology, is the subject of technology transfer. (Ibidem)

Technology transfer is based on constant cooperation between knowledge centers, academic units, enterprise sector and industry. Technology transfer programs correspond with missions and assumptions of academic institutions. Thus, they are connected with such issues as education, research activity and initiatives in favor of public utility.

Technology transfer processes are connected with: (Lipinski et al. 2008):

- mechanisms that play a significant role while performing the R&D activity, whose results are aimed at satisfying the needs and expectations of society;
- services addressed to scientific institutes and inventors, which are aimed at facilitating the management of an industrial activity dependent on technology transfer;
- methods in the form of an additional support of industrial research that facilitate and encourage entrepreneurs to R&D initiative;
- sources of unlimited funds available for institutions whose aim is to support research activity;
- sources of specialist knowledge essential to carry out the R&D activity;
- methods that help institutions meet continually changing requirements.

Cooperation between innovative business entities with scientific infrastructure enables quick exchange of information, consulting and promotion of innovation which leads to increase of knowledge of up-to-date techniques and qualifications of industrial employees. Moreover, another significant issue is the reduction of costs related to obtaining information about innovations and current market situation, more efficient use of the potential of human knowledge and easy information processing and access to it. (Popławski 1995)

Technology transfer is a phenomenon that may be observed between companies, and companies and the R&D sector, including higher education facilities. Specialist literature on the subject provides for various terms that apply to this phenomenon, e.g. technology transfer channels, forms, sources, mechanisms or modes. Sources of new technologies may comprise own R&D studies, experience in production, quality management, marketing, design and construction of production facilities. Furthermore, another issue that appears important is being up to date with the latest scientific and technical publications and patents, employing well-educated staff including scientists and engineers, and having contacts with scientific facilities and state research organizations. In this case mergers or acquisitions, joint-venture, scientific and research cooperation and transfer of know-how are also of great importance. (Freeman 1992)

Technology transfer is also described as a process of transferring specialist knowledge from the "exporter country" to the "importer country", and applying such knowledge once all necessary adjustments have been made. This is an act of using both tangible and intangible knowledge that is or was previously used in a different country.

Usually, technology transfer takes place via a few basic channels (Kraciuk 2009:14):

- direct foreign investments, partnership alliances and control takeover;
- trade of hi-tech goods and equipment;
- licences.

Whereas, informal technology transfer methods include the exchange of scientific and technical staff, scientific and technical conferences, trade fairs and exhibitions, training sessions for foreigners, trade missions and industrial intelligence. (Ibidem)

Technology transfer may affect the employment situation both within individual business entities as well as the entire country. Technology transfer between countries may lead to structural changes in economy of the importer country in three main ways. Firstly, the existing economic structure may be extended by new segments. This may be achieved by initiating innovative investments that enable creation of new branches of industry. Secondly, technology transfer may accelerate development of certain fields of industry by increasing their share in economy due to new investments or extension/modernization of the existing projects. Technology and/or a product improved and upgraded thanks to technology transfer may support development of some sectors. Thirdly, technology transfer may exert direct impact on actions undertaken in other sectors. It may help to strengthen the structure of domestic industry as well as support the development and improve efficiency of related and ancillary domains, which may appear necessary for domestic companies to become competitive. If appropriate connections exist, new technology imported may lead to structural adjustments in other sectors of industry.

Long-term actions may produce the following results: (*Negocjacje w transferze...* 2004)

- Accelerated industrial growth due to GDP increase,
- More efficient use of production factors in the importer country,
- Heightened competitiveness of domestic enterprises on the international market,
- Greater balance of the structure of the state economy.

Technology transfer constitutes one of many ways to reach technical innovations. Imported technology may have a direct impact on economic development of the importer country in three partly unrelated ways, i.e.: (Ibidem)

- Technology transfer may increase physical resources of accessible production factors such as: foreign employees who render technical services or hold managerial positions in local enterprises, imported machines and specialist devices, foreign raw materials, components and elements unavailable in a given country, and relevant technology transfer contracts; the said increase may be either short-term, e.g. temporary employment of foreign specialists, or long-term.
- Foreign technologies may contribute to economic increase through the use of the existing resources, for instance by creating new jobs for the unemployed, reducing the unused potential in certain sectors of economy, increasing acreage to start growing new crops. This category may also include cases when local resources, which were not previously exploited due to their limited technical potential or poor condition of local enterprises, start being utilized.
- Transfer of a foreign technology may trigger off a significant efficiency increase of the existing factors, e.g. workforce, equity, natural resources including land. This is possible thanks to increase in the production volume while maintaining an unchanged volume of outlays, or decrease of outlays while maintaining an unchanged production volume.

