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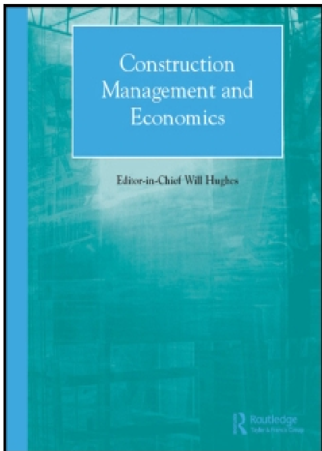

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Irem Dikmen Ozdoganm; M. Talat Birgonul

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A decision support framework for project sponsors in the planning stage of build-operate-transfer (BOT) projects

IREM DIKMEN ÖZDOGANM and M. TALAT BIRGÖNÜL

Middle East Technical University, Civil Engineering Department, 06531 Ankara, Turkey

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Every decision-making problem is oriented towards the selection of the correct strategies for achieving objectives, and depends on the assumptions associated with different scenarios. Project planning in a build-operate-transfer (BOT) project is a complicated decision-making problem because the model has a complex financial and organizational structure which is influenced also by the socio-economic environment in a country. A decision support framework is reported, as used in the planning stage of a hydropower plant project in Turkey, which helped the project company to check project viability against some predefined critical success factors, define the risk sharing scenarios under which a project becomes viable, incorporate risks into cash flow analysis and, finally, define effective risk mitigation strategies. Key challenges in the realization of BOT projects, particularly in developing countries, are discussed together with possible risk sharing principles between the private and public sector participants.

Keywords: Build-operate-transfer (BOT) model, risk management, Monte Carlo simulation

BOT model

Build-operate-transfer (BOT) is a private sector participation model in which a project company is established to finance, design, construct and operate a facility for a concession period before it is transferred to the government. Project sponsors arrange necessary financing for the realization of the project through equity contributions and loans; this is referred to as a 'debt service'. Financing of BOT projects is different from conventional systems because they are financed on a project finance basis with no or only limited recourse, which means that the parent companies of project company members do not incur liabilities on their balance sheets, and only the revenue generation capacity of the project serves as a guarantee for the lenders. Although this is an advantage for the project company, non-recourse financing is viable only when a project clearly is capable of generating revenues and the lenders can be satisfied with the cash flow of the project as a unique guarantee for the repayment of the debt service. Usually BOT projects in developing countries are financed on a limited recourse basis rather than non-recourse, and the main guarantee is project revenues where government guarantees against country risks exist as well (Cordukes, 1994). After the project is awarded to a company, the 'project company' is set up legally and the construction stage begins. The project company has responsibility for all contracts including the construction contract. After the construction period is over, the facility is operated by the project company and services are either bought by the government (e.g. in cases of energy projects) or sold to the public (e.g in cases of toll roads). The operation period should be long enough to cover debts, expenses, equity contributions and an agreed profit, through the collection of tolls/tariffs. At the end of the concession period, the facility is transferred to the government free of charge and in good operating condition.

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BOT experience in Turkey

The BOT model, first coined by ex-prime minister of Turkey, Turgut Ozal, in 1984, has been seen as a solution to the energy bottleneck experienced in Turkey. In the Turkish Government's May 1996 plans it was reported that an investment of US$21.5 billion is required in the energy sector until the year 2000, which is virtually impossible to finance by government funds or foreign borrowing. The major objective of the Government in the implementation of the BOT model has been the realization of urgent infrastructure projects with the minimum possible financial burden and without affecting its limited borrowing capacity. Some advantages to be found include innovation and increased efficiency in services, possible reductions in unit cost of public services, technology transfer, development of local capital markets and transfer of risks to the private sector. However, experience in Turkey demonstrates that the BOT formula becomes workable only if a strong legal basis and regulative framework exist plus adequate risk allocation between host government and project company (Ozdogan, 1996). Although the BOT model was on the agenda of the Turkish Government starting from the 1980s, currently there are only 7 and 10 energy projects (of about US$3.2 billion) in operation or under construction, respectively. However, there are 39 projects at the negotiation stage, 100 projects at the feasibility stage and 83 projects on the waiting list. The reasons behind the low realization rate of BOT projects in Turkey can be listed as unwillingness of the Government to provide guarantees against country risks, lack of adequate legislation, inexperience of the Government in packaging BOT projects, ineffective tendering and award mechanisms, and a high level of bureaucracy resulting in delays (Birgonul and Ozdogan, 1998). Although the costs of the country risks that could initially be retained by a government usually are lower than the risk premiums paid by project sponsors to the lenders in the absence of government guarantees, Turkish Government usually insists that risks should be retained by the project company. This decreases the project viability and, consequently, the Government or the public pays for the increased costs of these risks which are reflected in the price of the service/product. Therefore, the success of the BOT model can be enhanced if both private and public participants agree that risks should be allocated in such a way that they are retained by the parties most suited to bear them.

