

## A CASE STUDY: PRACTICAL ETHICAL ASPECTS FOR TECHNOLOGY TRANSFER AND CHANGE IN COMPUTER CONTROL SYSTEM DEVELOPMENT

**Jozef B. Lewoc**

*Leader (Leading Designer), ul. Powst. Sl. 193/28, 53-138 Wroclaw, Poland  
e-mail: leader@provider.pl; website: www.leader.wroc.pl*

**Abstract:** The paper describes a positive case of practical application of ethics in the automatic control technology change in Poland. The case has its origin in the Automation Design Office of Elwro, the first Polish manufacturer of computers in late sixties. The severe limitations of the technology transfer in the beginning period of the Design Office forced to solve almost all problems with the local staff and home equipment. The paper discusses some results of such conditions. The paper discusses also some negative aspects of the technology transfer process ethics where the recipient countries are treated as lay labour only. *Copyright © 2005 IFAC.*

**Keywords:** ethics, technology transfer, technology change, computer, control

### 1. INTRODUCTION

The ethical aspects of the technology change and the role of IFAC in ensuring social stability are investigated by SWIIS research workers (Kile, 2001; Hersh, 2001). Some exemplifications are given by Lewoc (2003). The present paper discusses another positive case of the technology change ethics.

The leading centre of automation (called then analogous (conventional) and digital (computer) ones) in the late sixties in Poland was The Automation Design Office (the Design Office) of Elwro – then biggest Polish manufacturer of computers, acquired and liquidated by a big international corporation in the early nineties (Izworski, 2001). The severe political constraints put on the technology transfer and the very high dollar exchange rate in those years forced to develop home-made solutions of the automation systems. This was a real school of automation and of the real life for the authors which were employed in the Design Office. The knowledge acquired enabled to establish and maintain in a good condition an automatic system

developer (ENES), in spite of very severe financial and political constraints in the early nineties.

The paper will present typical systems developed by ENES (more than 200 smaller or bigger systems developed since 1987). A symptom of the technology change done during this period is that the difference between the “conventional” and “computer” automation disappeared completely. Therefore, almost all systems developed and implemented by ENES are computer-based ones. The basic speciality of ENES are computer automation and power supply /systems for air handling (ventilation, air conditioning, dust removal). However, the Company has got quite nice results for other working media (water, steam, waste water).

Negative ethics examples for the technology change process managed in another way will also be given. Some big corporations try to get a success in the technology transfer area by “making the recipient countries happy by force”. The examples should be a lesson for them that such approach is not appropriate. The biggest computer corporations of the world, like the one involved in acquisition and liquidation of

Elwro, another one involved in acquisition and liquidation of a Lower Silesian computer control system design centre for the power industry, still another one involved in establishment and liquidation of a nearly pure localisation company or a corporation that has established a nearly pure localisation company and has suffered serious problems with it, suffered serious problems implied by their unethical, "colonization-based" approach to the technology transfer.

Some benefits (technical and financial) resulting from implementation of the automation systems will be presented. On this basis, some more general, practical ethics aspects of the technology transfer and change management will be mentioned.

The first one is that no developing country society must be treated as a set of lay labour, since this means technical and economic dependence what implies the political dependence. Another issue is that it is worthwhile even decelerate the technology change for the sake of educating the country own staff to manage and operate the technology change in a long term. Still another issue is that nobody wins when the technology transfer is managed unethically, so that the recipient societies are treated as lay labour only.

## 2. THE ENES HISTORY

### 2.1. *The origins of the company*

The middle sixties, when Elwro, the first Polish manufacturer of computers, run the Automation Design Office (Pracownia Projektow Automatyki), are the initial period of the professional automation systems in Poland. The Design Office was involved firstly in analogue automatic control systems and drives but soon a team involved in applications of digital devices and computers in automatic control was established.

The Design Office developed designs and were involved in implementation of the automation systems for the most important manufacturing enterprises of Poland and Comecon countries at that time. The enterprises included big metallurgical works, mines, glass production works, paper factories, etc. The Design Office designed and commissioned also the first Polish computer control system, intended for material flow monitoring, production co-ordination and control in a steel rod mill (Wojsznis 1971).

