Control and Cybernetics

vol. **30** (2001) No. 2

Structural marketing innovation conflict analysis and support

by

T. Szapiro[1] and J. Matysiewicz[2]

[1]Warsaw School of Economics, Division of Decision Analysis and Support
Al. Niepodleglosci 162, 02-554 Warsaw, Poland
E-mail: tszapiro@sgh.waw.pl

[2]Academy of Economy, Department of Theory of Marketing
ul. Bogucicka 14, 40-225 Katowice, Poland
E-mail: matysiew@figaro.ae.katowice.pl

Abstract: The aim of this analysis is to draw conclusions from the consideration of the transformation of Polish economy from a command to a market driven one on the basis of results from innovation theory. As the starting point it is assumed that welfare is related to market economy with a considerable number of private and privatised companies. It will be further explained that these companies have to be innovative so as to be successful. The most visible innovation is related to the introduction of marketing units in companies. This, however, implies coping with two generic types of marketing conflicts. The first one is the structural marketing conflict: it results from the internal conflicting objectives. The second one is the marketing implementation problem: it results from the resistance attitudes. The model describing structural conflicts is presented in the paper. It is explained how the model allows the use of existing computer software to support managers.

Keywords: marketing conflict, group decision making, negotiation, DSS.

1. Introduction—transition as innovation and as a decision problem

Traditional approaches attempt to understand the economic process from the black box perspective. Following this picture some assets are transformed in the economy into products. Since the complex structure of economy impedes strict descriptions, the whole economy is described as a black box, i.e., one object without internal elements and relations. Thus, we arrive at the *production*

product (or service) to assets (labour and stock). Although it seems hopeless to elicit the strict domain of this function, its mathematical form, at least for a large number of examples of the production function, can be postulated and estimated using econometric methods (e.g. Cobb–Douglas production functions). The thus obtained mathematical shape of the production function proved its usefulness in several widely reported cases.

One of the disadvantages of the production functions in the understanding of and application to management and control of economic processes is related to the following observation. There exist processes (firms) where the same assets lead to different outcomes. Therefore, there must exist other factors which influence production. The following two factors: *human capital* and *technology* are to be noted. Conscious manipulation of these factors may lead to desirable changes in production. Investment in human capital (e.g. aimed at the upgrading of education, health) as well as in the change of technology are the most important success factors for a company.

These considerations result in the theory of innovations—which presents definitions, classifications, general statements and methods for innovative management. Following an economic definition (Mansfield, 1991) the innovation theory deals with the changes of technology. Classically, the theory is focused on creation of the product. The (multiple-factor) rate of productivity is used as a measure of innovation. If the level of production is denoted by Y, and X_i (a_i) stands for quantity (unit price) of i-th production factor used in the production then the rate i of multiple-factor productivity π between time t_1 and t_2 is given by the formula $i = (\pi_2 - \pi_1)/\pi_1$; $\pi = Y/(\sum_{i=1}^{n} a_i X_i)$, here n stands for the number of production factors. Symbols π_1 and π_2 correspond to time moments t_1 and t_2 respectively. This measure helps in identifying the weaknesses of the production process (Hayes et al., 1988). Measures of innovation also help in the estimation of the *learning curve*, which explains the process of reduction of uncertainty involved in managerial decisions. Learning curve exhibits the reduction of average unit costs and of experience production (the number of produced units—being in the direct proportion to time—measures the experience, and so the average costs indirectly indicates effects of learning from experiences collected). Learning curves is an important tool in price policy design.

The abovementioned approach to derive managerial techniques from economic reasoning is supplemented by efforts to summarise current managerial experiences and to abstract general rules from them. Innovation is seen in the managerial perspective as the process of analysis and use of concepts, product design, production organisation and product placing at target markets. It is observed that the understanding of the innovation process and its diffusion leads to increased effectiveness. The analyses of innovations should not be narrowed to inventions since they are oriented towards the creation of new undertakings and services, not only products (Drucker, 1985, p. 17). Its worth noticing here that contrary to the customers' view, the product, like the innovation, needs

pany perspective one deals with an innovation if new production methods, new designs or new promotion types are involved.

Following Robertson (1967) there are three typical innovation strategies concerning innovation. The strategy of continuous innovation responds to the discontinuity of demand for a product and helps to decrease the negative effect through, e.g., modifications. The strategy of dynamically continuous innovation focuses on new ways of satisfying existing needs. Thus, for instance, when known models of the consumption process are employed by a firm, then the additional knowledge on behaviour has to be taken into account, which results in modifications of inadequate assumptions of the former model. The last strategy, i.e. the one of discontinuous innovation, provides response to changes of demand connected with the change of the market.

