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1.1.1 Context

The TACTICS project was undertaken in a period of sweeping changes in the field of study, generated by the merger of two distinct technological trajectories:

- the century old telephone utilities and their equipment suppliers
- the younger computer industry together with publishing, entertainment, television, cable and film companies emerging strongly, resulting in the origin of new Advanced Communications Technologies and Telematics (ACT&T) industries and services

- Dismantling the 'natural monopolies' in the telecommunications industry in USA and Western Europe (be it private or state) and deregulation of the whole chain of activities.

These two global processes coincided with the ongoing process of economic transformation of Eastern Europe.

To a varying extent, the three Balkan countries involved in this project created some industrial potential in the field of communication networks. By the end of the 1970s substantial moves were made towards producing and installing networks to specific standards. During the transition all three Balkan states encountered the same problems engendered by the collapse of the former COMECON and by the necessity of adaptation to the European and world market by gradually replacing the technology and equipment, software, protocols and standards, organisation forms, etc.

To modernise the Balkan countries' industries and step up their innovation potential it was first necessary to analyse examples of successful industrial development and innovation in certain sectors as well as some concrete mechanisms through which the economic environment of the 1990s suppressed those processes. Innovation and modernisation of Eastern European industries had been poorly researched compared with work on fiscal policy, structural reform and privatisation. It was not until the end of 1996 that we witnessed a certain effort to speed the reforms and to improve the state of development of the Balkan states.

There were two reasons for the unsatisfactory state of the studies on innovation potential in Eastern Europe. *Firstly*, it was due to the collapse of the totalitarian economies in the field of high technology and innovation. The stable culture of secrecy in the field of technological innovation, i.e. its binding with the Military Industrial Complex, was an additional factor in this process. *Secondly*, it resulted from the restrictions imposed by the neoclassical (monetarist) economic models which reigned until recently and according to which technologies and innovations are an 'exogenous factor' of economic development. There were two major novelties in this sphere during the last decade; firstly the rise of the 'economics of technical change', especially the so-called evolution paradigm (Ch. Freeman, G. Dossi, R. Nelson, etc.); secondly the progress of the sociology of innovation and the techno-economic networks (TEN) approach (Callon, Akrish, Law). What deserved our appraisal of the evolution paradigm was the better understanding of the zone of reciprocal adaptation between economy and technologies through the introduction of a new notion – 'couplage' or 'adjustment' between technology and the market (Callon, Law, 1989). The TEN approach theory, provided a solution to the way the couplage should be realised by

elaborating the problem of the 'translation' between the logistics of the market and those of the inventions.

1.1.2 Objectives

The TACTICS objective for a successful and pragmatic study in the field of industrial modernisation of Eastern European economies was to secure the missing reliable empirical information concerning the harnessing of technological innovation which needs to be analysed in the light of the new theoretical ideas in the field of economics and sociology. More precisely the project provided:

i) Description and quantitative analysis of the state of art in supply and use of Communication Technologies and Telematics in the three Balkan countries in the context of the administrative economy of the recent past (the second half of the 1980s); Quantitative economic data of progress in this sector in the 1990s, noting the desire for modernisation and innovation within the three Balkan countries;

ii) Identification of patterns of development of the new private firms in the field during the 1990s;

iii) Representative empirical information and an assessment by the managers of this industrial sector, about 1) dominant technologies, human resources, forms of partnership in the business, relationships with customers, level of R&D activities; 2) the effectiveness of the legislative basis and the government policy; 3) the major problems and difficulties facing the modernisation of traditional industrial sectors and its integration into the European and world market.

