



TRACECA :
Rolling Stock Maintenance - Railways
TNREG9309

Completion Report

Project summary

Part 1/4 - July, 1997

Project Title	TRACECA - Railways : Rolling Stock Maintenance	
Project Number	:	TNREG 9309
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Reporting period : Completion Report
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1. Project Synopsis

Project Title	:TRACECA - Railways : Rolling Stock Maintenance
Project Number	:TNREG 9309
Country	:All TRACECA Countries
Project starting date	: 6 March 1996 (effective date of the contract)
Project duration	: 14 months (from the effective date of the contract)
Wider Objectives :	
Improvement of the rolling stock maintenance of the railways companies in the TRACECA countries, enabling them to operate the TRACECA corridor in the short term and ensuring continuity in the long term.	
Specific Project Objectives :	
<ul style="list-style-type: none"> - Short term recommendations for the maintenance management of each country, and to propose immediate actions to be undertaken on the rolling stock, on its maintenance or on the management of the supply of spare parts, equipment and vehicles. - Proposal for long term investment plans for maintenance facilities and recommendations for the supply of spare parts, in both cases, whenever possible, within the framework of a market-oriented railway system. - Transfer of know how in management of rolling stock maintenance 	
Planned outputs :	
<p>Analysis of the current situation of the rolling stock and its maintenance, rolling stock maintenance management and organisation (detailed for one of the TRACECA countries), including an assessment of economic and commercial aspects : facilities and enterprises for rolling stock manufacturing and maintenance, and for spare part production</p> <p>Future requirements for new rolling stock and future rolling stock maintenance requirements, which will be based upon traffic and operational forecasts and rolling stock projections ;</p> <p>Proposals for future maintenance strategy and a development plan for construction or upgrading of major workshops ; the development plan will include organisational , financial and economic evaluations as well as aspects of restructuring, capacity balancing and task distribution ;</p> <p>Case study, consisting of an economic feasibility study of one proposed development project covering at least two state railways and deeply involving local staff ;</p> <p>Local seminar, attended by two key persons of each of the railways, with two major subjects, viz., maintenance policies practised in western railway companies and discussion of the proposed maintenance strategy ;</p> <p>A two week study tour for the two key persons of each of the railways, with two major subjects, viz., organisation and execution of rolling stock maintenance in western railways and familiarisation with western technology.</p>	

2. Summary of project progress

During the first period of the project, the existing situation (Phase 1) was performed. Several experts of the team have spent about 2 weeks in each country. The second phase, analysis of future requirements, has been initiated.

During the second period of the project, the main activities were performed :

Completion of Phase 2, analysis of the future requirements (activities 2A to 2G). In particular, assumptions on traffic forecasts and operation performances required several cross checks, analysis, discussions with members of other projects and beneficiaries.

Performance of a week seminar in Tbilisi

Performance of a two week study tour in Paris

Case study on the rehabilitation / reconstruction of the Baku tank wagon workshop

Case study on the modification of the Bishkek locomotive depot

Case study on the implementation of a bogie workshop in Kyrgyzstan

Economic analysis of the current costs of operation and maintenance

Economic analysis of 3 alternatives of change

Estimate of an investment plan for the next 10 years

Draw up of the completion report

Most of the Tbilisi seminar participants were also able to attend the study tour in Paris, where concrete examples of the concepts developed during the seminar were visited. The active participation of those invited proved the interest generated during the Tbilisi seminar and the presentation and conferences performed in Paris.

3. Project progress in final project period

3.1 FORM 2.2 :PROJECT PROGRESS REPORT

Project title : TRACECA Rolling Stock Maintenance - Railways		Project number : TNREG9309		Countries : ARMENIA, AZERBADJAN, GEORGIA, KAZAKHSTAN, KYRGHYZSTAN, TURKMENISTAN, TADJIKISTAN, UZBEKISTAN													
Planning period : 06 / 03 / 96 to 06 / 06 / 97		Prepared on : May 97		EC Consultant : SYSTRA SOFRETU SOFRERAIL													
Project objectives : Provide recommendations to solve existing problems in railways rolling stock maintenance																	
Phase	MAIN ACTIVITIES	TIME FRAME												INPUTS			
		1996						1997						EC Consultant		Counterpart	
		MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	Planned	Utilised	Planned	Utilised
1.	CURRENT SITUATION													9 M x M	9 M x M	10 M x M	10 M x M
2	REQUIR. FORECASTS													15 M x M	15 M x M	6 M x M	6 M x M
3	FINAL REQUIR. LOCAL SEMINAR													8 M x M	8 M x M	4 M x M	4 M x M
3 A	STUDY TOUR													2 M x M	2 M x M	4 M x M	4 M x M
3 B														1 M x M	1 M x M	8 M x M	8 M x M
		TOTAL												35 M x M	35 M x M	32 M x M	32 M x M