By spreading the effects of the R&D and innovation activity both throughout the local, domestic as well as international ground, technology transfer translates into strengthening the condition of economy and increasing economic competitiveness, and consequently allows creating new jobs and improving situation on the job market.

INNOVATION ACTIVITY AND TECHNOLOGY TRANSFER IN THE VOLVO GROUP AND THEIR IMPACT ON THE EMPLOYMENT STRUCTURE

The Volvo Group represents an example of a Swedish enterprise which due to its innovation activity, against a background of competition, achieved success and increased the employment level. The company is one of the leading producers of trucks, buses and construction equipment and drive systems. (Grupa Volvo 2009)

The Group has clients in 180 countries worldwide, mainly in Europe, North America and Asia. Its products and services are available via a network of independent dealers and outlets owned by the Group. Clients' queries and orders for spare parts or any other services are handled by a global service network. In this way the Group's structure includes such areas of activity as product development, production, and supply of spare parts, logistics, administration and supporting functions. (Ibidem)

The Volvo Group comprises about twenty enterprises including Volvo Trucks, Renault Trucks, Volvo Buses, Volvo Penta, Volvo Financial Services (VFS), Mack Trucks, Nissan Diesel, Volvo Construction Equipment, Volvo Aero, Volvo Logistics, Volvo 3P, Volvo Powertrain, Volvo Parts, Volvo Business Services Central Europe CE, Volvo Treasury and Volvo Group Real Estate (VRE). The Group's business activity is greatly based on technological innovations, and thus it is hardly surprising that the following departments: Volvo Technology, Volvo Information Technology and Volvo Technology Transfer are present in the corporate structure. (Struktura Grupy Volvo 2009)

Volvo Technology (VTEC) develops new technical and business solutions mainly for entities of the Group. This innovative company tries to find new technical and conceptual solutions related to products and processes from the transport and automotive industry. Its biggest clients are entities of the Volvo Group and Volvo Car¹, as well as selected suppliers. Moreover, Volvo Technology runs strategic programs and specialist tasks regarding innovations. It is involved in domestic and international research programs which gather universities, research institutes and other enterprises. VTEC employs over 350 professionals and has offices in Lundbystrand and Chalmers Science Park in Gothenburg and Volvo plants in France (Lyon) and in the USA. (Volvo Technology 2009)

Volvo Information Technology (Volvo IT) provides solutions for all areas of the industrial process. Its clients are both companies from the Volvo Group as well as Volvo Car Corporation, and other global industrial companies. Volvo IT has offices in many countries all over the world, and its business activity covers a wide range of IT domains. (Volvo Information Technology 2009)

Volvo Information Technology AB was founded in 1998 as a subsidiary of the AB Volvo². Currently it employs over 6 000 employees all over the world. It should be also noted that Volvo Information Technology looks after proper functioning of complex IT systems. Volvo IT provides solutions for all areas of industrial process and offers its exceptional skills, experience and expertise in the broadly defined IT operations. (Volvo Information Technology 2009)

Along with the Volvo Group activity related to technological processes, from the point of view of the Group, Volvo Technology Transfer AB, which develops and supports innovation activeness, plays also a crucial role. Scope of the Volvo Technology Transfer actions covers three main areas: (www.volvo.com/gr... 2009)

1. Bringing the Volvo Group closer to new technologies or services by investing in companies and projects that are interesting from the technical and commercial viewpoint;
2. Supporting the development of entities that use Volvo technology based on potential from outside the Group;
3. Supporting the development of resourcefulness and innovation inside the Volvo Group.

In the case of innovation and competition issue, technology transfer plays a significant role. Thanks to updates and innovations that are being developed and implemented, likewise technology transfer, business entities are able to face the ongoing and continuous market changes, expectations of customers and the omnipresent competition. In the end, apart from better quality of products and services, intensified and improved flexibility of production and services rendered, reduced labour costs per unit, lower consumption of materials and energy per unit etc., Swedish business entities may extend the range of goods and services, enter new markets or increase their market share in the existing markets. Consequently, this is connected with production boost and development of a company, which often entails employing new staff.

