

ZBIGNIEW KŁOS*, PRZEMYSŁAW KURCZEWSKI*

LCA in Poznań and Poland. Research teams and their achievements

Key words

LCA, Poznań, Poland, research centres, research activities.

Słowa kluczowe

LCA, Poznań, Polska, centra badawcze, działalność badawcza.

Summary

Increasing interest of different organisations (industrial companies, governmental authorities, consultancy agencies and non-governmental organisations) in the environmental evaluation of products has caused the need of tools for its realisation. Some attempts have already been made in this field in the world, mainly for every-day life consumer products (packaging, hygiene wares and cleaners, simple household equipment, etc.). In the paper, the history and actual situation in research on LCA in Poznań (in detail) and in Poland (briefly) is presented. The main LCA research centres, key figures working there, and their professional activities are characterised.

1. Introductory remarks. early activities in the field of LCA

Each new branch of science looks for its roots. The same is with LCA. Some papers showing the need of more complex environmental analysis of

* Poznań University of Technology, Faculty of Working Machines and Transportation, Institute of Working Machines and Transportation Piotrowo 3 St., 60-965 Poznań, Poland.

products were published in seventies, but the LC approach appeared in publications in the end of eighties, as showed in his fundamental book G. Huppes [1]. The history of introduction of LCA into research practice in Poland is similar. Some already “pre-historical” activities connected with Life Cycle frames were done in second part of eighties. They are connected with research centre, located at Poznań University of Technology (PUT). As a first such activities one can consider the following:

- The first paper on LCA: Rozważania o celowości wyznaczania środowiskowego kosztu istnienia maszyn i urządzeń (Considerations on the Usefulness of Determination of Environmental Expenditure of the Existence of Machines and Devices), published in *Zeszyty Naukowe Politechniki Poznańskiej* (Scientific Works of PUT), seria: *Maszyny Robocze i Pojazdy* (series: Machines and Vehicles) in 1986 (author: Zbigniew Klos);
- The first book on LCA related issues, written by Zbigniew Klos: *Sozologiczność obiektów technicznych. Studium wartościowania wpływu maszyn i urządzeń na środowisko* (Environment Protection Oriented Property of Technical Objects. A Study of Valuation of Machines and Devices Influence on Environment), published by Wydawnictwo Politechniki Poznańskiej (Editions of PUT) in 1990; and,
- The first PhD thesis was *Ekobilansowanie maszyn i urządzeń na przykładzie sprężarek powietrza* (Ecobalancing of Machines and Devices with the Example of Air Compressors) was defended by Grzegorz Laskowski (supervisor: Prof. Zbigniew Klos) at Faculty of Machines and Vehicles, PUT in 1999.

The first other activities in nineties include the following:

- Participation in work activities of European LCA research groups; Zbigniew Klos as a member of SETAC-Europe Workgroup on LCA and Conceptually Related Programmes (1994-95) and member of SETAC-Europe WG on LCA Case Studies (1994-96);
- Participation in European Union Research Programme LCANET in 1996-97 and in European Union Concerted Action CHAINET in 1998-2000 (Zbigniew Klos);
- The creation and further development of original methodology for quantification of technical objects influence on environment (elaborated in late eighties and presented in 1990 in the above mentioned first LCA book) with examples of application (idea, assumptions and structure of this method are similar to those developed at the beginning of 90s ties in well known UBP-method and in works elaborated in CML);
- A scientific stay in the famous LCA centre – CML, University of Leiden in May-June 1995, where Zbigniew Klos was a contractor of TEMPUS/ PHARE programme;
- A cycle of ten conferences focused on TQM and environmental problems (first conference – 1992), presenting also ecobalancing problems and actual state of art on LCA studies in Poland; and,
- Attempts of LCA application as a tool for assessment of environmental impacts of different objects: coal electrodes produced by Zakłady Elektrod

Węglowych S.A. (1998), machines and appliances in Pofamia S.A. (1999) and selected products of the company PoWoGaz S.A. (1999), as well as other specific projects on diagnosis and environmental optimisation of the production processes in different companies, e.g. PoWoGaz S.A., Trepko, Amica.