The working conditions of the designers of both analogue automatic control systems and digital computer control systems were rather severe. The Cold War, various rather ridiculous embargos that were to protect against proliferation of modern

weapons (in fact, they blocked the technology transfer for civil people while the army had no serious problems with buying the most modern equipment via intermediate countries), mutual distrust of the two political blocks, incompatible development levels of various countries resulted in a rule of the ill economy of those years: a dollar was equivalent to the infinity in zlotys. In other words, any Polish product, irrespective of its price, was cheaper of a similar product that had to be imported from the West.

Therefore, the designers of that period simply had to employ home products, using Western equipment only in the cases that no similar equipment was available in the Comecon countries. And the time lag in the automation and control equipment available at that period in comparison with the equipment available in well-developed countries was assumed at some 5 – 10 years (the basis of this assumption being the year that the hardware was launched into the market for the first time).

In addition, due to similar political and economical reasons, the knowledge transfer was also severely limited.

To summarise, the technology transfer was severely limited, the knowledge (especially know-how, i.e. the practical knowledge how to develop successful computer systems) transfer was close to zero, the designers had at their disposal the equipment out-of-date of some 5 – 10 years, and they were to design and implement operable and reliable analogue automatic control systems or computer control systems.

And some of them did it successfully. To achieve a success, they were to think much more than their Western colleagues. It was a great school of the automatic control or computer control and many other associated domains. And it is not a joke that the Design Office designers of that time who were successful were better than those working comfortably in the well developed countries.

Lewoc (2003a) mentions an example of the Cavendish Laboratory, Cambridge, and the radio-astronomers who used to attack even the most complex and difficult research problems using tools available for them, as simple and cheap, as possible. In Cambridge, such approach resulted from their research tradition based on the conviction that the research workers who have at their disposal more simple and economic tools and can cope with their problems have to develop their own skills and experience at a much higher degree than their colleagues (or competitors) working with more advanced and expensive tools.

For the designers of the Design Office in Poland in the sixties, the approach adopted in the Cavendish

Laboratory was simply a must. In Poland, they say that “You can not make a whip of merely nothing” but only the ones who could deny this proverb were the real designers needed in that country and in those years. Many could and at the end of the sixties, there was available a team of highly skilled and experienced designers and associated staff, usually of higher skills and experience than their Western colleagues (competitors) (Blach, 1991). This staff was employed by the Wroclaw Automation Enterprise Elam separated from Elwro.

## 2.2. *The seventies*

In the seventies, the group governing Poland was changed and the country was opened fast to co-operation with the West. In addition, rather considerable credits were granted to the country making it possible to import high-tech equipment.

The facts were of negative and positive consequences. The negative ones were that, rather often, the decisions of possible importation of new complex plants were undertaken by rather incompetent managerial staff and, in practice, were not controlled by actual technical specialists. Therefore, they were made basing rather on expectations and hopes of some, usually incompetent, people than of some objective premises. This resulted in failures of many large-scale projects or, at least, in high time delays in commissioning and obtaining the full capabilities of the imported plants. The debts of Poland implied by such failures have not been fully paid back even till the present days.

A very positive consequence of the political decisions of those times was that they allowed for the large-scale technology transfer process. When this process was controlled in a professional and competent way, by the specialists knowing the local problems and the technical issues, the results were very encouraging: the high-tech products became a standard in Poland and the final users learned to make use of them rather fast.

A very ethical aspect of the technology transfer process during the decade was that the staff of the Design Office was successfully involved in various automation system modernisation projects. They were also involved in several projects of identification and optimisation of the new plants imported by other organisations without adequate knowledge of the production process and/or automation system structure and operation.

The way assumed by the Design Office: importation of high-tech equipment unavailable in Poland at that time and making use of the local design and implementation staff who knew well the local needs, expectations and conditions to develop the design studies and to manage the implementation processes

is clearly, the optimum one. On one hand, it enables to implement new systems and to make their capabilities actually available for the final users fast. On the other hand, the high-tech providers can sell more of their products due to the positive image gained by them during such process. From the view point of Poland, such approach may be called ethical.

The technology transfer process of that decade, though not always conducted in an appropriate way, resulted in a major technology change in the domain of the automatic control system and computer control systems: in order to be accepted in Poland, the solutions had to be of the capabilities, reliability, availability and dependability comparable with the systems applied in the well developed countries.