Since many years, the Volvo Group has been widely known for its innovative approach to design, which may be reflected in the level of expenditure allocated to the R&D activity. (Niemożliwe staje się... 2009; see table 1)

Data illustrate a hesitant tendency as regards outlays on the R&D. Nevertheless, in 2000-2008 a growing trend could be observed. In the end, despite a drop in financial support initiated in 2009, in 2010 the level of financing of the R&D increased by approx. 49.7% compared to 1997.

TABLE 1: VOLVO GROUP R&D EXPENSES FROM 1997 TO 2012 (in million SEK³)

Year	Level of R&D expenses in the Volvo Group
1997	8,659
1998	10,104
1999	4,525
2000	4,876
2001	5,391
2002	5,869
2003	6,829
2004	7,614
2005	7,557
2006	8,354
2007	11,059
2008	14,348
2009	13,193
2010	12,970
2011	13,276
2012	14,794

Source: *The Volvo Group Report 2007*, AB Volvo, Gothenburg 2007, p. 149, http://www3.volvo.com/investors/finrep/ar07/annual_report_2007_eng.pdf, 18 Feb 2009 and *Volvo Group. Report on operations 2008*, AB Volvo, Gothenburg 2008, p. 6,

http://www3.volvo.com/investors/finrep/interim/2008/q4/q4_2008_eng.pdf, 18 Feb 2009 and *The Volvo Group 2010. Moving ...*, Volvo Group, Gothenburg 2011, http://www3.volvo.com/investors/finrep/ar10/ar_2010_eng.pdf, 21 Dec 2011, p. 129, 136, *The Volvo group annual report 2012*, AB Volvo, Gothenburg 2012, p. 89, http://www3.volvo.com/investors/finrep/ar12/ar_2012_eng.pdf, 04 April 2013

Furthermore, a few examples of an incessant innovative activity of some companies of the Group, due to which it strengthens its position in the international area, should not be underestimated. Since the Volvo Group is a large company, the innovation analysis has been narrowed down to Volvo Trucks.

Novelties introduced lately by Volvo Trucks include: (*Innowacje Volvo adresowane...*2009)

¹ Volvo Car Corporation, with its registered office in Gothenburg, until 2004 was a part of the Volvo Group; then it was purchased by Ford Motor Corporation. Volvo Car Corporation is a producer of prestigious Volvo cars that are sold in over 100 countries. Apart from the United States, which are its major customer, high sales are also reported in such European countries as Sweden, Great Britain and Germany.

² AB Volvo is an official brand name of the Volvo Group.

³ SEK 1= PLN 0.5031 (NBP mid-rate as of 4 April 2013).

- Driver Alert Support System which warns weary drivers when their attentiveness is affected (applied in a truck for the first time in Europe);
- Lane Changing Support System which allows the driver to detect other vehicles in the blind spot on the passenger side; cornering lights that illuminate the edge of the road when turning; rain sensor which automatically adjusts the speed of the windscreen wipers (introduced in trucks for the first time in Europe);
- Electronic Stability Program system designed for 6x2 trucks with trailers (first in the world); Security Service – a service which enables drivers to quickly contact the nearest police station in case of emergency.

It should also be mentioned that in the nearest future Volvo Trucks will start manufacturing hybrid trucks. The hybrid technology allows reducing fuel consumption even by 30%. (*Rozwizania jutra...*2009)

Volvo research centre, Volvo Technology, is the leader in the most important EU project on traffic safety which is aimed at finding solutions that would enhance traffic safety in the future. Results of their work have been implemented in the Integrated Safety Truck. Volvo Technology has appointed a team whose task is to streamline vehicle safety systems. Effects of its work will soon find application in trucks all over the world. (*Ich praca...*2009)

Despite their reduction in 2008, increase in financial outlays on R&D activity of the Group resulted in the company's greater innovation and sales growth, e.g. of the Volvo Trucks (see table 2).