Next, PhDs devoted to the LCA related issues, defended mainly at the Faculty of Machines and Transport, PUT, are shown in Table 1.

Table 1. PhDs in area of LCA at PUT
Tabela 1. Doktoraty w obszarze LCA w Politechnice Poznańskiej

PhD student	Title	Supervisor	Defended in
Grzegorz Laskowski	Ekobilansowanie maszyn i urządzeń na przykładzie sprężarek powietrza (Ecobalancing of Machines and Devices with the Example of Air Compressors)	Prof. Zbigniew Kłos	1999
Przemysław Kurczewski	Ekobilansowa ocena wybranych procesów w przemyśle spożywczym (Ecobalancing Assessment of Chosen Packaging Processes in Food Industry)	Prof. Zbigniew Kłos	2001
Anna Jurek	Zagadnienia wpływu maszyn i urządzeń na środowisko (Issues of Environmental Influence Assessment of Machines and Appliances)	Prof. Zbigniew Kłos	Prepared in PUT, defended at Faculty of Mechanical Engineering, Wrocław University of Technology in 2003
Piotr Radomski	Zastosowanie oceny cyklu życia jako narzędzia decyzyjnego w środowiskowym rozwoju maszyn przemysłu spożywczego (Application of LCA as a Decision Making Tool for Ecodesigning of Food Industry Machines and Devices)	Prof. Zbigniew Kłos	2004
Agnieszka Merkiś-Guranowska	Wieloaspektowa analiza uwarunkowań rozwiązania recyklingu samochodów osobowych w Polsce (Multi-aspect analysis of solution conditions of car recycling in Poland)	Prof. Zbigniew Kłos	2004
Jędrzej Kasprzak	Ekobilansowa analiza procesów eksploatacji i likwidacji maszyn i urządzeń przemysłu spożywczego (Ecobalancing Analysis of Operation Period and Disposal Processes of Food Industry Machines and Devices)	Prof. Zbigniew Kłos	2006

2. Presentation of Poznań Research Groups

2.1. Research Group on Ecobalancing and Quality at Poznań University of Technology

Actually the Group main members are Zbigniew Kłos (head of Group), Przemysław Kurczewski, Jędrzej Kasprzak, Robert Lewicki, and Krzysztof Koper. Some details about the members of the Group are presented below in Table 2.

Table 2. Research Group on Ecobalancing and Quality in PUT
Tabela 2. Zespół badawczy ds. ekobalansowania i jakości w Politechnice Poznańskiej

Name	Education	Professional activities	Publications	Areas of scientific and technical work
Zbigniew Kłos	1972 - M.Sc. in Mechanical Engineering at PUT, 1979 - Ph.D. at PUT, 1990 - D.Sc. (post doctoral thesis) at PUT, 1994 - Associate Professor at PUT in the field of quality and sustainable development, 2001 - Professor	<ul style="list-style-type: none"> – member of the International Research Group on Wear of Engineering Materials of OECD – member of the Jury of Polish Quality Award member of Society of Environmental Toxicology and Chemistry (SETAC) – member of SETAC-Europe Workgroups on LCA, LCA NET and CHAINET – member of the Jury of Poznan International Fairs Golden Medal Competition – council member of Individual Polish Quality Award Committee – contractor of TEMPUS/PHARE grant N IMG-94-PL-2027, carried out at Rijks Universiteit Leiden, NL – member of Management Committee COST 530 Action „Sustainable Materials Technologies” – head of Doctoral Studies at the Faculty 	6 books 9 textbooks 245 other publications	<ul style="list-style-type: none"> – development of LCA methodology – method of cumulative environmental costs – investigations on ecological criteria of technical objects (mainly machines and devices for food processing industry) – development of quantitative estimation methods of technical objects influence on environment (director of the projects granted by Polish State Committee for Scientific Research) – development of idea of corporate culture model for organisations – elaboration of standard methods dealing with application of reliability in