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3.2 FORM 2.3 : RESOURCE UTILISATION REPORT

Project title : TRACECA : Rolling Stock Maintenance - Railways		Project number : TNREG9309		Countries : ARMENIA, AZERBAIJAN, GEORGIA, KAZAKHSTAN, KYRGHYZSTAN, TURKMENISTAN, TADJIKISTAN, UZBEKISTAN	
Planning period : 06 / 03 / 1996 to 05 / 06 / 1997		Prepared on : May 1997		EC Consultant : SYSTRA SOFRETEU SOFRERAIL	
RESOURCES/INPUTS	TOTAL PLANNED	PERIOD PLANNED	PERIOD REALISED	TOTAL REALISED	REMAINDER AVAILABLE
PERSONNEL					
EC Coconsultant	35 M x M	16 M x M	16 M x M	35 M x M	
Local Consultant	32 M x M	17 M x M	17 M x M	32 M x M	
Sub-total	67 M x M	33 M x M	33 M x M	67 M x M	
EQUIPMENT AND MATERIAL					
Computer	1 set	-	-	1 set	
Sub-total				1 set	
OTHER INPUTS					
Local seminar	1 week			1 week	
Study tour	2 weeks			2 weeks	
Sub-total	3 weeks			3 weeks	

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3.3 FORM 2.4. OVERALL OUTPUT PERFORMANCE PLAN

<p>Project title : TRACECA : Rolling Stock Maintenance - Railways</p>	<p>Project number : TNREG9309</p>	<p>Countries : ARMENIA, AZERBADJAN, GEORGIA, KAZAKHSTAN, KYRGHYZSTAN, TURKMENISTAN, TADJIKISTAN, UZBEKISTAN EC Consultant : SYSTRA SOFRETU SOFRERAIL</p>
<p>Planning period : 06 / 03 / 1996 to 05 / 06 / 1997</p>	<p>Prepared on : July 1997</p>	
<p>Outputs (to be described and target dates indicated)</p>	<p>Agreed Objective Verifiable Indicators</p>	<p>Constrains and Assumptions C/A</p>
<p>Inception Report : English version 1996 - May Russian version 1996 - July Project Progress Report English version 1996 - October Russian version 1996 - December Draft Final Report English version 1997 - April Russian version 1997 - May Final Report English version 1997 - June Russian version 1997 - June Local Seminar Study Tour 1996 - October 1996 - November.</p>		<p>- Russian translation requires 1 to 2 weeks - Report Agreements of 8 beneficiaries require time and travels or communications - Inputs from other project could delay the project - Specific requests of the beneficiaries could modify the schedule</p>

4. Overall report of the project

4.1 Executive summary

The present study aims at assessing the rolling stock and its related maintenance in eight countries of the TRACECA corridor, and at proposing recommendations to solve the difficulties faced by the railway in the field of rolling stock management.

Structure of the project area

The railways were split in large regions sharing the same type of rolling stock.

The TRACECA corridor includes two of those different regions :

- Caucasus countries, rather small and dense countries mostly fitted with Direct Current traction power and rather old rolling stock :
- Central Asian countries, large and non-dense countries equipped with Diesel traction power and Alternative Current traction power on the most busy routes, and most recent rolling stock than in Caucasus countries.

Current railway management

The existing situation of rolling stock management results from former objectives of FSU (Former Soviet Union) when railways were the main link, and sometimes the only link between population for goods transportation as well as for passenger transportation, being one of the major gains of the FSU economy.