## 2.3. *The eighties*

During the eighties, the conditions for design and development of the general automatic control systems and computer control systems, in the sense of the lack of availability of modern hardware and the know-how of successful system development, were similar to those described for the power industry (Lewoc 1992, 2003a, b, c, d). The Marshall law enforced in the country, i.e. the legislation that was to help the power to fight with the Solidarity movement, resulted in serious economic repercussions, the boycott of Polish products in many important markets and, consequently, in a prolonged down-economy period in Poland. In additions, the political events were the reason for the well-developed countries to strengthen the severity of the embargo Policy. The political conditions of that time were the basic reasons for establishment of barriers to ethics in the technology transfer process.

Due to the economical difficulties, the investment processes in Poland were severely limited. Consequently, the demand for new automatic control and computer control systems decreased at a high extent. In addition, due to the ill promotion policy implemented in the country after the Second World War (the persons who failed in the domain of technology had the biggest chances to get promotion in the managerial domain) the managerial staff of big Polish enterprises (including Elwro and Elam) had merely no chances in almost free competition with Western companies when the dollar to zloty exchange rate was established at some finite level. Furthermore, the naïve liberalism that started to be implemented in Poland of the late eighties, consisting in that the government nor the local self-government were not, actually, interested in the processes occurring in the enterprises possessed by them nor in providing any help needed by them.

Like in many Polish enterprises at that time, the managerial staff of Elwro and Elam failed and the

process of collapse commenced both in Elwro and Elam.

When discussing the progress of technology in the area of analogue automatic systems and computer control systems during the decade, introduction and rapid increase in use of programmable controllers should be mentioned. Starting from the late eighties, the analogue automatic control system specialists had to become digital computer programmers and the computer control system specialists had to cope with the automatic control issues, such as PID control, etc. This technology change resulted that the difference between the automatic control people and computer control people vanished. Therefore, hereinafter they will be called computer control specialists.

At the turn of the decade, a few experienced computer control system designers, realising that their enterprise, Elam, under management of the incompetent managerial staff, has very limited chances to remain in the market, decided to leave the enterprise and to establish their own computer system design and development business, the ENES.

The beginnings of the new small company were rather difficult. The only goodwill of the company was the knowledge and experience of the founders. They had not financial resources needed to hire premises for the company and prepared designs in their flats or houses. They acquired commissions thanks to their individual contacts concluded when they were employed by Elam. But they learned the profession of a control system designer in the sixties and later, and they knew they had learned the profession well. This conviction helped them to survive the difficult initial years and they entered the last period of some dozen years as a stabilised design and implementation company in the domain of computer control systems.

#### *2.4. The period after 1989*

Similarly to the increased activities of the colleagues working for the power industry (Franasik 2001; Izvorski 2003a, b, c,d; Kaluzny 2003; Kieleczawa 2003a, b; Lewoc 2003a, b, c, d), the company under presentation have also grown rather significantly during the last dozen or so years. This seems rather strange considering that all big companies operating in the computer control system domain, that established their subsidiaries in the Lower Silesia region, simply failed though they had the financial and technical resources available that were much, much higher than those available to ENES.

To remind, a big international corporation acquired Elwro and had to liquidate it even not a year later. The same corporation had got a commission for automation of a new power plant in Poland and managed to execute some dozen or so of the work

scope assumed and designed several years earlier by a Polish team.

Another big international corporation involved in the power system control acquired a computer control system design and development centre in Wroclaw and, after a few years, they had to close down their centre and move out from Wroclaw.

Still another corporation operating in the power industry domain established a subsidiary in Wroclaw, failed to acquire a significant market share and liquidated their subsidiary.

Another power industry corporation established their subsidiary in the Lower Silesia region and have serious problems in maintaining the subsidiary (a symptom: they could not even manage to pay wages for their staff in due time).

It may seem improbable: a small company having the technical and financial resources incomparably lower than those available to the big corporations mentioned above has got a success and the big corporations not. For the big corporations, it is common to use the excuse of the severe recession in the world and in Poland. But the excuse can not be accepted: the recession is more dangerous for the small company having not financial resources enough to survive the periods when no commissions are available.

The actual reason is in the approach to the technology transfer process ethics. The designers of ENES work so that the necessary equipment, especially the high-tech one – is, when needed, imported but any design and programming work is realised by the experienced, local staff. Due to their long and wide experience in design and implementation of the control systems, they know the Polish conditions, the expectations and the requirements of the end users very well and may customise and/or develop the hardware and software structures required in an efficient and low-cost way. They behaved ethically: they claimed that they worked for the country they lived, and they were right.