TABLE 2: SALES OF VOLVO TRUCKS PRODUCTS FROM 2008 TO 2012

Market	2008	2009	2010	2011	2012
Europe	58,187	49,145	65,503	95,113	84,355
North America	15,887	17,574	24,282	42,613	47,806
South America	12,890	12,587	21,483	29,274	23,443
Asia	13,440	34,800	53,833	51,514	56,165
Other markets	5,584	13,575	14,888	15,226	16,899
Total	105,952	127,681	179,989	238,391	224,017

Source: adapted by the author based on *The Volvo Group 2009*, AB Volvo, Gothenburg 2009, p. 41,

http://www3.volvo.com/investors/finrep/ar09/ar_2009_eng.pdf, 27 Dec 2011 and *The Volvo Group 2010. Moving ...*, Volvo Group, Gothenburg 2011, p. 29,

http://www3.volvo.com/investors/finrep/ar10/ar_2010_eng.pdf, 27 Dec 2011, *The Volvo group annual report 2012*, AB Volvo, Gothenburg 2012, p. 59,

http://www3.volvo.com/investors/finrep/ar12/ar_2012_eng.pdf, 04 April 2013

Bigger number of products sold is also connected with the value increase of these products, which in 2007-2008 grew by almost 8% and reached the level of SEK 203,235 million. The European market constitutes the largest market for Volvo Trucks products. Interestingly enough, in 2007 the second largest market was Asia which outstripped the US (see table 3).

TABLE 3: NET SALES OF VOLVO TRUCKS PRODUCTS FROM 2007 TO 2012 (in million SEK)

Market	2007	2008	2009	2010	2011	2012
Europe	108,651	109,914	65,874	69,606	83,451	76,365
North America	27,255	26,588	21,563	26,901	37,042	42,650
South America	11,483	14,680	12,490	21,680	26,847	21,172
Asia	26,593	37,515	26,943	35,231	37,840	36,531
Other markets	13,910	14,538	12,069	13,887	13,741	15,565
Total	187,892	203,235	138,939	167,305	198,920	192,283

Source: adapted by the author based on *Volvo Group. Report on operations 2008*, Volvo Group, Gothenburg 2008, p. 11 and *The Volvo Group 2010. Moving ...*, p.

135, Volvo Group, Gothenburg 2011, http://www3.volvo.com/investors/finrep/ar10/ar_2010_eng.pdf, 21 Dec 2011, *The Volvo group annual report 2012*, AB

Volvo, Gothenburg 2012, p. 59, http://www3.volvo.com/investors/finrep/ar12/ar_2012_eng.pdf, 04 April 2013

Transfer of developed technologies, which created the possibility of production and sales increase, resulted in employment increase in 1997-2007. A year later, this level was brought down, just to increase again by approx. 2.3% in 2010 (see table 4).

TABLE 4: NUMBER OF VOLVO TRUCKS EMPLOYEES FROM 1997 TO 2012

Year	Number of Volvo Trucks employees
1997	22,090
1998	22,560
1999	23,330
2000	24,320
2001	44,180
2002	43,470
2003	46,900
2004	49,450
2005	50,240
2006	49,900
2007	64,390
2008	64,280
2009	56,505
2010	57,796
2011	62,315
2012	61,256

Source: adapted by the author based on *Number of employees at year - end in Volvo Group*,

http://www3.volvo.com/investors/finrep/ar07/eng/elevenyearssummary/business_area_statistics.html, 07 Jan 2009 and *The Volvo Group 2010. Moving ...*, p.

136, Volvo Group, Gothenburg 2011, http://www3.volvo.com/investors/finrep/ar10/ar_2010_eng.pdf, 21 Dec 2011, *The Volvo group annual report 2012*, AB

Volvo, Gothenburg 2012, p. 182, http://www3.volvo.com/investors/finrep/ar12/ar_2012_eng.pdf, 04 April 2013

The aforementioned technological capacity and innovation of the Volvo Group translate into its strong position on most markets. In the third quarter of 2007, the increase of the Group's sales and income continued. Most importantly, demand for Volvo products and services remains at a high level in Europe, Asia and South America, while in North America low demand prevails. (*Informacje dla inwestorów 2009*)

Thanks to technology transfer and innovation, in 2007 the Volvo Group as a whole observed a 10% sales growth, i.e. up to SEK 285.4 billion, and a noticeable export increase. Moreover, in 2008 employment in the Group increased up to 97 thousand employees in 58 countries, with the highest number of employees in Sweden, France and the United States. (Grupa Volvo 2009)

Operating in 58 countries, selling its products and services on 180 markets and investing in innovations, development and technology transfer, in 2007 the Volvo Group reached the average sales of approx. EUR 27 billion. (*Volvo: Information Regarding New Capital Structure 2009*)