To reach so important objectives, the railways were characterised by :

- High reliability reached through rather low objectives of operation performances : low speed, frequent standstill for maintenance and inspection purposes, which means no optimisation in the use of equipment so as to avoid failures
- High level of maintenance and inspection, redundancy in line inspections, availability of a large fleet of spare locomotives and wagons
- Widely spread stations for passengers and freight, and widely spread shunting yards and shunting loops
- Widely spread maintenance facilities
- High involvement of FSU government in the financing of one of their most important strategic tools.

As a consequence of such organisation, the railway staff was neither trained to enter into competition with other modes of transportation nor trained to manage a tight budget for rolling stock maintenance in particular spare parts, whereas, the FSU organisation provided them systematically with the spare parts they needed in order to prevent them from shortage.

So as to keep control of the safety of the whole system, the railways were highly centralised. Technical specifications, procedures, normative rules, as well as spare parts procurement came from main headquarters and rolling stock manufacturers. Tight control by production certificates prevented anyone from supplying something which could downgrade the railway system. Thus few of the TRACECA countries have vehicles or components production capabilities.

The bursting of the FSU and the autonomy given to the various networks involved the following consequences for the management of the rolling stock :

- Needs of foreign currency for spare parts procurement since there is no spare parts manufacturing facility in the area
- Payments in foreign currency for specific maintenance to neighbouring networks equipped with the adequate workshops required for some overhaul maintenance which also are very few in the area

- Withdrawal of government financial supports in most countries, which are now obliged to adapt the rolling stock management in order to be cost efficient.

Rolling stock

The main priority given to the railways by the FSU and the high traffic justified the large fleet of rolling stock, the large fleet of spare vehicles and spare equipment.

The existing locomotives are certainly reliable but from an old technology, They does not comply with the future requirements of the market economy which imposes high performances and cost efficiency.

However, the vehicles of the whole fleet of TRACECA region are not very old, even though they are older in Caucasus countries than in Central Asia.

Due to slowdown of traffics, the fleets of all kinds of vehicles are larger than required to cover the traffic needs for at least the next 10 years if the related maintenance is properly done.

Many vehicles are out of service, getting old, canabalised or waiting for maintenance. However, the remaining available vehicles are still enough. That situation will not last very long if no action is rapidly undertaken to re-start maintenance as it should be done. In particular, spare parts management should be urgently upgraded.

As an overview :

- Among the existing fleet of rolling stock, 40% could be available for operation in Caucasus countries, and 60 to 80% could be available in Central Asian countries
- The average age of rolling stock in Caucasus is 20 to 25 years, whereas it is 15 to 20 years in Central Asia
- The main lines locomotives are mainly double unit sets, the shunting locomotives are diesel power traction
- The wagons are mostly fitted with 2 double axle bogies, few of them are fitted with 4 double axles bogies
- Electric power supply is not always available to feed the electric locomotives in Caucasus, whilst most of the traction power comprises electric locomotives
- Since most of the passenger lines are trans continent lines, most of the passenger coaches are sleeping cars, No intercity coaches have been found, but Electric Multiple Units (EMUs) offer regional services.

The fleet of TRACECA region could be split as follows :

	Total fleet	Available	Required
Diesel locomotives	2493	2020	843
Electric locomotives	1397	1158	546
Shunting locomotives	2122	1562	918
Passenger coaches	7273	5379	5034
Wagons	215 500	123 000	92 000

The required fleet shall cover the 1996 traffic in the actual operating condition of the network with the current management procedures.

The real fleet requirements of passenger coaches and consequently for passenger locomotives could not be evaluated since the present demand of passenger traffic is not known.

For the time being, the trains are scheduled according to former time tables and changed in relation to coach availability and relationships between neighbouring countries which are more and more downgraded.

However, most of the time, the average load rate of trains is close to 100%, knowing that fraud and corruption are certainly very high.

Maintenance management

The main priorities given to the railways by the FSU government and the high traffic level justified the wide spread maintenance facilities, the high frequency of inspections and the unconditional exchange of spare parts:

The first priority should be to manage spare parts. During the performance of surveys in the whole TRACECA countries, it was highly complained about. The situation is deteriorating so rapidly that, if nothing is done, the remaining available fleet of rolling stock will not be able to cover the needs on a short term basis.

However, a new spare parts procurement policy should come into force :

- Only on the required fleet of rolling stock
- Only on the worn components, and unconditional exchange should be strictly limited to the safety devices.