The BOT model is attractive for the private sector also, since it provides above average profits and an opportunity to stay in the market during recession periods, and further it creates opportunities for foreign investors to penetrate new international markets (Papantonopolous, 1994). Nevertheless, potential benefits for the private sector are achievable only if parties can utilize effective strategies against uncertainties characterized in developing countries. In a questionnaire designed to determine the risk perceptions of Turkish construction companies in different types of contract (Yener, 1998), 25% of the 103 responding companies declared that they had taken part in BOT projects and answered the questions about the BOT model. The survey results demonstrate that the most important problems that plug the way of private sector in Turkey can be listed as political and economical instability, lack of experience of public institutions in packaging of BOT schemes, immature legal basis for the model and difficulty in preparing an attractive financial package due to country risks. 90% of the respondents have found political and economical instability either 'very important' or 'important'. On the other hand, the lack of experience in the private sector about BOT arrangements together with construction and technical risks have been reported as the least important problems. The major outcome of the survey is that BOT-type projects are perceived as high risk undertakings and a key challenge is the management of the risks that are outside the control of the project company.

Risk management in BOT projects

Packaging of BOT projects requires effective management of risks associated with the complex financial, legal, organizational and socio-political structure of the model, and adequate allocation of risks between a considerable number of parties whose perceptions and aspirations are different. It should be noted that a potential conflict area is always present because members of the project company are also suppliers of services to the same company. A contractor is usually in a paradoxical position because the owner-side tries to cut prices in order to get the job, while the contractor-side tries to inflate prices to maximize profits from the construction services. This feature of BOT projects complicates the decision-making process of the parties because they would sacrifice some portion of the profits they would normally earn on conventional contracts (Augenblick and Custer, 1990).

Since the Government and the private sector are both on learning curves, there are no records of successfully applied risk allocation principles, and lengthy negotiations are the norm rather than the exception in promoting BOT projects (Tiong *et al.*, 1992). In this paper, a decision support framework (DSF) which has been used in the planning stage of an energy project is presented. The planning stage covers a feasibility analysis and a cost estimation before tendering. Within the con-

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text of the DSF, the viability of the project is tested by using a checklist approach against 'critical success factors' (CSFs), risk allocation scenarios under which a BOT project becomes viable are created and alternative risk mitigation procedures are defined so that initial estimates of tariff rates can be based on assumptions about risk sharing principles between the parties. For this purpose, the risk management principles utilized by a Turkish construction firm in the planning stage of a hydropower project are discussed and the impact of the risks inherent in BOT projects, especially in developing countries, is examined using the hydro-power project as a case study.

DSF application in an energy investment

The case study is based on a 3×60 MW hydroelectric power plant project proposed to be carried out on a BOT basis in Turkey. The project initiator is a famous Turkish construction company which had been involved previously in a similar BOT project (for confidentiality reasons, the name and location of the project are being withheld). The DSF proposed for use by the project company in the planning stage of this project is presented in Figure 1. The project company utilized this decision support framework because it provides a systematic approach to the assessment of project viability and helps to set up a realistic risk allocation scenario, which is used as a basis for a successful tender that reflects the impact of risks.

Assessment of project viability

After the necessary technical and financial investigations were carried out, the project initiator, which was the construction firm in this case, used a checklist approach to test the viability of the project. Technical principles were set, costs were estimated and preliminary debt service arrangements were made before determining the economic, legal and socio-political conditions under which the project would be viable. The list of critical success factors (CSFs) used in the assessment of project viability is presented in Table 1 and some comments now follow.

1. The checklist of CSFs, designed specifically for infrastructure projects in developing countries, involves 3 different criteria, namely, project-specific (PS) factors, country-specific (CS) factors and government actions (GA). The feasibility of a project is related directly to the existence of favourable PS factors given that the CS factors are satisfactory. However, a non-feasible project may turn out to be feasible if there are suitable GAs. The basic principle is that the conformance of project to the CSFs should be evaluated with respect to conditional cases, whether or not the undesired PS or CS factors can be compensated for by GAs. The required GAs in this project are indicated in Table 1.

2. In the evaluation process, the project initiator looked first at the PS factors: if a PS factor is controllable, then decisions are given accordingly, e.g. choice of an experienced and reliable operating company. Consequently, CSFs helped the project sponsor in the selection of potential project company members. Similarly, if a PS factor is uncontrollable, the project initiator tried to determine if an unfavourable condition could be mitigated by transferring it to other parties, e.g. an attractive financial package could be prepared if the Government gave a certain revenue generation guarantee.

3. It is clear that some PS and CS factors are more important than others. Although it was possible to assign weights to each criterion and rank all the factors according to their relative importance, this kind of analysis was not tried because the overall viability is related to the existence of Government guarantees. The decision-makers agreed that the relative importance of these factors correlated with to the level of Government guarantees against unfavourable country factors. The multi-criteria problem is a complex one due to this dynamic change in relative importance weightings and to the highly subjective nature of the majority of the criteria. Consequently, the overall viability of the project was not quantified. The project sponsor tried to increase the viability of the project by meeting all the CSFs. The main question asked in the viability assessment was: are all of the PS and CS factors favourable and, if not, can any GA compensate for an unmet PS or CS factor ?