1.2 Research method

The TACTICS Research Methodology resulted from intensive theoretical analysis of the relevant economic and sociological literature (see *TACTICS Paper search report*) and from a technological assessment of relevant Advanced Communications Technologies and Telematics (ACT&T), see *TACTICS Technology Assessment Report.* The authors shared the recent critiques of the idea of the transition in the East European economies as 'rational design of [new] economic institutions' and the view of David Stark that capitalist economy and its institutions are not the outcome of a rational design, like the communist Utopia. (Stark 1998, Hannan and Freeman, 1989; Nelson and Winter, 1982; David, 1986). The empirical studies show that after the collapse of communism every country is distinguished by its own institutional heritage. In this sense, the transition is bound to start from the 'ruins' of the previous system and that is why the way destruction was effected and the form of the ruins are very important. Hence the project methodology might be outlined in the following key concepts:

- *The concept of 'construction of the markets'*. It opposes the traditional treatment of the market and the state as independent entities and emphasises the constitutive nature of the relations between them (Block, in Smelser & Swedberg, 1994). When related to the emerging markets in Eastern Europe in the period of transition the state must play "a central part in the formation of the new constellations of ownership and the new markets". The unambiguous differences between the East European countries show that at every single moment of the transition the societies have a wide spectrum of choices to combine the markets and the actions of the state. Hence Bulgaria, Romania and Macedonia should be regarded as having specific institutional, political, cultural and material characteristics that provide possibilities for 'different choices' in the course of the transition.

- *The concept of 'path dependency'*. It has the heuristic advantage of examining what is happening here and now as a constant activation of the existing (available) organisational forms, institutional mechanisms, social relations and products, used by the actors to answer immediate practical dilemmas (Hausner, Jessop, Nielsen, 1995; Stark, 1992, 1996). The evolutionist approach and the concept of 'path dependency' once emerged in the works of Christopher Freeman, R. Nelson, S. Winter and others as an attempt to bring back technology and innovation in the midst of the economic analysis. The key problem that remained unsolved in the evolutionist approach was the mechanism of coupling, of combining the two logics of invention and the market. (Callon & Law, 1989).
- *The concept of techno-economic networks (TEN)* with its *notion of translation*. The concept of techno-economic networks has structural similarities with the above concepts in understanding of the transformations in Eastern Europe. In the original project proposal we fixed TEN as a co-ordinated set of heterogeneous players that participate collectively in the development and spread of innovations (independent laboratories, technical research centres, industrial and financial organisations, users and public authorities). The TEN approach is particularly suitable for analysing the modernisation of traditional industries in the three Balkan countries, i.e. the newly emerging market in which technologies for communications and Telematics are 'key variables'. There are emerging adaptations and reconfigurations that are closely related to the traditions and specific circumstances in each country.

Based on this theoretical framework, a *threefold methodology of data collection* was applied:

- *historical analysis* (analysis of relevant literature and archives, interviews with key actors in the sector);
- *case studies* of limited number of typologically selected ACT&T firms;
- *representative survey* with ACT&T firms. The survey comprised 306 firm in Bulgaria, 280 firms in Romania, and 138 firms in Macedonia. (See *TACTICS Survey Technical Reports*).

The methodological framework resulted from theoretical discussion between the partners, held via electronic communications and presented as a series of theoretical papers at TACTICS Workshops in Bucharest, Romania (April 1999) and Ohrid, Macedonia (July 1999). The final TACTICS Conceptual framework was elaborated jointly by the Bulgarian (Ivan Tchalakov, Svetla Koleva) and French partners (Michel Callon and Philippe Laredo). The TACTICS Survey data have been analysed with advanced methods for statistical analysis of nominal data - *cluster analysis* and *multiple correspondence analysis (homogeneity analysis)* using SPSS 9.0 software. The method for data treatment was designed by the Bulgarian team (Ivan Tchalakov) and French team (Michel Callon and Philippe Laredo) in a number of working meetings held in Paris (CSI, Ecole des Mines) during the autumn of 1999 and winter of 2000. Each national team conducted the statistical analyses for National Survey reports. The Bulgarian team designed the computer database and conducted an advanced statistics comparative analysis (Ivan Tchalakov, Donka Keskinova). The course and results of statistical analysis of survey data for Bulgaria, Romania and Macedonia and their comparison were evaluated at TACTICS Workshops held in Paris (July 2000) and Sofia (September 2000).