TABLE 5: NET SALES ON WORLD MARKETS FROM 2007 TO 2012 (in million SEK)

Market	2007	2008	2009	2010	2011	2012
Western Europe	124,239	123,881	84,452	87,241	97,925	88,325
Eastern Europe	27,116	28,126	9,632	12,570	20,298	20,751
North America	49,435	47,600	37,291	45,409	58,253	68,297
South America	15,638	19,553	16,610	27,876	34,013	27,970
Asia	42,429	55,641	44,842	65,072	73,017	68,500
Others	17,938	20,131	15,660	19,207	20,083	22,188
Total	276,795	294,932	208,487	257,375	303,589	296,031

Source: Volvo Group. Report on operations 2008, AB Volvo, Gothenburg 2008, p. 6,

http://www3.volvo.com/investors/finrep/interim/2008/q4/q4_2008_eng.pdf, 18 Feb 2009 and *The Volvo Group 2010. Moving ...*, p. 58, Volvo Group, Gothenburg 2011, http://www3.volvo.com/investors/finrep/ar10/ar_2010_eng.pdf, 27 Dec 2011, *The Volvo groupannual report 2012*, AB Volvo, Gothenburg 2012, p. 92, http://www3.volvo.com/investors/finrep/ar12/ar_2012_eng.pdf, 05 April 2013

Financial standing of Volvo may be reflected in the export structure of the Volvo Group products. It may be observed that the export level of the company's products was subject to considerable fluctuation, but within ten years increased by approx. 50% (see table 6).

TABLE 6: SWEDISH EXPORT OF VOLVO GROUP PRODUCTS FROM 1997 TO 2012 (in million SEK)

Year	Export level of the Volvo Group products
1997	58,569
1998	64,401
1999	52,719
2000	46,251
2001	50,394
2002	52,730
2003	49,300
2004	62,653
2005	71,133
2006	80,517
2007	88,606
2008	96,571
2009	41,829
2010	72,688
2011	91,065
2012	84,314

Source: Financial information. Eleven - year summary, http://www3.volvo.com/investors/finrep/ar07/eng/elevenyearssummary/volvo_group.html, 07 Jan 2009,

The Volvo groupannual report 2012, AB Volvo, Gothenburg 2012p. 179, http://www3.volvo.com/investors/finrep/ar12/ar_2012_eng.pdf, 04 April 2013

The Volvo Group employs people virtually all over the world. Apart from AB Volvo in Sweden, the company provides employment in its subsidiaries and branches for tens of thousands of people in Western and Eastern Europe, North and South America and Asia.

Due to continuous innovation activity and multiple offices all over the world, between which transfer of developed technologies takes place, the Volvo Group offers hundreds of thousands of people a job. At the end of 2008, the Group employed 97,030 workers, while in 2007 the number totaled 92,260. (Volvo Group Report on operations 2008; *The Volvo Group Report 2007*) (see table 7).

TABLE 7: TOTAL EMPLOYEE COUNT IN THE VOLVO GROUP FROM 2006 TO 2012 BROKEN INTO VARIOUS MARKETS

Market	2006	2007	2008	2009	2010	2011	2012
AB Volvo in Sweden	160	178	196	190	198	171	236
Subsidiaries, branches:							
Sweden	26,722	27,826	28,126	23,637	23,313	24,793	23,028
Western Europe	26,380	27,340	27,584	25,533	23,515	24,241	22,116
Eastern Europe	4,225	5,027	5,694	5,542	5,768	6,220	6,603
North America	14,609	11,716	10,625	10,091	12,429	15,380	16,481
South America	3,874	4,664	4,328	4,180	5,264	6,080	6,150
Asia	4,075	12,824	17,924	16,650	21,205	22,915	24,798
Others	3,145	2,685	2,553	2,261	2,558	2,448	2,670
Total	83,190	92,260	97,030	88,084	94,250	102,248	102,082

Source: *The Volvo Group Report 2007*, AB Volvo, Gothenburg 2007, p. 122, 156, http://www3.volvo.com/investors/finrep/ar07/annual_report_2007_eng.pdf, 18 Feb 2009, *The Volvo Group 2009*, AB Volvo, Gothenburg 2009, p. 104, http://www3.volvo.com/investors/finrep/ar09/ar_2009_eng.pdf, 27 Dec 2011 and *The Volvo Group 2010. Moving ...*, p. 104, Volvo Group, Gothenburg 2011, http://www3.volvo.com/investors/finrep/ar10/ar_2010_eng.pdf, 27 Dec 2011, *The Volvo groupannual report 2012*, AB Volvo, Gothenburg 2012, p. 132, http://www3.volvo.com/investors/finrep/ar12/ar_2012_eng.pdf, 05 April 2013

Having analyzed the employment at the Group from 1999 to 2010, it may be observed that its level was variable. In 1999-2012, the trend in employment was upward, but in 2009 the number of employees fell by approx. 11% compared to the previous year. However, in 2010 a slight change was noticed, with an increase of 0.22% in the number of employees (see table 8).