On the other hand, most of the big Western corporations, those mentioned in the present paper and the other ones, have treated the country as a source of lay labour only. Usually, the biggest task they appointed to their subsidiary staff was the localisation (polonisation) of their software solutions. And even then, they made light of the Polish experienced staff and employed greenhorns in the computer control system domain. This must have resulted in expensive solutions, poorly adapted to the local conditions and hardly meeting the expectations and the requirements of the final users. In contrast to ENES, the big corporations were unethical: they

claimed that they worked for the country and, in fact, they tried to work for their own benefit only.

At the very beginning of the free technology transfer process in Poland, many final users addressed their hopes, expectations and requirements to the big Western companies, hoping that their successes in the world will be repeated in Poland. However, when they learned that the services of such companies are rather expensive and do not meet their expectations or requirements, they turned to the local companies like ENES, that were more widely open to their actual needs and constraints.

Some big Western corporations, like the one mentioned first, tried to make use of the local design and development staff in the projects allocated to them. However, they looked for companies of visible signs of success: premises, equipment, bank accounts. It was a major error in the country: the companies of those signs of the managerial success could rarely offer the best available technical staff. And the premises, equipment and money alone can not develop efficiently and economically the computer control systems while the actually experienced staff can do it without any big resources. Therefore, if they looked for experienced staff instead of the virtual signs of success, they would achieve much more success. Note that they would apply then the ENES'es approach to the technology transfer process.

It should be mentioned here that, in most cases, the experienced local staff were, at the beginning, very apt to co-operate with the big Western corporations, provided that the latter treated them seriously, as experienced thinking people. They could have done even the localisation tasks in an efficient, thinking manner. But when they learned that the companies behaved unethically, looked for their short-term benefits only and not for the interests of the country, made light of them and of their knowledge and experience, claiming that they had got their own specialists and that they did not needed other experts, the experienced staff were simply forced to become competitors for the big Western companies.

Possible suggestions as to how ethical transfer should be carried out seem to be rather straightforward. If we assume that the successful technology transfer is the actual and not virtual objective of the big Western corporations, then they should look for the most experienced people in the recipient countries and make use of their know-how in working in the countries. This would surely enable for the big corporations not to make the basic mistakes described and to continue their work for the people of the biggest experienced available in the recipient countries.

### 3. THE ACTIVITY RANGE OF ENES

The company is involved, from the very beginning, in design and development of computer control systems for various industries. The reference list of the company covers more than 200 computer control systems of various sizes. During several last years, the company gained a major share in the Polish market of the working media control systems for big buildings of trade centres and/or industrial plants (electric power supply, air handling (ventilation, air conditioning), compressed air, cold and hot water, steam, gas as well as anti-burglary and staff monitoring systems, etc.).

Another major sector of the company activity are the computer control and monitoring systems for industrial boilers. The monitoring and control systems for water and waste water treatment are also worth mentioning. The company developed successfully the monitoring system for a medium-size power generating unit.

### 4. SOME GENERAL EFFECTS OF AUTOMATION ON THE CASE STUDY OF ENES

As described above, during the activity period of ENES, various big Western corporations tried to realise the technology transfer process, treating the recipient country (Poland) as a source of lay labour only. In the best case, some of them tried to employ the local staff in their projects but they did not try to find the specialists of the widest experience available in the country. Such unethical approach resulted in the effect that the potential final users (in the domain of the computer control systems as well as in other domains of the country economy) stopped to believe that the Western companies could help them in their problems and turned their expectations to the local companies.

Another matter of ethics is the way in which the big Western companies treated the Polish experts of the widest experience available (e.g. mobbing, black lists, fraudulent (thieving) actions), who did nothing wrong to the companies and, moreover, were very apt to co-operate. The thoughtlessness of the lack of ethics characterising this way of behaviour is obvious: for this case study all big Western corporations, that established their subsidiaries in the Lower Silesia region, lost.

And, finally, there is cultural effect worth mentioning: More and more people of Poland has realised that their local designers of the computer control systems, who learned their profession in very heavy conditions, are better than their Western colleagues who designed their systems in much more comfortable conditions.