1.3 Results and achievements [1]

1. General economic characteristics of the sector

- There are important *differences in the dominant economic characteristics* of the firms between the countries. In Bulgaria the largest type are self-employed and micro firms with a turnover below DM 10 000 per year and a personnel of less than 5 people (above 40% of the firms). In Romania and Macedonia there is a more even distribution among the economic types of firms.
- Analysis of firms activities in the fields of production, assembling, trade, services, consulting and system solutions shows *domination of trade and service oriented firms* - the four groups of service and trade firms accounts for 5*3,6%* of the firms. *Production oriented firms are 14.5%* (together with assembly-oriented firms their share increases to 27.1%). Distribution among the countries reveals significant variations, production and services being well represented in Bulgaria, trade oriented firms - in Macedonia and Romania.
- *Importing/assembling of hardware* and *production of software* account for the biggest share of firms' technological activities in Romania and Macedonia followed by *systems integration*. In Bulgaria we observed a more evenly distributed profile, *industrial automation* being more represented. Clustering of technological profiles identified the important group of *advanced communication firms* (30.5%), combining hardware and software with at least one type computer communications (system integration, Internet, telecommunication, Telematics,). *Complex hardware firms* are another group with 14.5%. There are several smaller groups of *specialised mono-profile firms, software producers* being the largest one (16%).
- *Sources & purpose of credit relational variable* revealed that during the 1990s the ACT&T firms in Bulgaria, Romania and Macedonia relied heavily on *self-financing* for the development of their businesses. In *four out of six relational modalities self-financing dominates.* Investment funds (including venture capital funds) together with state and international programmes did not play a significant role in financing business in the sector. Bank loan accounts are used by a small fraction of firms, often in combination with leasing and inter-firms credit. There are clear differences between the countries.

2. Legal framework of the sector

- Legal entities dominating the branch are *sole traders* in Bulgaria and *limited liability companies* in Romania and Macedonia. *Share holding companies* account for approximately 10% of the firms (slightly lower in Macedonia - 6.5%).
- *The sector of information technologies and telecommunications*, 10 years ago almost entirely possessed by the state is *now completely privatised*, the state or municipalities having a control share in less than 2% of the firms. However, measured as share of turnover, the state sector is bigger, because the National Telecomms Companies in Bulgaria and Macedonia are still not privatised.
- The share of *foreign capital* in the branch is low. With 8.3% Romania has the highest share of foreign capital controlled companies. Although small (3.2%), the control share of foreign capital in Bulgaria is bigger than the state one (1.6%), and if estimated along with the presence of foreign investors in the Bulgarian firms, it increases to 5.2%.

[1] Survey data refer to the situation about May 2000.

- The former big IT enterprises have been privatised or have disappeared and the vast majority of firms are new, established after 1990. There are important variations between the countries concerning number of newly established firms during the years.
- *Execution of property rights.* In the majority of firms (53.2%) the *property rights* are executed entirely by their *owners* or *co-owners*! This share varies from 59.8% of the Bulgarian firms to 56.1% of Romanian firms and to *only 34.1% of Macedonian firms*. The classical sharing of property rights between managers and owners/Board/General Assembly was observed in 26.8% of the firms. The shares of managers and owners (Board/GA) changes in reverse proportion from 'daily' (prices, salaries, etc.) to 'core' (residual return, residual assets) property rights.
- The very interesting modality of *omnipotent manager' firms* (12.8%) was found. This apparently contradicts the property rights theory - managers of the firms retaining all property rights, including rights to residual return and residual control over its assets! The above finding is directly linked with the *phenomenon of 'hidden ownership'*, which appeared also during the interviews and case studies. There are two varieties:
    - when the firms are owned by politicians or high state officials (political party leaders, members of parliament, ministers or deputy ministers, etc.) who officially are not permitted to conduct their own businesses;
    - when the members of former high communist party nomenclature own the firms, who also cashed their property and business because of the possible legal prosecution of the origin of their property.