Name	Education	Professional activities	Publications	Areas of scientific and technical work
		of Machines and Transportation PUT – former Vice-Dean of the Faculty (1993-1996, 1999–2005)		technology, including calculation of indices for sliding pairs – introduction of environmental criteria into the framework of Polish Quality Award Competition
Przemysław Kurczewski	1997 – M.Sc. at PUT, Faculty of Machines and Motor Vehicles, field of study: mechanical engineering, title of diploma work (M.Sc.): Environmentally oriented analysis of the quality of the compressors for the food industry, 2001 – Ph.D. at PUT, title of Ph.D. thesis: Ecobalancing assessment of chosen packaging processes in food industry	– member of Society of Environmental Toxicology and Chemistry (SETAC) – member of Management Committee COST 530 Action “Sustainable Materials Technologies” – member of Life Cycle Costing Working Group (SETAC – Europe) – member of Committee of Quality Award for Wielkopolska Region – vice-chairman of Organizing Committee of conferences in the field of quality and environment (2004, 2006)	3 books more than 60 other publications	– analysis oriented on reduction of overall life cycle impacts of products – optimisation of technical objects with respect to environmental issues – application of LCA in design process – research in area of control of technical and quality of technical objects – development of the complex quality assessment methods – Life Cycle Management methodology development
Jędrzej Kasprzak	2002 – M.Sc. at PUT, Faculty of Machines and Transportation, field of study: mechanical engineering, title of diploma work (M.Sc.): Consideration of environmental aspects in the	– member of Society of Environmental Toxicology and Chemistry (SETAC) – member of COST 530 Action “Sustainable Materials Technologies” – member of Organising Committee of conference in the field of quality and	1 book almost 30 other publications	– ecobalancing of technical objects – environment protection in the industry – environmental impacts of operation period of technical objects – application of LCA in operation

Name	Education	Professional activities	Publications	Areas of scientific and technical work
	designing of food industry machines and devices, 2006 – Ph.D. at PUT, title of Ph.D. thesis: Ecobalancing analysis of operation period and disposal processes of food industry machines and devices	environment – member of the Organising Committee of the International Summer School of Practical and Technical Problems Solving in Mechanics, Material Engineering and Transportation		processes – refurbishment processes of food industry machinery – analysis oriented on reduction of overall life cycle impacts of products – optimization of technical objects with respect to environmental issues
Robert Lewicki	2004 – M.Sc. at PUT, Faculty of Machines and Motor Vehicles, field of study: ecology of transport, title of diploma work (M.Sc.): The analysis of environmental effects of different scenarios of car recycling, 2004 – now – doctoral studies at PUT – Faculty of Working Machines and Transportation, 2006 – opened Ph. D. Course title of Ph.D. thesis: Environmental analysis of consequences of motor vehicles utilization	– member of the Polish Scientific Society of Combustion Engines – member of Organising Committee of conference in the field of quality and environment – member and chairman of the Organising Committee of the International Summer School of Practical and Technical Problems Solving in Mechanics, Material Engineering and Transportation		– environment protection in the industry – ecobalancing of technical objects – environmental impact of products' end of life – analysis of car recycling processes in Poland – mechanics of machines and appliances – basis of combustion engines construction
Krzysztof Koper	2007 – M.Sc. at Silesian University of Technology, Faculty of Organisation and Management, field of study: quality and technology	– member of the Organising Committee of the International Interdisciplinary Technical Conference of Young Scientists <i>InterTech</i> – member of the	5 publications	– quality and environmental management – technical objects quality factors with special attention given to environmental

Name	Education	Professional activities	Publications	Areas of scientific and technical work
	management, 2007 – now – doctoral studies at PUT – Faculty of Machines and Transport	Organising Committee of the International Summer School of Practical and Technical Problems Solving in Mechanics, Material Engineering and Transportation		impacts connected with object's usage and disposal – environmental impact of upgrading processes – sustainable development issues