In the actual economical situation, the former spare part policy is effectively source of :

- Storage of useless spare parts
- Canibalism of useful spare parts on useless vehicles
- Extra costs in maintenance personnel
- Reluctancy to contract maintenance activities to neighbouring countries since every one is well aware that the quality expected does not correspond to the price to be paid for the maintenance.

No efficient monitoring of spare part usage is performed. Therefore specific surveys are compulsory to determine the effective costs of the maintenance and to analyse the real need of spare parts procurement.

Moreover, the local staff repairs a lot of spare parts which should have been changed.

As a result, the effective costs of maintenance are unknown. A rough estimate of what the effective costs could be tells us that they should be in the range of 40% to 70% of the present costs.

Maintenance facilities

An overview of the existing maintenance facilities shows that :

- Depots for running maintenance of locomotives are evenly distributed every 250 to 300 km so as to allow a crew composed of a locomotive, a driver and a driver assistant having a return trip within a working shift of 8 to 12 hours
- Workshops for overhaul of locomotives are very rare in the whole area (Tashkent, Tbilisi) since half of the overhauls were carried out by the manufacturers (Tbilisi for DC electric locomotives)
- Depots for running maintenance of passenger coaches are rather well distributed and mainly located in the main cities
- Running inspections of wagons are carried out in main stations, loading stations and some depots for running maintenance
- Depots for running maintenance of the wagons are evenly distributed in the area, and the former productivity of those depots was high (night shifts and weekend shifts)
- Workshops for overhauls of wagons are rather well distributed in the whole area. However, since some of those workshops are specialised in some specific types of wagons, workshops for those types of wagons are not sufficient ; for instance, workshops for refrigerator wagons and tank wagons.

Inventory of maintenance facilities

Locomotives	Arm.	Azer.	Geo.	Kaz.	Kyr.	Tadj.	Tur.	Uzb.	Total
Running maintenance	2	6	7	42	2	3	3	11	76
Heavy maintenance	-	-	2	7	-	-	3	5	17

Coaches	Arm.	Azer.	Geo.	Kaz.	Kyr.	Tadj.	Tur.	Uzb.	Total
Depot for DR	1	1	1	6	2	2	2	2	17
Workshops for KR	-	-	1	1	-	-	1	1	4

Wagons	Arm.	Azer.	Geo.	Kaz.	Kyr.	Tadj.	Tur.	Uzb.	Total
Depot for TR	2	4	3	21	5	2	4	8	49
Workshops for KR	-	-	3	-	1	-	1	5	12

Analysis of alternatives for change

Taking into consideration that rolling stock and maintenance facilities are in sufficient quantity but not designed to match the new political environment, a technical and an economical analysis have been performed for three alternatives for change, in order to be able to propose relevant recommendations and investment plans :

- Do nothing or « do minimum » alternative : however, some minor changes should have to be taken into consideration.
- Wide restructuring alternative, without any plan for new rolling stock procurement.
- Wide restructuring alternative and replacement of old rolling stock with a new one.

This analysis shows that :

- The « Do minimum » alternative, could not allow the railways to survive on a long term basis.
- The « Restructuring alternative » is technically feasible due to the skill of local workforce and the reasonable conditions of the rolling stock and the maintenance facilities.
- The « replacement of old rolling stock with a new one » would allow a better efficiency but the savings expected could not justify the investment for such rolling stock.

As a conclusion, it is recommended to restructure the railways using the current equipment and facilities, to increase their efficiency, to maintain them at least 10 to 15 years, and not to purchase any new rolling stock of that technology. The requirements for the long term and the definition of the suitable new technology to replace the old one when it will reach its lifetime and when the infrastructures will be improved is to be undertaken.

Recommendations

Taking into consideration the results of the comparative analysis and in order to keep the railway alive (mainly in Caucasus countries), the priority should be given to the management restructuring. Maintenance facilities have to be upgraded accordingly. Some actions have also to be undertaken to upgrade some of the vehicles so that they reach their life time in good conditions and they match the railway objectives of service quality.

To match the new economical environment the railway organisations have to maximise the use of their assets, increase as much as possible the efficiency and the productivity of their personnel and their equipment, and then reduce the assets at the just necessary level.