In both varieties *the ownership of the firms was formally transferred to family members, relatives or 'trusted persons'*. However, these 'hidden owners' conducted the entire management of the firms and executed all property rights through their appointees. This phenomenon was particularly well pronounced in Macedonia but it is also present in the other two countries, albeit at a lower extent. We consider as indirect confirmation the relatively higher level of contacts of Macedonian ACT&T firms with public powers.

3. *Foreign business partnership*

- The business activities in the branch are oriented towards the domestic market - almost 4/5 of the firms have no exports!
- The exporters are divided into three well defined groups, with important common characteristics related to their R&D activities, business interactions, intensity of contacts with public bodies, etc.:
    - Developed countries exporters (Western Europe, North America, Far East, Israel)*;*
    - Big emerging markets (ex-COMECOM, Balkan countries) & developed countries exporters*;*
    - Small exporters in emerging markets (ex-COMECOM, Balkan countries).
- Multiple correspondence analysis indicates *not simply exports but the type of foreign business partnership is most important*. It shows that about 45% of the firms have no foreign business partners at all, but the rest are engaged in some type of foreign relationships (import, export, non-trade partnership (R&D, staff training, etc.). There is a small group of firms (8.7%) restricted by their foreign partners (mostly multinationals) to sell on the domestic market only. However, the majority of this group are big firms; 2/3 have a turnover over DM 1 million (few below DM 50 000).

4. *R&D activities*

- About 1/3 of firms in the sector are high-tech firms (28.6%), investing over 20% of their annual turnover in R&D. Another 18.2% invest between 5-19% of their turnover in R&D. Overall, 52.4% of the studied firms have R&D activities. Another 11% declare that they did in the past but ceased R&D because of the difficult economic situation !
- *The average investment for 1999 for R&D firms was DM 100 297*. Taking into account the confidence interval the average annual investment in R&D was between DM 56 000 and 144 000, the highest amount being DM 1.865 millions (1 million 865 thousand).
- The largest share of investments in R&D came from firms' own resources. The conclusion is that conducting R&D is a strategic choice for an important part of firms in the sector as a way to survive in the difficult situation of 1990s, closely related with their strategy for export. This is particularly true for software and industrial automation firms.
- More than 1/3 of the new IT and telecommunication firms employed R&D staff of former state-owned IT and telecommunication industries. The most important finding came from multiple correspondence analysis, where the *'staff from former state-owned industries' relational variable has one of the lowest discrimination measures* among the other 25 relational variables. The possible conclusion is that, after 10 years of profound economic transformation, the former industrial structure has gradually diminished its influence.
- Interesting differences between the countries in their s*taff advanced qualification* were found. *Macedonian firms led in percentage of staff with multinationals' certificates (*38.4% versus 25.1% for Bulgaria and 24.3% for Romania.). Case studies and historical analysis have shown that Yugoslavia (including Macedonia) was better integrated in the Western market of information and communication technology (ICT) and contacts with multinational corporations were much wider in comparison with the former COMECOM countries. *Bulgarian firms led in staff with scientific degrees* (25.8% versus 18.6% for Macedonia and 8.2% for Romania). The large R&D sector in Bulgarian state-owned electronic and telecommunication industries, together with the country's applied academic research in these fields, are the main reasons for the observed differences.

4. *Telecommunications services*

- Most of the studied firms experience problems when subscribing or using national telecommunication operators' services. The share of firms reporting problems is lower in Romania (especially in operation and maintenance), the only country with privatised national telecomms.
- Delays in telephone line installation and problems during its operation are higher in Bulgaria. Macedonia has the higher share of firms complaining of problems during subscription and use of advanced telecommunication services, i.e. connection to Internet, ISDN and data transmission network.
- Less than 1/5 of firms use (regularly or incidentally) advanced communication services (IP telephony, videoconferences) in their contacts with customers. The share of Bulgarian firms is lower, if in the framework of statistical error.
- The share of customers with national and international computer network vary from almost 1:3 for Bulgarian firms to almost 1:2 for Macedonian firms. The higher share of small firms in Bulgaria reflects in the lower share of customers serving their own country and especially international computer networks.