The recognition of importance of innovations from both economic and managerial perspectives resulted in the analysis of research and development (R&D) activities. They focus on basic research (e.g. creation of new technologies), application (creation of applicable models to use known research results) and development (e.g. implementation of known methods in the local context of a company). Since a significant risk of losses is related to R&D activities, serious optimisation analyses are simultaneously performed (e.g. at the stage of selection of research projects). The problem is related mainly to compromising project's costs versus profit from created knowledge. However, the unsuccessful projects should be taken into account in the analyses as well, since they create useful knowledge. Other costs result from the evaluation procedure itself as well as the over-optimistic expectations of the authors of research proposals. Different procedures are viewed as tools in the analyses of efficiency of R&D policies (time-cost trade-off curves or Leontieff model to mention only these two). Econometric models (e.g. logistic trend) are employed in the estimation of diffusion of innovations.

It is, however, observed that independently of these techniques, the likelihood of the implementation of the project is greater in firms where the R&D and marketing departments created efficient communication channels (Mansfield, 1981). Significant data bases describing the technological and market environments leave important gaps in information needed to make managerial decisions. Lesson learned from managerial experience shows that this gap has to be filled with current marketing surveys and holistic evaluations of the decision problem situation performed by executive managers.

Having generally described the background of economic undertaking within the framework of innovation theory let us consider the transition process as the decision problem. The aim of the transition will be narrowed to economic perspective. The complete description of transition process cannot be performed in purely economic terms since it involves intangible values (e.g. freedom) or creation of complex social institutions (e.g. democratic system as a guarantee of preserving market rules). For the same reason transition cannot be as the so

	Public sector			Private sector			
	Total	SOEs†	TOJC*	Total	Domestic companies	Joint Ventures	Coope-ratives
Total							
a	n.a.	8872[1]	248[2]	n.a.	11901	410	17500
b	51768	5924	958	131488	62756	15167	19746
c	n.a.**	4955	876	n.a.**	69284	19737	19816
Manufacturing							
a	3216[2]	2861[2]	41[2]	n.a.	2975	243	2411[2]
b	3716	2495	515	20473	12914	4638	2587
c	n.a.	2414	493	24104	14258	5841	2638
Construction							
a	1846[2]	1595[2]	57[2]	n.a.	2661	12	732[2]
b	1698	1016	96	14494	12413	1147	1018
c	n.a.	867	88	13783	10516	1299	1050
Agric.							
a	1586[2]	1543[2]	2[2]	n.a.	n.a.	n.a.	n.a.
b	1596	806	41	6970	1062	178	4180
c	n.a.	127	83	n.a.	1354	282	3900
Trade							
a	n.a.	566[2]	63[2]	n.a.	1767	34	15[2]
b	958	518	114	34156	23155	5958	3784
c	n.a.	580	25	37533	25996	7742	3795

†—State-Owned Enterprises, *—Treasury-Owned Joint Stock Companies, **—total # of firms in public and private sectors—196,160, [1]—as of 30 June 1990, [2]—end-1990, a—31. Dec. 1989, b—31 Dec. 1993, c—31 Dec. 1994

Table 1.2. Composition of Polish corporate sector 1989–94. Source: Rapacki (1994). Please compare the underlined numbers and note the domination of private sector.

2. An analysis of conflict

The reports on the functioning of marketing departments in companies in Poland after the 1989 breakthrough describe several typical cases of conflict and resistance linked to the introduction of marketing departments in Polish firms after 1989. Following Mruk (1994) we attempted to perform a simplified analysis of these conflicts. In the analysis we identified the following spheres of a company: organizational issues, attitudes and skills, supplies, production, and finance. This structure expands the black box perspective which assigned products to assets. Assets here are represented by supplies. The black box corresponds to four dimensions: the co-ordination dimension (labelled as "organisation") and three administration dimensions involving human resources ("attitudes and skills"), production, and financial operation. The marketing conflicts are analysed through a description of their conflict and their consequences. Conflicts are described through the identification of parties and sources, and point to some

The consequences of conflicts are split into classes of internal and external effects. The results of reports are briefly summarised in Tables 2abcde.

Organisation—conflict description

Parties	Source	Helping factors
trade unions	failure to understand objectives	training
supervisory council	lack of understanding of tasks	evolutionary change
	position of marketing unit in the company structure	direct subordination of marketing unit to superiors
	furniture and equipment	

Organisation—conflict consequences

Internal effects	External effects
hostility attitudes manifested towards marketing unit's staff	distribution of negative opinions on the marketing unit
expressing concern for irrational expenses	

Table 2a. Description, sources, and impact of conflict related to introduction of marketing unit to a Polish firm. The organisational dimension.