To maximise the use of the assets, it is recommended :

- To implement a tight control of the status of the rolling stock so as to reduce the maintenance standstill and to schedule the maintenance actions during the lowest needs of train operation. This would allow purchasing the just required spare vehicles.
- In order to maximise the availability of a locomotive not attach the drivers to their locomotives. Doing so could allow a daily use of each locomotive of 18 or 20 hours, therefore, a locomotive could run about 200 000 to 300 000 km per year whilst today, it runs less than 100 000 km.

- To increase the average speed of the trains, so as to reduce the turn around of all kind of vehicles and to allow a better efficiency of the rolling stock.
- To concentrate as much as possible the maintenance facilities in order to reduce the overhead expenses ; to merge the experience and the skills of the personnel so as to increase the efficiency and the capabilities of the workshops.

To match the expected service quality and efficiency it is recommended :

- To increase the capabilities of maintenance facilities for tank wagons and refrigerator wagons. For the first one, the depots and workshops are either not in sufficient quantity in some areas or not in condition to match the current requirements. For the second ones, no specific depots and workshops were found in the area.
- To improve the condition of passenger coaches which still could match the requirements of operation for many years if the minimum actions are undertaken to improve their conditions.

To prepare the future, it is proposed :

- To test new technologies for diesel engines as well as for electric locomotives in order to determine the best technology to be applied in the region.
- To analyse the implementation of locomotive and passenger coach construction plants for electric locomotive, diesel locomotive, passenger coaches and wagons, in terms of external assistance, technology, type of construction or assembly. Some negotiations are in progress in the area. It is not the purpose of that project to interfere with those negotiations.

Proposed actions

Therefore, the following **restructuring plan** is suggested :

- Implementation of an efficient maintenance management system to control the rolling stock performances and the spare parts requirements and performances
- Implementation of control quality procedures and its related means based on new entities and training
- Restructuring the maintenance in four levels. Each of those levels will be organised in business unit specialised in the maintenance of running maintenance of trains : light maintenance and repairs of vehicles, overhaul maintenance of vehicles and heavy equipment, specialised workshops of equipment
- Implementation of an organ oriented maintenance organisation : only the organ which needs maintenance is removed from the vehicle and replace by another one. Therefore, the vehicle is not immobilised and does not wait.
- Implementation of engineering departments in charge of maintenance rules and tooling
- Review of operation and maintenance procedures in order to increase efficiency of maintenance, to reduce redundancy and maintenance costs. Initialisation of such reviews should be undertaken by external agencies who would take the lead of tests and analysis

And the following **investments** are recommended :

Purpose of investment	Amount mln. USD	Priority
Investments related to the above mentioned restructuring actions implementation	22.1	Short term
Procurement of specific spare parts at a very short term basis to cover the urgent needs	120	Very short term
Heavy overhaul of tank wagons	70	5 to 10 years
Refurbishment or heavy overhaul of the required fleet of passenger coaches	377	Short and long terms

Upgrading of depots and workshops	215	Short term
Implementation of a workshop for AC electrical locomotive in Central Asia	50	5 to 10 years
Construction of a modern paint shop in Central Asia	10	Short term
Upgrading and building of construction plants for locomotives and passenger coaches	80	5 to 10 years

However, such a wide change should be implemented with much care. Even if the current organisation shows some deficiencies, it is a huge working organisation, It is extremely risky to modify part of it without a thorough analysis of the consequences.

Any proposal of change should come with a proposal for assistance by an external agency who should start with pilot projects or tests. Further to the experimentation, those pilot projects could be extended to the whole railway organisation.

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COMPLETION REPORT Part 1

4.2 FORM 3.2 : PROJECT COMPLETION REPORT

Project title : TRACECA : Rolling Stock Maintenance - Railways		Project number : TNREG9309		Countries : ARMENIA, AZERBADJAN, GEORGIA, KAZAKHSTAN, KYRGHYZSTAN, TURKMENISTAN, TADJIKISTAN, UZBEKISTAN	
Planning period : 06 / 03 / 1996 to 05 / 06 / 1997		Prepared on : July 1997		EC Consultant : SYSTRA SOFRETU SOFRERAIL	
REPORTING PERIOD	MAIN ACTIVITIES UNDERTAKEN	EC CONSULTANT	INPUTS UTILISED		
			MATERIALS AND EQUIPMENT	OTHER	
March 96 - July 96	Analysis of the current situation	9 M x M			
July 96 - Dec 96	Forecasts of future requirements	15 M x M			
September 96 - February 97	Definition of alternatives for change - Action plan	6 M x M			
February 97 - July 97	Final report draw up - Corrections of results according to new inputs	6 M x M			
October 96	1 week seminar in Tbilisi	2 M x M			
November 96	2 weeks study tour in Europe	1 M x M			
TOTAL			39 M x M		