- 2/3 of Bulgarian and Romanian firms and 4/5 of Macedonian firms have customers with their own web-site. For about 10% of the firms more than half of their customers possess such a web-site.
- Web sites are used mostly for advertising and for supplying information to the customers. Still almost 10% of the firms have customers taking steps in e-commerce and on-line maintenance.

5. *Relationships with state offices. Licensing*

- *Problems with state offices.* There is significant variation in the negative daily relationships of ACT&T firms with state offices. It is remarkable that 1/2 of Bulgarian firms declare some problems with state licensing and control offices yet almost 3/4 of Macedonian firms have no such problems. Romanian 'no problems' firms with a share of 57.1% take an intermediate position. The problems with *court, local administration, taxation offices and customs* were the most pronounced. The big difference between the countries concerning *'problem with taxation office firms'* might be related to the fact that, until recently, Macedonia was the only country without VAT.
- The data for licences for type approval, voice, data, paging, Internet, etc. have been collected. Licensing regimes vary among the countries (for example Bulgarian and Macedonia have different regimes for Internet providers). The survey showed that the majority of firms in Bulgaria and Macedonia (about 68%) possess no type of licence (including type approval), whilst 56% of Romania firms possess some type of licence. Approximately the same share of Romanian and Bulgarian firms (13-14%) had some problems with their business partners because of their lack of licences. In Macedonia 1/3 of the firms had such problems with their business partners.

6. *The results from multiple correspondence analysis of firms' networks of relationships*

The multiple correspondence analysis aimed at revealing those relationships and dependencies of the firms that are not directly observed. It was realised by simultaneous treatment of all 25 relational variables (clusters), each measuring a specific type of relationships, e.g. with business partners, customers, legal and financial bodies, state offices, etc. The tool used produces a number of dimensions, each splitting the population simultaneously in a number of characteristics. We analysed the *first five dimensions,* where each dimension explained at least 10% of the total dispersion and possessed a discrimination measure above 0.3 for at least one relational variable. The two poles of each of the five dimensions produced the *empirically identified strategic profiles of firms*, which oppose in couples. Some of these strategic profiles are *country specific*. The results are given in details in Part III of TACTICS Joint Report.

- *I dimension* (explains 22.2% of the dispersion)

Network pole - the firms of this pole are *NOT distinguished by the type of their product/services* (own, standard, licensed). Neither are they *distinguished by technology profile*. *All, however, are strongly integrated into different types of networks* (business, financial, legal, and educational, with public powers). These are *large firms whose turnover exceed DM 1 million* and, to a lesser degree, *firms with a turnover ranging between DM 200 000 and 1 million*. The relative share of Bulgarian, Macedonian and Romanian firms in the *network pole* is approximately the same.

Information technology & Telecom ***Robinson's pole*** - these firms *do not invest* (or rarely invest) in relationships with other actors outside the business. The firms here sharply limit relationships to the business proper, maintaining no contacts with business partners, legal and financial bodies, and state offices. They operate on the domestic market only and do not have foreign partners. The firms in this pole were identified as predominantly *Bulgarian small software firms* with *turnover up to 10 000 DM* per year, *sole traders, self-employed or with 0-1 person staff.* These firms basically count on the attractive ratio between price and quality of the products and services they provide with minimum indirect expenditure.

- *II dimension* (explains 13.5% of the dispersion)

R&D pole *(negative) - Export-oriented firms (some with foreign shares), focusing their efforts on development of technology*. They export to developed (Western) markets with a small number of large private customers, offer original products/services based on their own intensive R&D efforts, employ high quality personnel investing in their training and qualification and are *open to association* with business partners. They have *less problems with state offices* due to their specific technology profile and export orientation (software and industrial automation), use limited professional legal and economic advice and have limited contacts with the public powers. These are predominantly *Bulgarian software and industrial automation firms*.