Attitudes and skills—conflict description

Parties	Source	Helping factors
superiors	generation gap associated with differences in salaries, education and lifestyle (e.g. clothes)	upgrading professional education
subordinates	ignoring the image of the company, spontaneous criticism of the company	change in management style, staff integration focused on marketing policy
	assumed (wrongly) overcharge or irrational function costs	
	use of external providers of advertising services	
	co-operation with other companies	

Attitudes and skills—conflict consequences

Internal effects	External effects
gaps in units' activities	image of mismanaged company

Table 2b. Description, sources, and impact of conflict related to introduction of mar-

Supplies—conflict description

Parties	Source	Helping factors
supply unit	range of supplies (e.g. supply minimisation principle)	focused on tasks integration of supply, production and sales units
marketing unit	level of resources stored	adjustment of resources level to own needs and not to suppliers' preferences
	enrichment of production components	
	shortening order implementation time	

Supplies—conflict consequences

Internal effects	External effects
increasing the level of costs implied by irrational purchase and storing	low product quality
	difficulties in product adjustment to market requirements

Table 2c. Description, sources, and impact of conflict related to introduction of marketing unit to a Polish firm. The supply unit dimension.

Production—conflict description

Parties	Source	Helping factors
production unit	replacing production orientation with marketing one	co-operation of marketing, production and selling units
marketing unit	product diversification	customer oriented production
	ignoring marketing research	compromising by marketing unit contracts which are more favourable for production units
	product quality evaluations	

Production—conflict consequences

Internal effects	External effects
hostility attitude manifested against marketing officer	loss of part of firm's market share

Table 2d. Description, sources, and impact of conflict related to introduction of mar-

Finance and economic analyses—conflict description

Parties	Source	Helping factors
customer/sales	service	improvement of service quality: working hours, location of cash desks etc.
marketing unit	flow of information between board, and analytical and marketing units	close co-operation between board and analytical and marketing units
	pricing	use of surveys prepared in marketing unit
	use of computers	training

Finance and economic analyses—conflict consequences

Internal effects	External effects
hostility attitudes manifested towards marketing unit's staff	low evaluation of service quality

Table 2e. Description, sources, and impact of conflict related to introduction of marketing unit to a Polish firm. The finance and economic analyses unit dimension.

A careful inspection of these tables allows splitting the conflict into two spheres. The first one has a psychological background and is related to resistance toward innovation. This part of the conflict will be called the *marketing implementation conflict.* The analysis of the marketing implementation conflict is omitted in this paper since it is rooted in attitudes common to introduction of any innovation. The marketing implementation problems result in clearly negative effects and all kinds of effective facilitation and negotiation techniques can be recommended to decrease the influence of these effects.

The second conflict will be called the *structural marketing conflict.* This conflict is related to conflicting objectives of different units in a company. This conflict results in a compromising of the effective strategies of the company. The structural marketing conflicts have therefore a negative as well as a positive impact on the firm's functioning. A simplified model of the structural marketing conflict is formulated in the subsequent section.

3. A model of conflict

Following the survey of Mruk (1994), one observes that the marketing unit enters the conflicts with all parties that appear on the scene. Trade unions, the supervisory council, the executive management (superiors), subordinates, the supply unit, production unit, as well as customers/sales are more or less equally resistant in any co-operation with marketing units. In order to understand why this happens, let us consider the objectives of these parties.

In order to simplify the consideration we limit ourselves to only three actors viz. marketing, finance, and production departments. The expansion of the case

The procedure requires from the user a model edition and a corresponding data input and then control of the process of solving through qualitative evaluation of trial solutions supplied by the system. The flowchart is graphed in Figure 4.1.

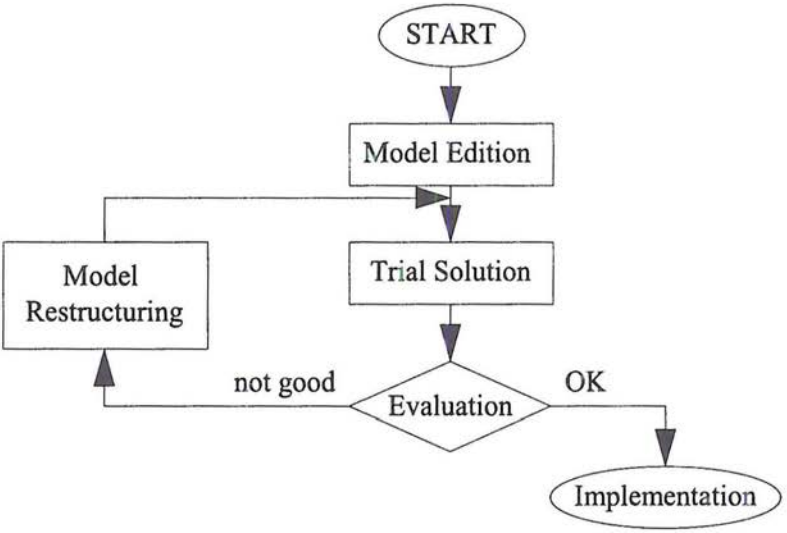

Figure 4.1. The simple flowchart of the Bi-Reference Interactive Procedure corresponds to standard interactive restructuring of a decision frame.