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4.3 FORM 3.3. OUTPUT PERFORMANCE SUMMARY

Project title : TRACECA : Rolling Stock Maintenance - Railways		Project number : TNREG9309	Countries : ARMENIA, AZERBADJAN, GEORGIA, KAZAKHSTAN, KYRGHYZSTAN, TURKMENISTAN, TADJIKISTAN, UZBEKISTAN	
Planning period : 06 / 03 / 1996 to 05 / 06 / 1997		Prepared on : July 1997	EC Consultant : SYSTRA SOFRETU SOFRERAIL	
Output results	Deviation original plan + or - %	Reason for deviation	Comment on constrains & assumptions	
Analysis of the current situation	Wide synthesis of existing rolling stock and maintenance facilities	Initially, very poor statements of the existing situation	Difficulties to get reliable data (the local railways took over the management with few data)	
Future requirements of rolling stock	As planned Done according to inputs	Many requests to Tacis from beneficiaries		
Future requirements of maintenance facilities	As planned Done according to rolling stock requirements and proposed restructuring			
Maintenance organisation	Four case studies instead of one			
Case studies	As planned			
1 week seminar in Tbilisi	As planned			
2 weeks study tour in Europe				

5. Lessons learnt

Communication difficulties

Since the beginning of the project, the difficulties of communications were known. The surveys were organised so that the experts were split into two groups : one in the Caucasus countries, the other in the Central Asia countries. The project management could have been split into two parts.

Difficulties to get reliable information

Cross checking of all information were necessary all along the performance of the project. A good knowledge of the beneficiary behaviour as well as a good knowledge of their way of thinking were essential to analysed the data and to adjust them when possible.

Shortage of data

Traffic forecasts had been difficult to analyse, some of required data are still not missing. Results of the specific study (Regional Forecasting Traffic Model) has not been available during the duration of the project and the data supplied were not relevant for the project. Existing freight traffic is certainly close to effective demand, even though new services would change the structure of freight demand. However, existing passenger traffic does not give a fair image of the real demand. New operation plan would certainly change the structure of the traffic Assumptions have been analysed and checked with the beneficiaries.

Seminar and study tour

Once more it was pointed out that seminar and study tour had created strong links between beneficiaries and project experts. One of the main factors of that benefit was due to the fact that most of the attendants of the seminar attended also the study tour.

Local manufacturing of vehicles and rolling stock components

Since the beginning of the project, the deficiencies of manufacturing were known. A survey of existing facilities showed few local production. Local production is certainly possible in most of the concerned countries, recommendations are proposed to deal with development of local manufacturing, but for commercial and political issues, it was not possible to propose concrete implementation.

Local counterparts

Outside railway organisation, few independent entities have experience in the fields of railways. Therefore, local counterparts came generally from the railway companies. Since they were not trained to work with Western methods, they were generally not efficient when EC consultants were not on the site.

Difficulties to fulfil the project program

Among the reasons of postponement of the project completion it should be pointed out :

- the original suspicious of the beneficiaries who were reluctant to co-operate with EU expets
- the short time allocated to several countries ; within the project budget, it was not possible to stay several month in every country
- the late availability of data coming from other projects
- the late availability of data coming from the beneficiaries
- the late corrections given by the beneficiaries on major inputs

All those constraints obliged the project team to take into consideration major inputs very late in the project schedule.

Implementation of recommendations

The wide objectives of the project and the short term to complete it, have not allowed the project team to develop or to implement some of their recommendations as the beneficiaries, the TACIS task management and the project team would have expected to do. It is in particular the case for Management Information System, spare parts management, further development of business units and investigations of private involvement in business units.

End of Part 1