Pole of hardware importers - the strategic profile reveals *firms oriented predominantly towards the domestic market*. They are basically importers and not exporters with no permanent foreign partners, oriented to the *supply of standard products on the domestic market,* with a large number of customers in both the private and public sector. These are predominantly *small and medium* (up to DM 200 000) *Macedonian and Romanian firms,* some of which are joint ventures or branches of larger local or foreign firms.

- *III dimension* (explains 10.9% of the dispersion)

Resellers from teaching books pole - this pole reveals a business strategy that seems to be taken from an economic teaching book: new firms headed by managers who are not so much focused on technology but pay serious attention to the economic qualification of their employees. They sell licensed communication services on the local markets, both original or imported by foreign firms. They concentrate on their own business in a difficult and sometimes hostile environment, restricting the relationships with domestic business partners (including financial partners) and are always trying to find legally acceptable way out of their problems. This pole comprises mostly *Romanian communication services* (cable TV, Internet, media) and *software* firms, mainly large and medium with a turnover more and less than DM 1 million respectively, very often *with foreign shares in their capital.*

Omnipotent manager's pole - the pole consists almost entirely of different types of *Macedonian firms (large, medium* and *small),* together with a few *small Bulgarian firms.* This odd strategic profile reflects the contradictory character and 'irrationality' of the Macedonian situation and part of that in Bulgaria. It is characterised by covering up the real owners and an *exotic form of execution of property rights* whereby the manager executes all rights including the right to sell shares and distribute profits. There is high level of using financial services and legal advises, including the extensive use of bank credit (apparently a privileged group) without *problems with state offices.* The specific profile of foreign trade comprises large imports from the developed Western countries and exports to the former COMECON partners and Yugoslavia. Considering the declared high share of R&D the non-

differentiated attitude to the quality of the personnel and lack of R&D partners is questionable.
This indigenous pole is one of the important findings of the TACTICS project. It needs further exploration using additional data from the case studies and interviews.

- *IV dimension* (explains 10.7% of the dispersion)

Communication equipment & service providers pole - the strategic profile of the firms in this pole is almost entirely determined by the nature of the services & products they are offering, i.e. *telecommunication equipment & services, cable TV and computer communications*. According to the number of their customers, their turnover and staff experience are split into two categories: a) firms with large turnover and with relatively large number of personnel with low dynamics and b) small firms in communications services. There are slightly more Macedonian and Romanian firms and fewer Bulgarian firms. They maintain both institutionalised and *informal contacts* with their business partners, some firms collaborating only in the field of *market self-organisation* (i.e. joint efforts in combating monopolistic actions, establishing and enforcing certain business rules, protection against political and administrative intervention). The firms in the pole are not engaged in specific forms of competition (R&D, qualified staff, etc.) but maintain *relations with foreign partners*, resulting from the very nature of services they are offering, i.e. communications (typically, these are not multinational companies, nor R&D partners).

Software & complex hardware SME pole - the strategic profile of the firms in this pole reveals firms working in specific technology areas combined with specific levels of R&D efforts and preferences in staff qualification. It comprises firms with various volume of turnover, number of personnel and various forms of ownership and management in the three countries. The balance of their sales lies between original, standard and licensed products offered to a determinate number of customers. Together with this appear specific types of problems with government bodies and efforts to solve these and other problems by increasing business collaboration. There is slight dominance of *Romanian firms*.

- *V dimension* (explains 9.1% of the dispersion)

The umbrella of economic competencies & Public authorities pole - this is a strategy followed predominately by *Macedonian firms (and to a lesser extend Romanian firms)* with different technology profiles and turnover. Among these firms the phenomenon of 'hidden owner' appears again (See *Omnipotent managers pole* in the II dimension). The difference here is a number of new characteristics such as the explicit high level of contacts with public power, attention to the economic qualification of personnel and possession of patents. Business collaboration in *legal framing of the market* is another important characteristic *(*co-operation in the development, introduction and promotion of new standards, joint lobbying for the establishment of an advantageous legal framework for the business, defining strategies of economic policy, etc.).