Model edition requires from the decision maker a declaration of decision variables, a set of constraints, the evaluation criteria, the worst outcome and the tolerance vector. Given the model definition, the procedure provides the user with the first trial solution. If the solution is acceptable to him/her the procedure stops with this solution being the final decision. Otherwise, the decision maker declares which criteria are to be improved, which can be worsened and which are to be preserved in the next iteration. The model is restructured following this information and the next trial solution is proposed. The procedure stops when either proposed solution is acceptable for the decision maker or two succeeding solutions differ less than by the tolerance vector. Technical details of the Bi-Reference Interactive Procedure are omitted here (the existence of trial solutions was derived in Szapiro, 1991).

Let us now consider the BIP procedure in application to the structural marketing conflict described in the previous section. The course of the procedure is described through Figs. 4.2–4.4 with selected printscreens from BIP4W v. 2.02—

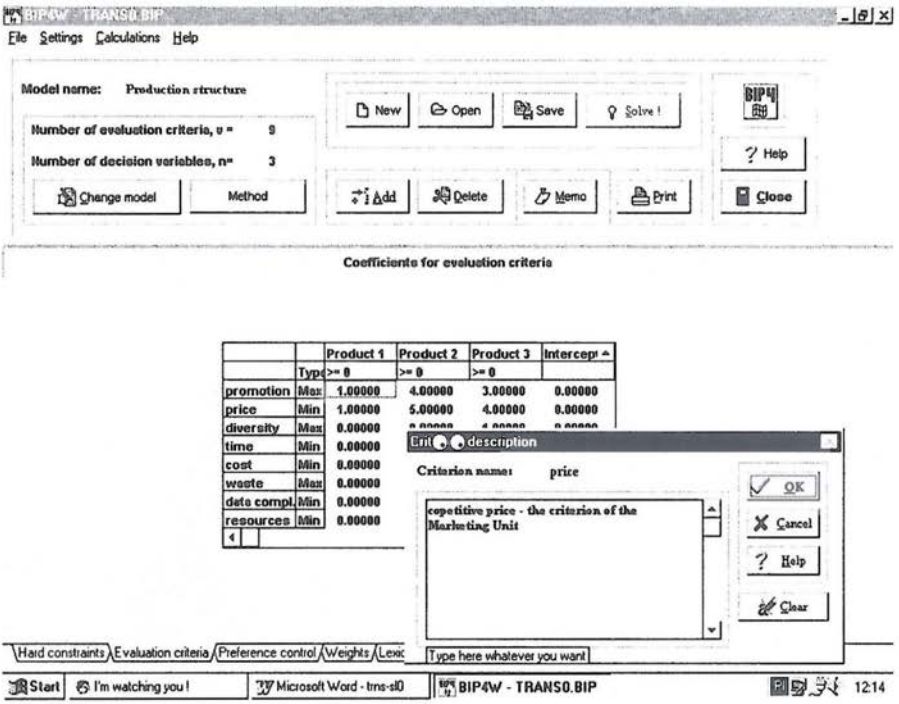

Figure 4.2. The printscreen of the second sheet ("Evaluation criteria") for the model of the situation described in Table 3.1. The buttons of the upper strip manage flexibly the model (number of decision variables and criteria), the central spreadsheet-like table allows user to define, label and describe qualitatively and quantitatively the criteria. A link with the standard spreadsheet is available to facilitate input of large data bases.

We assume the following managerial negotiation scenario. Executives (they will be called in the sequel: *parties*) who are responsible for the three units described in Section 3 try to agree on the production levels x of their firm. Each of parties defines the set of three criteria presented in Table 3.1. The criteria represent different costs or they are cost-related, and therefore use of linear expressions is justified. Assets (range of decision variables) are also limited. Thus, one deals with a compact set of feasible options and the continuity of the objective vector functions leads to necessary existence of an optimal solution. Information is not confidential in the group under consideration. It can be input and processed by a software which is designed to compute nondominated outcomes. These outcomes are to be returned to users as proposals of final decisions. The Interactive BiReference Procedure enables flexible definition of decision variables and their ranges (hard constraints) as well as evaluation