Considering the number of employees in the Volvo Group as well as its innovation activity, it may be assumed that innovations developed and implemented since 1999 enabled the company to hire more people. During the decade the number of employees increased by almost 100%, from 53,470 to 101,381 in 2008.

TABLE 8: EMPLOYEE COUNT IN THE VOLVO GROUP FROM 1999 TO 2012

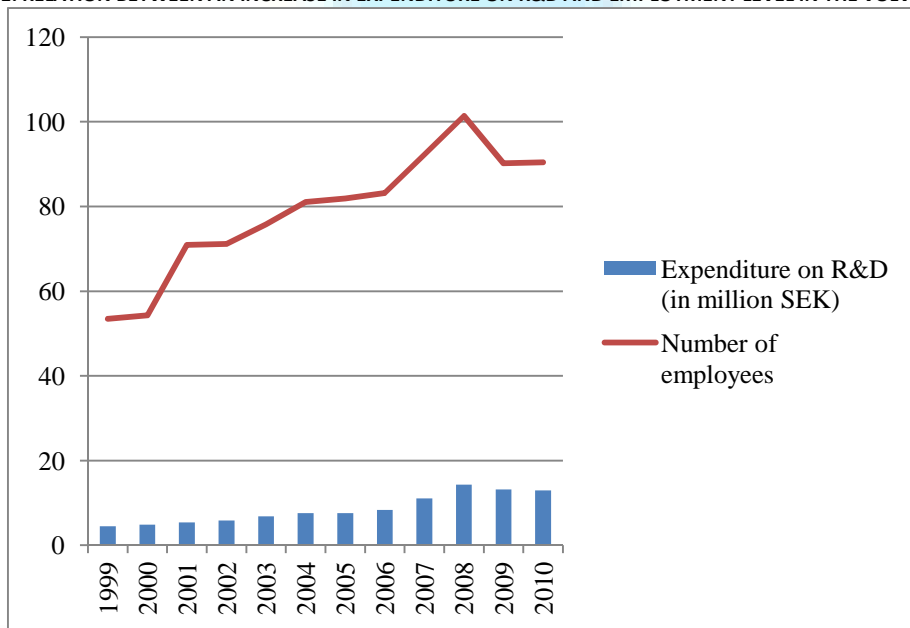
Year	Number of employees
1999	53,470
2000	54,270
2001	70,920
2002	71,160
2003	75,740
2004	81,080
2005	81,860
2006	83,190
2007	92,260
2008	101,381
2009	90,208
2010	90,409
2011	98,162
2012	98,717

Source: *The Volvo Group Report 2007*, AB Volvo, Gothenburg 2007, p. 122, 156, http://www3.volvo.com/investors/finrep/ar07/annual_report_2007_eng.pdf, 18 Feb 2009; *Volvo Group. Report on operations 2008*, AB Volvo, Gothenburg 2008, p. 9, http://www3.volvo.com/investors/finrep/interim/2008/q4/q4_2008_eng.pdf, 18 Feb 2009 and *The Volvo Group 2010. Moving ...*, p. 136, http://www3.volvo.com/investors/finrep/ar10/ar_2010_eng.pdf, 21 Dec 2011, *The Volvo groupannual report 2012*, p. 187, http://www3.volvo.com/investors/finrep/ar12/ar_2012_eng.pdf, 04 April 2013

TABLE 9: EXPENDITURE ON R&D AND EMPLOYMENT LEVEL IN THE VOLVO GROUP

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Expenditure on R&D (in million SEK)	4,525	4,876	5,391	5,869	6,829	7,614	7,557	8,354	11,059	14,348	13,193	12,970	13,276	14,794
Number of employees	53,470	54,270	70,920	71,160	75,740	81,080	81,860	83,190	92,260	101,381	90,208	90,409	98,162	98,717