Self-organised Bulgarian engineers pole - a strategy applied predominantly by *non-capital Bulgarian firms, specialising in the field of industrial automation.* Its essence rests on three pillars: a) stress on original technological competencies and know-how, b) avoiding contacts with public power, and c) solving tax, customs and licensing problems with state offices by *market self-organisation* (i.e. joint efforts in combating monopolistic actions, in establishing and enforcing certain business rules, joint protection against political and administrative intervention) and use of professional legal advice.

The true sense of the V dimension two poles below cannot be understand if taken in isolation. They show two opposing groups of firms: a) those having *serious problems with state legal & financial offices and with state licensing & control bodies* and b) those who have no such problems. The other opposition between the two groups is the different ways to approach these problems. The first pole approach is by improving economic competencies together with lobbying and maintaining high level of contacts with public power. The second pole approach is by developing self-support inside business community and improving engineering competencies.

1.4 Problems encountered

1.4.1 Overview

Delays in starting and completing the survey were the main obstacle. This particularly occurred in Macedonia, where there were two external influences that were unexpected. One was the introduction of VAT, resulting in a surge of activity for businesses to adapt, leaving them no time to be interviewed. The other was the conflict in Kosovo. Other problems concerned the questionnaire and survey.

1.4.2 The Kosovo conflict

The presence of large numbers of refugees and troops in Macedonia, plus curtailment of air travel to Skopje, caused a major conference in Ohrid to be cancelled. It had been intended to hold a project workshop at the same time and place but this had to be postponed to a later date. Some TACTICS participants were then unavailable for the workshop. It is also suspected that NATO's heavy use and monitoring of telecommunications in the region is the reason for poor communication with the Bulgarian server for TACTICS E-mail, plus mirror sites for FTP and WWW.
Conversely, the Kosovo conflict triggered a rapid improvement in the telecommunications infrastructure to serve NATO needs. This resulted in a significant change in the field of Telematics, computer communications and telecommunications as a whole. The gradual process of evolution over the past few years abruptly changed as large-scale Western firms which were not so eager to start business in Macedonia, came rushing in with wide scope. There are tangible investments in a new infrastructure, direct presence of experts, change in the Macedonian infrastructure, recruitment of Macedonian specialists, etc.
The conflict put a load on Macedonian TELECOM resulting in an increase in expenditure and orders for telecommunication services; mobile phones, digital telephone network (at present only 18% of the telephones are not digital) as well as an increase in the ISDN lines. The revenues are 3-fold higher than the previous level, mostly because of the extension of the long-distance telephone lines. ALCATEL is investing to expand the capacity of the network of mobile communications whereupon 25 000 mobile telephones will be added to the existing 25 000. Therefore, the conflict has changed the market and competition. Neighbouring countries entered into competition with local firms in the Macedonian market of telecommunication services.

1.4.3 Questionnaire and survey

1) *Questionnaire design* - Problems were encountered when matching the theoretical logic of the survey with the 'practical' (or 'opportunistic') logic through which the managers consider the investigated problems. Additional difficulties arose in accessing managers as an elite and overloaded group. We solved the problem by conducting a pilot study, as a

result of which the initial structure of the questionnaire was changed both in structure and length to fit the practical situation of the interview.

2) *During the fieldwork in Macedonia*, which resulted in almost two months delay (till early April instead of early February 2000). First in February in the Republic of Macedonia the annual financial reports are made and the managers of the enterprises then were very busy and refused interviews. Then from 1 April, 2000 the newly passed Law on VAT was to be effective, increasing taxes to 19%, from the previous 5%. This raised the demand for computers enormously. The managers again were too busy during the period of booming sales before 1 April.