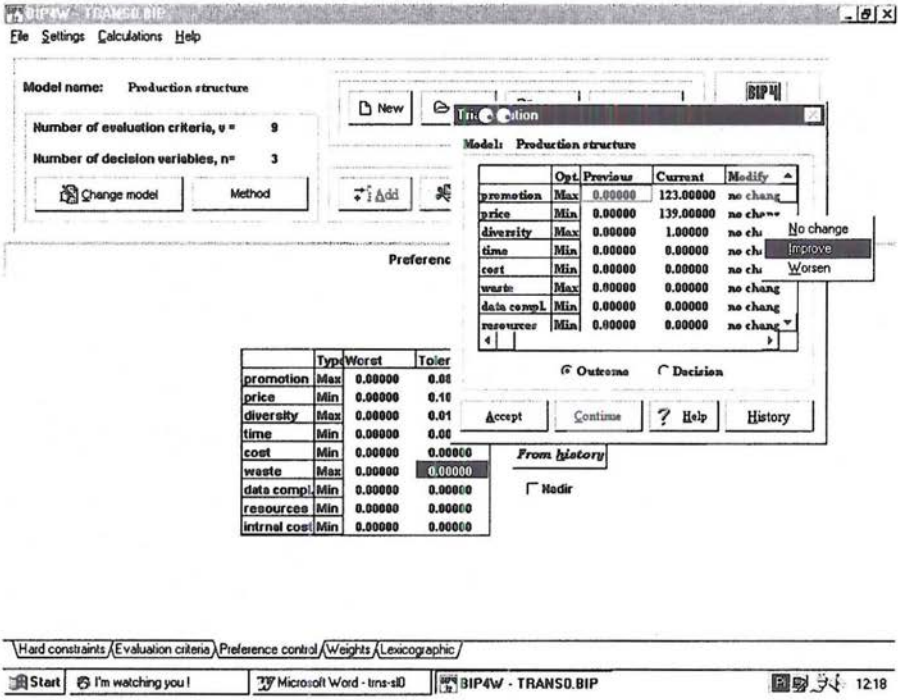

Figure 4.3. The printscreen of the third sheet "Preference control"—for the model of the situation described in Table 3.1 and the Bi-Reference Procedure based method of poly-optimizaton. The small right window allows to improve, worsen or keep the values recently obtained. The biggest window presents the history and the currents state of the decision making process. The small table below presents worst outcomes and tolerances.

Decision makers provided with proposals of final decision (*trial decision* in BIP-terminology) can review efficient frontier using dual frame of reference. This frame is derived from qualitative evaluation of the trial solution (increase-decrease-keep type of decision is required). This reference frame (*displaced worst outcome* and *displaced ideal point*) defines improvement direction and maximal—but still feasible—outcome in this direction is presented to users as the next trial solution. This solution (together with former ones) can be further analyzed until the stop rule (corresponding to close similarity of solutions) or the users halt the process. Due to the existence of the improvement direction, the solving procedure for the poly-optimal problem is reduced to the iterative use of the Simplex Algorithm for a series of subsequent different LP problems.

The BIP v. 300 allows to use other methods (lexicographic ordering and weighting methods) independently of BiReference Procedure or to compare re-

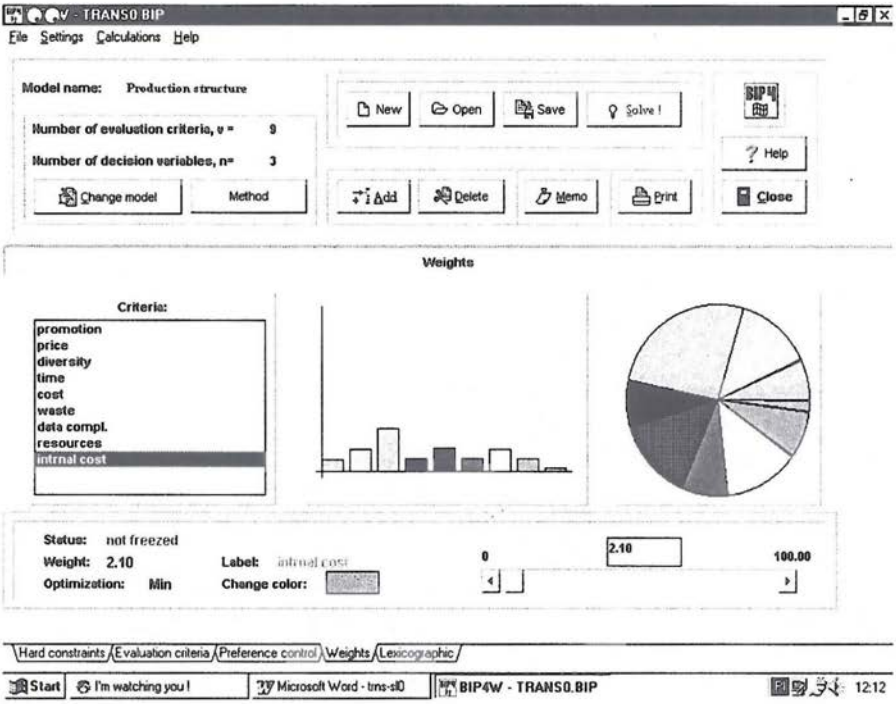

Figure 4.4. The printscreen of the fourth sheet "Weights"—for the model of the situation described in Table 3.1, with the weighting method of poly-optimizaton. As before the buttons of the upper strip manage flexibly the model. The central part of the screen helps in the control of weights in three modes (numerical, bar and pie control).

of perception the graphical control of weights as well as numerical input are available in the software.