The detailed social, ethical and cultural aspects of the technology transfer process need investigations to be performed by professional research workers involved in the domain, like Hersh (2001) or Kile (2001). The practitioners can only describe case studies and some serious effort is needed from the research workers to present the phenomena in the way applicable to the more general case and enabling effective whistleblowing.

#### ACKNOWLEDGEMENT

This study was sponsored in a part by the 6<sup>th</sup> Framework Programme of the European Commission.

#### REFERENCES

- Blach J.K., Cybinska-Pirog L., Lewoc J.B. and Rozent M (1991), West-East Approaches of Automation: A Case Study, In: *CAA '91 (IFAC)*, Krems.
- Franasik L. et al. (2001), System Media – A Step towards Computer Integrated Manufacturing and Management Systems, AMSE Press, pp. 37-46.
- Hersh M.A., Technology Change, Technology Transfer and Ethics (2001), In: Kopacek P. (Editor), *Social Stability: The Challenge of Technology Development (SWIIS '01, IFAC)*, Vienna, pp. 63-68.
- Izworski A., Skowronski S. and Lewoc J.B. (2003a), Simulation and Modelling of Computer Networks, In: *The 3<sup>rd</sup> International Conference on Computational Science*, Petersburg.
- Izworski A., Lewoc J.B. and Skowronski S (2003b), Robust Performance Case Study: Topology of System Media, In *Control Applications of Optimisation (IFAC)*, Visegrad.
- Izworski A. and Lewoc J.B., Robustness Comparison of Enterprise Energy Distribution Systems of Various Topologies (2003c), In *Robust System Design (IFAC)*, Milan.
- Izworski A. and Lewoc J.B. (2003d), Approximate Analytical Performance Modelling of a Computer Integrated Manufacturing and Management System, In *4<sup>th</sup> IMACS Symposium on Mathematical Modelling, (IMACS)*, Vienna.
- Kaluzny G., Kieleczawa A. Lewoc J.B. and Straelecka H. (2003), Automation, Control and Supervision of Combined Heat and Power Systems: A Case Study of Poland, In *Automatic Systems for Building the Infrastructure in Developing Countries (IFAC)*, Istanbul (accepted for publication).
- Kieleczawa A., Lewoc J.B. and Tomczyk A. (2003a), A Case Study: An Approach to Home Automation in Poland, In *8-th Symposium on Automated Systems Based on Human Skill and Knowledge (IFAC)*, Geteborg (Accepted for publication).
- Kieleczawa A., Lewoc J.B. and Tomczyk A. (2003b), Automation, Control And Supervision of Electrical Powers Systems: A Case Study of Poland. In: *Automatic Systems for Building the Infrastructure in Developing Countries (DECOM-TT 2003, IFAC)*, Istanbul (accepted for publication).
- Kile F. (2001), Insights into Future International Social Stability, In: Kopacek P. (Editor), *Social Stability: The Challenge of Technology Development (SWIIS '01, IFAC)*, Vienna, pp.45.
- Lewoc J.B, Rozent M. and Sazuk I. (1992), The Computing Power and the Computer Systems for the Power Industry in Poland, In: *MICC (IFAC)*, Prague.
- Lewoc, J.B. (2003a), A Case Study: Automatic Computer Control Technology Transfer for the Polish Power Industry, In: *Technology and International Stability (IFAC SWIIS '03)*, Waterford (Accepted for publication).
- Lewoc J.B., Olejnik S and Tomczyk A. (2003b), An Approach to Building Automation, In: *The 8-th Symposium on Automated Systems Based on Human Skill and Knowledge (Chalmers, IFAC)*, Goeteborg (Accepted for publication).
- Lewoc J.B. and Rozent M. (2003c), Economic, Ethical and Cultural Aspects of Power System Automation Technology Change: A Case Study of Poland, In: *Automated Systems Based on Human Skill and Knowledge (Chalmers, IFAC)*, Goeteborg (Accepted for publication).
- Lewoc J.B. (2003d), References. Available at: [www.leader.wroc.pl](http://www.leader.wroc.pl).
- Wojsznis W. and Lewoc J. (1971), Metal Flow Control System in a Rod Mill, in: *Proceedings of the IV International Conference of the Comecon Countries on Production Process Automation in the Black Metallurgy*, Zaporozhe (in Russian).