The following are common activities including applications and participation in the 5 and 6 FP:

- MAKE-IT – Manufacturing Management Based on Knowledge and Information Technology Category – Competitive and Sustainable Growth Key action – Innovative products, processes and organisation Objectives – Intelligent production; efficient production, including design, manufacturing and control;
- HEADS – Harmonisation and Integration of European Analytical Databases for Sustainability Category – Integrated Projects Field - Sustainable development, global changes and ecosystems;
- IN-SUSTAIN – The implementation of Integrated Product Policy Category - Network of Excellence Field - Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices (Optimisation of „production-use-consumption” interactions);
- PSIE – Post-graduate School of Industrial Ecology Category - Maria Curie Conferences and Training Courses Field - Maria Curie Actions;
- PROTEKO – Centre of Excellence for Proecological Technical Solutions (Centrum Doskonałości Proekologicznych Rozwiązań Technicznych) Category - Network of Excellence; and,
- Life Cycle Inventories for Environmentally Conscious Manufacturing Category - European Cooperation in the field of Scientific and Technical Research Field - COST 530 Action - Sustainable Materials Technology (Zbigniew Klos, Przemyslaw Kurczewski – members of the Management Committee).

2.2. Research Group at the Poznań University of Economics

Actually the Group members are Zenon Foltynowicz (head of the Group), Anna Lewandowska, Joanna Witczak, and Hanna Pondel, as well as PhD students Renata Bogucka, Barbara Borucka, Agata Kowal, Tomasz Alankiewicz, and Rafał Ostrowski. The activities of the Group members are presented in Table 3.

Table 3. Research Group at the Poznań University of Economics
Tabela 3. Zespół badawczy w Uniwersytecie Ekonomicznym w Poznaniu

Name	Education	Professional activities	Publications	Areas of scientific and technical work
Zenon Foltynowicz	1974 - M.Sc. in Chemistry at the Faculty of Chemistry, Adam Mickiewicz University (AMU) in Poznań 1981 - Ph.D. in Chemistry at AMU 1990 - D.Sc. (post doctoral thesis) at AMU 1998 - Associate Professor at the Poznan University of Economics, Faculty of Commodity Science	<ul style="list-style-type: none"> - vice-president and member of SETAC Central Eastern European Countries branch - member of the IGWT (International Society of Technology and Commodity Science) - member of Polish Society of Commodity Science - member of Technical Committee 270 Environmental Management in Polish Committee for Standardisation - Chairman of 7th and 8th Int. Symposium "Current trends in commodity science" - member of the editorial board of the Polish Journal of Commodity Science 2005 – founder and head of Product Ecology Department at the Faculty of Commodity Science 2005 – now - dean of Faculty of Commodity 	1 book 5 textbooks more than 120 other publications 29 patents 7 technologies	<ul style="list-style-type: none"> - environmental management systems (EMS) – implementation in Polish enterprises - ISO 14040x and ISO 14020x standards – translation into Polish and implementation in Poland; - environmental waste management, specially packaging waste - new solution in the field of packaging (oxygen scavengers, biodegradable materials) - nanocomposites and polymers - polymer recycling - intellectual properties protection

		Science at the Poznań University of Economics; (1999–2005 vice-dean)		
Anna Lewandowska	2000 – M.Sc. in Commodity Science, Poznań University of Economics, 2004 – Ph.D. in Economics Science, Poznań University of Economics, 2004 – Marie Curie fellowship, Institute of Environmental Science (CML), Leiden University	– member of SETAC Europe and SETAC CEEC – supervisor of the student’s scientific circle Eco-business – member of the Commission on Promotion of the Faculty of Commodity Science	3 books 3 textbooks more than 40 other publications	– product ecology and life cycle management (LCM) – life cycle assessment (LCA) – design for environment (DfE)
Joanna Witczak	1998 – M.Sc. in Environmental Protection, Adam Mickiewicz University (AMU) in Poznan 2000 – M.Sc. in Commodity Science, Poznan University of Economics 2008 – Ph.D. in Economics Science, Poznan University of Economics	Member of the Commission on Promotion of the Faculty of Commodity Science Member of the Organising Committee of the 10 th IcomSC'09	over 10 publications	– product ecology – green marketing – consumer behaviour – organic food market