All functions of the system i.e. model management, data input, solving, and interpretation are subordinated to cognitive human mechanisms. Models are written using standard Microsoft tools—bars and buttons corresponding to operations and are locally described in help strips. Standard operations (copy, save, paste) can be executed using standard shortcuts Ctrl+C, Ctrl+S, Ctrl+V, etc. Data are presented in tables similar to those known from everyday experience of, for instance, an accountant. In order to input data a user may take advantage of the keyboard or standard spreadsheet files known from his practice. Details of solving procedure are not presented to users. He/she controls the process through simple qualitative evaluation in natural language by pressing one of three command buttons.

The use of this system allows to meet typical requirements for support proce-

and more careful structuring of the decision making process, decrease of the groupthink impact, and ability to cope with large and complex data. The background of the marketing activities is a mixture of subjective factors related to values, fashions, needs and numerical processing of survey data. The system attempts to cope with this complexity through assigning subjective issues to human decision makers and computational tasks to computer. As mentioned before, the computing procedures are controlled qualitatively by human decision makers.

5. OR-based facilitation techniques in solving of marketing conflicts. The Polish case

The situation presented in Table 3.1 and implemented with the use of BIP v. 3.00 package is an example of application of a Group Decision Support System (GDSS). According to DeSanctis and Gallupe (1985), GDSS is "...an interactive computer-based system that facilitates the solution of unstructured problems by a set of decision makers working in a group...". GDSSs enable support of decision makers in solving structural marketing problems in situations when the set of criteria is easy to define and to agree upon and when numerical values (e.g. unit costs) are known. The supported decision process is faster (due to the shift of computations to the machine) and easier (due to qualitative control taking advantage of the user-friendly interface). Contrary to qualitative strategies of human consultants and advisers, precise numerical values are presented for implementation as the output of decision making process. One could say that BIP supports poly-optimization through restructuring. Although this process is free from technicalities, there are still large areas left for unsupported conceptual work. Here, model identification i.e. definition of crucial concepts used as decision variables, is usually rigid and is based on history and staff subjective experiences.

Therefore, there is still room for support of a group which is to achieve its goals (Eden, 1990). Ackerman (1993) recalls the following definition (Schien, 1988) of the facilitation process: "...the set of activities on the part of consultant that help the client to perceive, understand, and act upon the process events that occur in the client's environment in order to improve the situation defined by the client...". A part of the remaining activities is left to human facilitators who dynamically intervene in the process of compromising interests and criteria through managing the relation between decision makers. Effective teams seem to share a vision of organization and undertaking (Senge, 1990). Klein et al. (1995) recall that "...shared problem models based on explicit communication differentiated good from poor teams...". Poor communication, logical errors, inadequate situation assessment are pointed as sources of failures. Organizational techniques like brainstorming, nominal and Delphi groups as well as non computational support used in conferencing (Philips, 1989) and cognitive mapping SODA with computer support COPE (Eden, 1988; Eden and Ackerman,

Hinsz (1990), quoted after Klein et al. (1995), attempted to explain team decision making mechanism through the information processing framework. Within this framework, the decision making process can be described as a sequence of steps starting from the processing of objectives, going through attention/perception processes enabling information acquisition, encoding and storage. This information is retrieved. The analysis of group decision making process using this framework helps to identify biases specific to each step. The main methods to improve effectiveness of teamwork are careful organization design (e.g. team size, member proximity, task type, centralization of control) and group support technologies (computer support, electronic meeting management).

Typical objectives of computer support systems include: providing fast information which is more complete and more accurate, reduction of coordination effort, reduction of negative group interaction effects, improvement in the sharing of visions of the problem. These tasks require possibly accurate models as the basis to process data, enrich direct communication channels (use of graphical representations, video, animation and colors in discussions), create channels linking remote parties. In the marketing context facilitation should assist in coping with problems of appropriateness of information (too much of inadequate or shortage of information), lack of credibility (subjective and inaccurate data), operation problems (low access and insufficient time to process data).

The task of processing data is described better than the communication aspects. Marketing Decision Support System (MDSS) is "...a coordinated collection of data, systems, tools and techniques with supporting software and hardware by which an organization gathers and interprets relevant information from business and environment and turns it into a basis for marketing action..." (Kotler and Lilien, 1983). MDSSs provide executives with processed data from internal accounting files and with data on changing business environment (from marketing- intelligence sources—the Market Research Society of America may serve as an example of many institutions which sell reports based on marketing oriented surveys). Given sufficient information, MDSS can process data in order to optimize, and to aid in planning as well as decision making tasks. Usually, only single criterion models are used. This limits the support to suitable, single criterion cases.