FIGURE 1: RELATION BETWEEN AN INCREASE IN EXPENDITURE ON R&D AND EMPLOYMENT LEVEL IN THE VOLVO GROUP

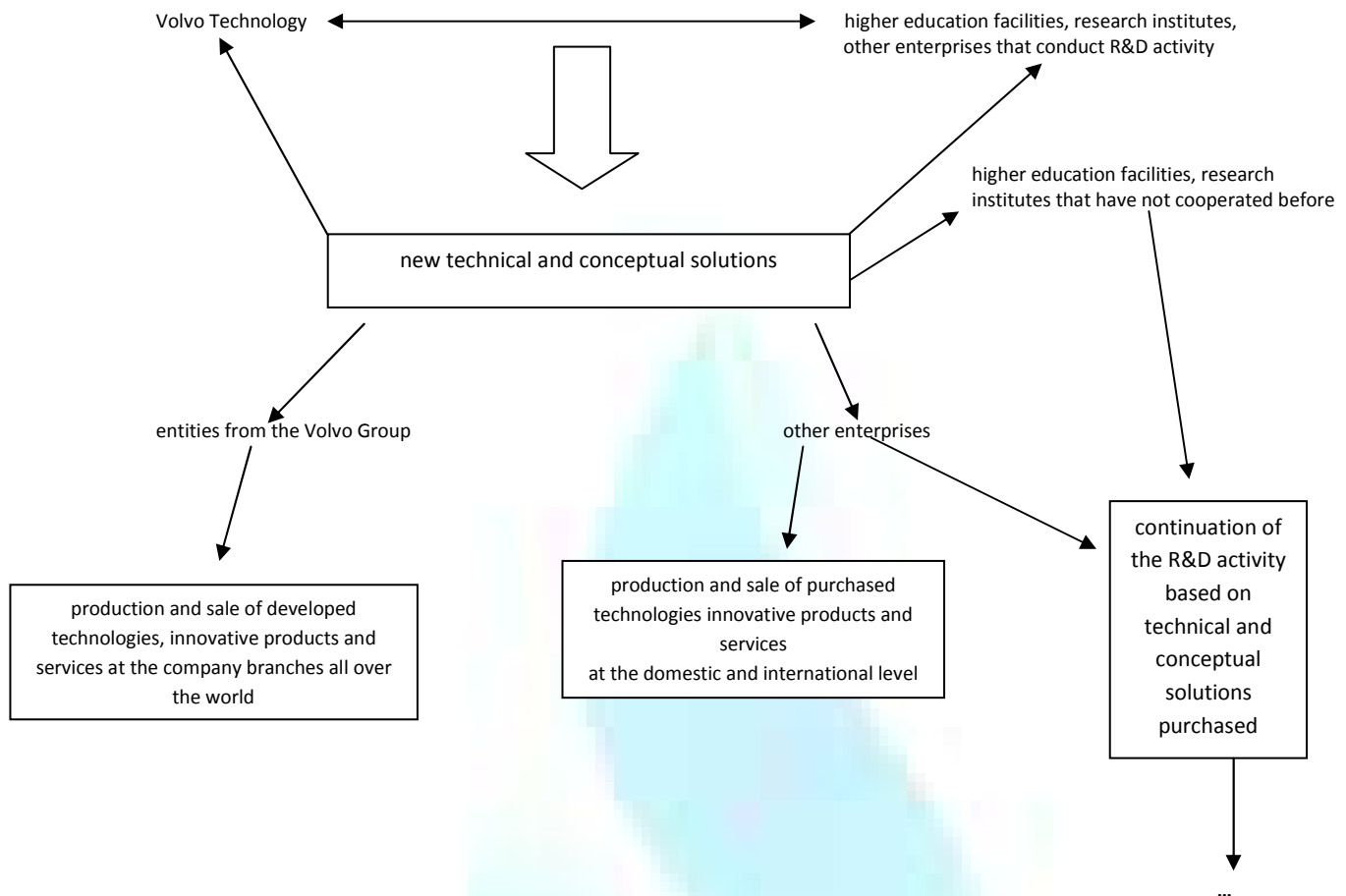


Source: adapted by the author based on *The Volvo Group Report 2007*, AB Volvo, Gothenburg 2007, p. 122, 149, 156, http://www3.volvo.com/investors/finrep/ar07/annual_report_2007_eng.pdf, 18 Feb 2009.; *Volvo Group. Report on operations 2008*, AB Volvo, Gothenburg 2008, p. 6, 9, http://www3.volvo.com/investors/finrep/interim/2008/q4/q4_2008_eng.pdf, 18 Feb 2009 and *The Volvo Group 2010. Moving ...*, Volvo Group, Gothenburg 2011, p. 129, 136, http://www3.volvo.com/investors/finrep/ar10/ar_2010_eng.pdf, 21 Dec 2011, *The Volvo groupannual report 2012*, AB Volvo, Gothenburg 2012, p. 89, 187, http://www3.volvo.com/investors/finrep/ar12/ar_2012_eng.pdf, 04 April 2013

It is interesting to note how the employment level has been shaped compared to financial outlays made on the R&D activity (see table 9). This relation has been illustrated in graph 1. It may be observed that financial outlays on the R&D activity, maintained on a stable or rising level, and dynamic technology transfer created strong possibilities for employment increase. In this way within ten years the number of persons employed has doubled.

New technical and conceptual solutions developed independently by the Volvo Technology or in cooperation with representatives of higher education facilities, research institutions or other enterprises that pursue R&D activity, are used in many different ways. Consequently, they are purchased by other business entities and research units which have never cooperated before. Moreover, innovative technologies are often subject to further research and undergo the production process, to be later sold in companies that comprise the Volvo Group as well as by other enterprises that are interested in innovations developed. Technology transfer process in Volvo covers both the R&D department of the enterprise, as well as its cooperators and subsidiaries all over the world, which are involved in the production and sales of innovative technologies. As already mentioned, while developing new technical and business solutions the Volvo Technology cooperates with higher education facilities, research institutions and other enterprises. Frequently, novel solutions are invented not necessarily by employees of the scientific department but by other persons from the cooperating units. Thus, the results of the R&D are mutually shared. In the case when a given project is developed by Volvo, the company makes respective information available to research institutes, which will further spread such data among the scientists or will use them to work on other innovation-related projects. Inventive scientific discoveries are also used by Volvo to produce innovative technical solutions. Volvo's R&D department provides all branches located all over the world with its novel discoveries. Innovative moves create the possibility of starting a new or boosting the existing production in factories all over the world. As a result, this allows the company to realize sales on new markets or increase its volume on the current ones, and also enables employment raise (see figure 2).