The scientific activities of the Group:

- Political and legal aspects of environment’s protection (environmental policy of Poland and UE, UE directives),
- The investigation of relations between products and environment, (i.e. sustainable development, Cleaner Production),
- Environmental management systems (EMS),
- Environmental life cycle assessments (LCAs),
- Design for environment (DfE),
- Green marketing,
- Ecolabelling,
- Ecological food and agriculture, and
- Biodegradable nanocomposites.

2.3. Research Group in Institute of Timber Technology

Publications:

- Wawrzynkiewicz Z.: Analiza cyklu życia (LCA – life cycle analysis) jako podstawa do przyznawania ekoznaków wybranym produktom drzewnym. Etap I. Rozpoznanie stanu zagadnienia. ITD maszynopis 1997
- Wawrzynkiewicz Z.: Analiza cyklu życia w badaniach drewna i wyrobów z drewna. Holz-Zentralblatt. Gazeta Drzewna (7/8), 1999
- Wawrzynkiewicz Z.: LCA pomoże ocenić oddziaływanie wyrobu na środowisko. Polski. Holz-Zentralblatt. Gazeta Drzewna nr 11, 2004
- Lewandowska A., Noskowiak A., Wawrzynkiewicz Z.: Specyfika przemysłu drzewnego w badaniach LCA; Gazeta Drzewna Polski Holz-Zentralblatt, (11) 2004, s. 16
- Strykowski W., Lewandowska A., Noskowiak A., Wawrzynkiewicz Z.: Środowiskowa ocena cyklu życia (LCA) w przemyśle drzewnym – możliwości i wyzwania; Drewno Wood; 48 (174) 2005, s. 55–56

Book:

- Strykowski W., Lewandowska A., Noskowiak A., Wawrzynkiewicz Z.: Środowiskowa ocena cyklu życia (LCA) wyrobów drzewnych; wyd. Instytut Technologii Drewna, Poznań; ISBN 83-915727-6-5
- Project led by ITD:
- Project No. 4T08E 05025: Zarządzanie środowiskiem w przemyśle drzewnym z wykorzystaniem Oceny Cyklu Życia (LCA) (2003–2005)

3. Other research groups in Poland

3.1. Research Group at Polish Academy of Sciences – Mineral and Energy

Economy Research Institute (MEERI)

The scientific activities of the Institute:

- The assessment of efficiency and profitability of new investments in the mineral resources economy and waste management;
- The assessment of the possibilities and economics of renewable energy sources use;
- Municipal waste management, especially the use of biogas by cities and communes;
- The analysis of risk in geotechnical projects concerning the underground storage of hazardous waste; and,
- The legal and economic aspects of industrial waste storage in exhausted mine sites.

Joanna Kulczycka, PhD – head of the Group:

- Professional activities:
 - A member of technical group for waste management created under the auspices of the Ministry of the Environment,
 - A member of working group for ISO 14040-14049 nomenclature and application in Poland,
 - A authorised person for LICYMIN and LIFETIME (projects in FP5),
 - A sub-contractor for the CLOTADAM project,
 - Involved in European Waste Management project Interreg 3C, and
 - Coordinator of two projects realised in Poland within Structural Funds.
- Publications:
 - 1 book and over 40 publications
- Polish projects performed:
 - Methodology of the ecological LCA on the example of selected processes in the chemistry and mining industry (2003-06),
 - New technology for use of post-flotation tailing for backfilling – including Best Available Techniques No. 6 T12 2004 C/06378 (2004-06),
 - The analysis and evaluation of possibilities to conduct ecological tax reform in Poland (2005),
- EU projects performed:
 - LICYMIN (1999-2003) – scope of the work:
 - LIFETIME (2001-03) – scope of the work:
 - OSELCA (2004) – scope of the work:

3.2. ABB Group – Polish branch

- History of LCA practice:
- Polish branch strategy of LCA:
 - Supporting of the LCA data base development oriented on environmentally oriented activities in the ABB Group,
 - Cooperation with Chalmers University of Technology,
 - The replacement of own LCA software by commercial LCA tools,
 - Continuous education and training programs, and
 - LCA application as a common tool to the studies oriented on Environmental Product Declaration in ABB products.

3.3. Research Group at University of Zielona Góra, Faculty of Management – Department of Environment and Public Economy Management

Actually, the Group members are Professor Magdalena Graczyk (head of the Group), Joanna Zareńska Ph.D. (2004) – *Algorithms of ecological balances of selected packaging*, Janusz Adamczyk Ph.D. (2006) – *LCA application in the environmental evaluation of the building* and Leszek Kaźmierczak - opened Ph. D. course – “LCA application in the assessment of ecological risk.”

3.4. Research Group at Central Institute of Mining (CIM)

The Group is leaded by Activities (internal projects):

- 1999 – LCA of selected products made from plastics, Describing of the rules of ecodesign of the products made from nonferro materials;
- 2000 – Ecodesign and LCA of computers using SimaPro 4.0;
- 2002 – Describing of the ecobalance methodology for different branches of industry;
- 2003 – Application of the EPS method in the LCA of selected products;
- 2004 – Methodology of the data collection based on the ISO 14048, as the main phase of the LCA study; and,
- 2005 – Assessment of the environmental efficiency of the PCV and PP pipe production.

Conclusions

Review of the situation in LCA and related areas allows drawing the following conclusions:

- 1) LCA centres are located mainly in academic centres, at university or scientific institutions and are engaged in research, standardisation, foresight and expert activities; and they are weakly inter-communicated.
- 2) There are different areas of projects covered, specially oriented on environmental interactions, identification, including conceptual studies and Environmental Product Declarations, ecological risk assessment, ecodesign, and LCM.
- 3) The range of analysed objects covers packaging, packaging machines and packaging systems, means of transport and transportation systems, investments in the mineral resources, energy sources and technical objects in the energy industry, building engineering, selected products from PCV, PP and different polymer materials.

Desired activities for future are listed below:

- More effective communication of the LCA research results to the outside world, specially industry and decision makers in administration;
- More advanced introduction of the LCA approach to the higher education;
- The integration of the LCA community in frame of conferences, common projects, as well as in experts environment; and
- The introduction of the LCA issues to the structure of the organisation of science (at least in Poland).

We hope that quarterly “Exploitation Problems of Machines” will aid in our attempts to continue to play a significant role.

References

- [1] Huppes G.: *Macro-environmental policy: principles and design* (Ph.D. thesis). Rijksuniversiteit Leiden, Leiden 1993.

Manuscript received by Editorial Board, December 01st, 2008

LCA w Poznaniu i w Polsce. Zespoły badawcze i ich osiągnięcia

Streszczenie

Wzrastające zainteresowanie różnych organizacji (przedsiębiorstw przemysłowych, władz administracyjnych, firm konsultacyjnych i organizacji pozarządowych) środowiskową oceną produktów wywołało potrzebę powstania metod dla jej realizacji. Pewne próby w tym zakresie zostały już dokonane na świecie, a dotyczyły one głównie przedmiotów codziennego użytku (opakowań, środków higienicznych i czystości, drobnego sprzętu gospodarstwa domowego itd.). W artykule zaprezentowana jest historia i aktualna sytuacja w zakresie badań z dziedziny LCA w Poznaniu (szczegółowo) i w Polsce (skrótowo). Scharakteryzowano ważniejsze centra badawcze i istotniejsze osoby działające w tym zakresie, przedstawiając zakres ich zaangażowania.