3) In collecting all necessary information. The task of identifying different kinds of ACT&T agents and their specific relationships led to a large number of open questions concerning the concrete names of the partners and specific features of these interactions. We encountered two serious difficulties:

   - Low representation of some specific groups of firms in the sample (*hardware & software firms, cable TV, Tier III Internet providers, etc.).*
   - Many interviewed managers (especially in Romania) refused to provide the names of their business and non-business partners, of their most important customers, etc.

   As a result in some indicators (partners' names and interactions) we collected information for less than 30% of population. This made the implementation of the qualitative network analysis software very difficult. The solution was found by coding a great deal of the qualitative information and using advanced statistics for quantitative social network analysis, modified to the purpose of the *techno-economic networks approach*. (Part II and II in Final Report).

4) *The sharp requirements on computer database*, imposed by the advanced statistics used. For the purpose of comparative analysis a unified, reliable and large enough database to satisfy the methodological requirements was needed. The use of multiple correspondence analysis required stable clusters (we called them *relational variables)* with an average of 7-8 groups (*relational modalities*) and a minimum number of cases at least five times exceeding the number of relational modalities (152). Also, the number of firms in the groups was supposed to be not less than 50 to be able to study statistically the characteristics of these groups. Fitting these requirements took the Bulgarian and French team more than six months intensive work. The optimal solution was found in applying the advanced statistics to *the entire database of 724 firms from all three countries*, and subsequent 'projection' of the '*country*' variable on the results obtained.

1.5 Publications and papers

1) *Joint conference of the European Association for Study of Science and Technology and American Society for Study of Science, Vienna, 27 September 1-October 2000.*

Special session *National Innovation System in Central and South Eastern Europe - Ten Years Later*. Session Organisers: Tchalakov, Ivan; Galev, Todor

Room 1, Saturday, September 30, 2000, 2:30 - 4:00:

Galev, Todor: R&D System in Bulgarian Telecommunications: from State to Market

Tchalakov, Ivan: The Bulgarian R&D System - Ten Years Later

Hoffman, Oskar; Glodeanu, Ion: Models and Social Actors in Diffusing the Innovation in Romania: a Case Study

Gurovska, Mileva: Penetration of information society in traditional society: advanced information and communication technology in Macedonia

Attended by Ivan Tchalakov, Todor Galev, Mileva Gurovska (Ion Glodeanu submitted report but did not attend because of visa problems)

2) *South East Europe Economic Forum*, 16-18 October 2000, at the National Palace of Culture - Sofia, Bulgaria.
TACTICS Presentation by Ivan Tchalakov.

1.6 Conclusion

1.The TACTICS Project provided unique data about the current state of the sector of Advanced Communications Technologies and Telematics in the three Balkan countries and outlined its national specific paths of development during the last two decades. Such data provide valuable information for the experts and policy decision-makers both in region and world-wide.

2. A new theoretical framework for studying economic transformation in South Eastern Europe and the role of technological innovation in this process was elaborated. Coupled with the advanced statistical methods for analysis of nominal data (cluster analysis and homogeneity analysis) this framework makes possible the identification of indigenous strategic profiles of ACT&T firms. These profiles reveal promising perspectives for further economic and sociological analysis.

3. The very co-operation within the TACTICS Consortium enlarged the experience of the partners. Close scientific relationships have been established among the three Balkan sociological teams and between the sociological institutes in Bucharest, Skopje and Sofia in general. These relationships have been restricted in previous decades due to various political and ideological reasons, as well as due to the financial difficulties during most of the 1990s. The TACTICS project provided the necessary financial, institutional and cognitive framework to spur the collaboration among the Balkan teams. The partnerships with Western colleagues improved the methodological and organisational level of the local teams. New research methods have been adopted, new management and organisational schemes have been introduced, albeit with difficulties. On the other hand the French and UK partners received access to new and interesting data about the process of economic transition and technological restructuring in South Eastern Europe that will improve their understanding on these processes.