On the other hand, it is well known that managers need to analyze data rather than to retrieve them. Hence, database management is not sufficient for them since sensitivity analysis is possible only when models are available. This means that the management scientist plays the role of intermediary and enables to bridge the gap between models and managers, hard and soft, and requirements and backgrounds, respectively. The obvious requirement is the speed of computations enabling immediate reaction to the changing marketing environment of the company. Kotler and Lilien (1983) point out also the role of time-sharing: "...problem solver identifies and deals directly with marketing

to optimize marketing multiple criteria evaluations of decision alternatives. The implementation (computer package BIP v. 3.0 presented in Section 4) illustrates advantages and drawbacks of the computer assisted compromising of structural marketing conflicts with the use of the BiReference Procedure. The general arguments on barriers, postulates and perspectives of Interactive and Intelligent Marketing Systems (Section 5) point to the need for future design procedures of decision makers support in their task of establishing options and criteria.

The second comment deals with the issue of the necessary infrastructure for computer assistance. To give a perspective on the background of this problem, let us start with some statistical data for mature systems for 1996 presented in Table 6.1.

	France	Germany	USA	UK
Expenditures per capita	450 ECU	520 ECU	830 ECU	450 ECU
% of households using computers	17%	30%	43%	26%
% of small firms using e-mail	29%	35%	48%	19%
% of firms medium size which use e-mail	38%	58%	70%	63%
% of big firms using e-mail	36%	47%	61%	41%

Table 6.1. Statistical data confirm the US domination over Europe in computer services as well as expenditures (per capita) on computers.

The difference between Western European countries and the USA is confirmed also by the share of the state budget allocated for modern technologies: 3.34% of GNP in the USA and 2.08% of GNP in Western Europe. This difference seems to be minor compared to Central and Eastern European countries. In 1994 Central and Eastern European countries placed further than twentieth place in Europe with respect to GNP per capita. Position on this list closely corresponds to the position in the ranking of the level of development of information infrastructure. Central and Easter European countries are placed on positions 21 (Hungary), 26 (Czech Republic), 27 (Slovakia) and 28 (Poland), see Golinski (1997), a pioneering work on overall information infrastructure development indices. The level of development of information infrastructure for Poland is low. The estimated number of Internet users is under 17 (per 10,000 inhabitants) compared to 89 in France, 141 in Germany, 671 in US and 229 in UK. The number of computers per 100 inhabitants is 2.2 in Poland compared to 14.0 in France, 14.3 in Germany, 29.7 in US and 15.1 in Great Britain.

Consequently, it may be expected that until the share of the state budget for modern technologies or the budget itself are not increased, the infrastructure level will remain low. This seriously impedes a possibility of using widely the computer supported assistance for the resolution of marketing problems. It is also worth noting that research data prove that involvement of computers is expensive: according to Intel reports, the price of a computer accounts for only 21% of overall costs. (Including repairs, net administration, software,

decreased—investment of the range after 100 billion USD in the net of 50,000 PCs leads to 30% of savings in case of Intel.)

Let us conclude with the last remark that the Support Systems require staff retraining. However "...decision training based on classical decision theory has not been shown to transfer to natural tasks outside the classroom..." report Klein et al. (1995). They add that novices and experts differ in use of domain knowledge rather than in knowledge of decision problem solving methods. It appears that decision making training needs to address the task and the decision context.

References

ACKERMAN, F. (1993) The role of Facilitators in GDS Systems. *Working Paper* 93/1, *Management Science. Theory, Method and Practice Series*, University of Strathclyde in Glasgow, U.K.

ACKERMAN F. and BELTON, V. (1994) Managing Corporate Knowledge Experiences with SODA and VISA. *British Journal of Management*, **5**, 163–176.

DESANCTIS, G. and GALLUPE, R. (1985) Group decision support systems: A new frontier. *Database*, 3–10.

DHAR, V. and STEIN, R. (1988) *Intelligent Decision Support Methods.* Prentice Hall, NJ.

DRUCKER, P.F. (1985) *Innovation and Entrepreneurship: practice and principals.*

EDEN, C. (1988) Cognitive mapping. *EJOR*, **36**, 1–13.

EDEN, C. (1990) The unfolding Nature of Group Support—Two dimension of Skill. In: *Tackling Strategic Problems-the Role of Group Decision Support*, Sage Publications, London.

EDEN, C. and ACKERMAN, F. (1989) Strategic Options in Development and Analysis. In: Doudakis, G., Land, F. and Miller, G., eds., *Knowledge Based Management Support Systems*, Ellis Horwood, Chichester.