FIGURE 2 TECHNOLOGY TRANSFER IN THE VOLVO GROUP



Source: adapted by the author.

CONCLUSION

Technology transfer appears to constitute a crucial determinant which shapes and defines the character of demand for work. It consists of a few phases related to research and development work, defining and monitoring continuous fluctuations observable on the market, and changes in customers' expectations, creating prototypes or assessing the accuracy of an invention designed. Such transfer leads to a multilateral cooperation between business and science, and obviously has an impact on the employment level in many spheres of life. Each phase listed requires various types of employees with a wide range of skills and expertise. Moreover, favorable results of the R&D activity and efficient technology transfer allow a company to start a new production or develop the existing one, thereby enable sales increase, which is naturally followed by employment increase.

Innovation clearly determines competitiveness of a domestic economy. At present, innovations along with advanced technologies serve as the basis for the functioning and development of both the greatest world economies, as well as countries characterized by strong competitive foothold and dynamically developing enterprises. Nevertheless, it should be noted that innovation activity may result in the development of any entity that pursues such type of business. This in turn enables companies to create new jobs.

Changes in products and product manufacturing processes that become innovation are followed by quality increase or cost reduction. Thus, they improve a company's financial standing, while higher quality boosts competitive advantage of a given entity. In the case of competitiveness of the domestic economy, a bigger number of innovative enterprises translates into an increase of innovative potential of the entire country.

Innovations that enable a company to reduce costs related to product manufacturing (product and process innovations) or overhead costs (organizational innovations) may increase its current or future competitiveness. (Świtalski 2005)

On the other hand, an increased competition of domestic business entities exerts positive effects on domestic and foreign markets, and yields higher profits from export and multiplies government receipts. Implementation of innovative solutions may produce stable sales increase followed by a surging demand for local raw materials, which is connected with an increased demand for workforce and employment. (Ibidem)

Innovation activity provides companies with opportunities to develop, enter new markets or expand into the existing ones, which consequently results in the necessity to create new jobs and determines economic development.

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