GĄSIOROWSKI, P. (1996) Selecting the credit policy of a bank (in Polish), M.B. thesis. Warsaw School of Economics, Warsaw.

GOLIŃSKI, M. (1997) *The Level of Development of Information Infrastructure of a Society* (in Polish). Akademicka Oficyna Wydanicza PLJ.

HINSZ, V.B., (1990) A conceptual framework for for a research program on groups as informaton processors. Technical Report, AF Human Resources Laboratory, Wright-Patterson AFB, OH.

LOTFI, V., STEWART, T.J and ZIONTS, S. (1992) An aspiration-level interactive model for multiple criteria decision making. *Computers and Operations Research*, **19**, 677–681.

KLEIN, G.A., ORASANU, J., CALDERWOOD, R. and ZSAMBOCK, C.E. (1995) *Decision Making in Action: Models and Methods.* Ablex Publishing Corporation, Norwood, New Jersey.

KOTLER, P. and LILIEN, R. (1983) *Marketing Decision Making.* Harper & Row,

MANSFIELD, E. (1991) *Managerial Economics.* W.W.Norton and Company, New York.

MICHAŁOWSKI, W. (1998) Use of the displaced worst compromise in interactive multiobjective programming. *I.E.E.E. Transactions on System, Man and Cybernetics*, **18**, 472–477.

MICHAŁOWSKI, W. and SZAPIRO, T. (1989) A Procedure for Worst Outcome Displacement in Multiple Criteria Decision Making. *Computers and Operations Research*, **16**, 3, 195–206.

MICHAŁOWSKI, W. and SZAPIRO, T. (1991) A Bi-reference Procedure for Interactive Multiple Criteria Programming. *Operations Research*, **40**, 1.

MRUK, H. (1995) Conflicts Related with Marketing Introduction in a Firm (in Polish). *Marketing i Rynek*, **2**.

NARULA, S.C., KIRILOV, L. and VASSILEV, V. (1992) Reference Direction approach for solving multiple objective nonlinear programming problems. *Proceedings of the Tenth International Conference on Multiple Criteria Decision Making*, Taipei, **2**, 355–362.

PHILIPS, L.D. (1989) People-centred Group Decision Support. In: Doudakis, G., Land, F. and Miller, G., (eds), *Knowledge Based Management Support Systems*, Ellis Horwood, Chichester.

RAPACKI, R. (1994) Polish Corporate Sector, 1990–93. In: Gołębiowski, W., ed., *Transforming the Polish Economy*, Warsaw School of Economics Press.

REILLY, R. (1982) Preference Reversal: Further Evidence and Some Suggested Modifications in Experimental Design. *American Economic Revue*, **72**, 576–584.

SENGE, P. (1990) *The Fifth Discipline.* Currency Doubleday.

SCHIEN, E.H. (1991) *Process Consultation—Its Role in Organizational Development.* Addison-Wesley.

SHIN, W.S. and RAVINDRAN, A. (1991) Interactive multiple objective optimization: survey I—continuous case. *Computers and Operations Research*, **18**, 97–114.

STEUER, S.E. (1977) An interactive multiple objective linear programming procedure. *TIMS Studies in Management Science*, **6**, 255–239.

SZAPIRO, T. (1993) Convergence of the Bi-Reference Procedure in Multiple Criteria Decision Making. *Ricerca Operativa*, **23**, 66, 65–86.

SZAPIRO, T. (1994) Bireference Interactive Procedure. Multiple Criteria Decision Support System (in Polish). The State Committee for Scientific Research (KBN), Poland, project No. 1 P 110 035 07.

SZAPIRO, T. and OŻDŻEŃSKI, W. (1995a) Choosing the Optimal Computer Configuration (in Polish). *Annals of the Faculty of Economic Analyses*, 2/95, Warsaw School of Economics, Warsaw.

SZAPIRO, T. and OŻDŻEŃSKI, W. (1995b) Computer Software for Continuous Polioptimisation Based on the Bireference Procedure (in Polish). *Technical Report* No. 03/E/0001/95, Faculty of Economic Analyses, Warsaw School

SZAPIRO, T. and OŻDŻEŃSKI, W. (1995c) Some Methods Supporting Multiple Criteria Decision Problems (I): System BIP 2.0 for Windows (in Polish). *Technical Report* No. 03/E/0001/95, Faculty of Economic Analyses, Warsaw School of Economic.

ZELENY, M. (1982) *Multiple Criteria Decision Making.* McGraw-Hill, New York.

ZIONTS, S. and WALLENIUS, J. (1976) An interactive programming method for solving multiple criteria problem. *Management Science*, **22**, 6, 652–663.

ZIONTS, S. and WALLENIUS, J. (1983) An interactive multiple objective linear programming procedure for a class underlying nonlinear utility functions. *Management Science*, **29**, 519–529.