As a result, a risk-sharing scenario was assumed between the company and the Government. This scenario which makes the project viable was selected as the 'basecase' scenario, and following decisions were based on it.

Risk identification and analysis

The next step after the assessment of project viability was an individual cash flow analysis carried out by each member of the potential project company. At this stage, the impact of the risks retained by each company were calculated and the initial cost/time estimates used in the feasibility analysis were refined. For this purpose, the construction company carried out a cash flow analysis by using Monte Carlo simulation. The aim was to quantify the impact of cost overrun and delays on the tariff rate, check if the tariff rate fell into acceptable limits characterized in the energy market and determine the sensitivity of the tariff rate to risks that

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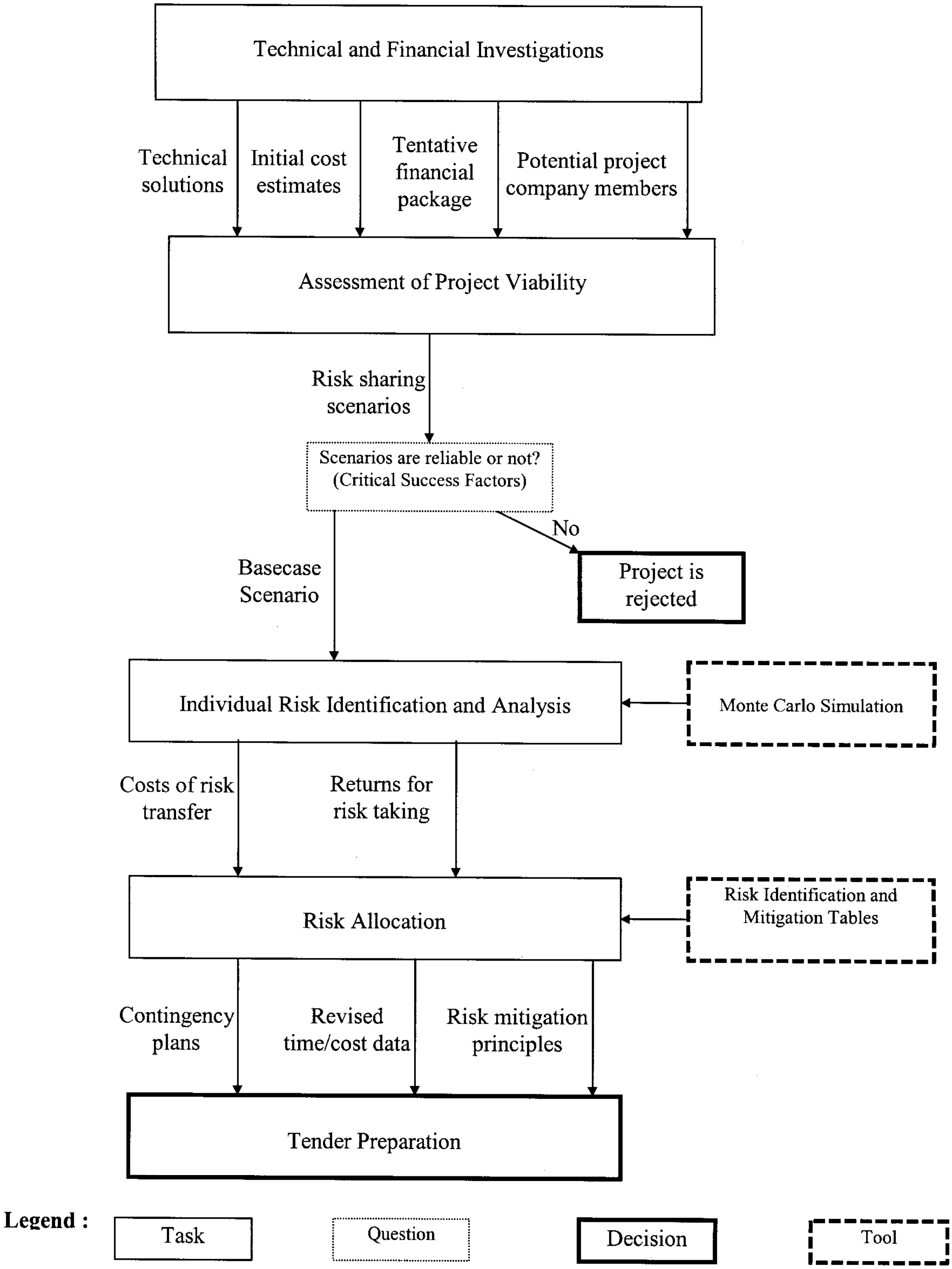

Figure 1 Decision support framework (DSF) in the planning stage of a BOT project

are under the control of construction company. In this way the construction company aimed to prepare a fixed price-firm date proposal which would also make the proposed tariff rate competitive.

Monte Carlo simulation

Monte Carlo simulation is a probabilistic risk analysis technique based on the assumption that variables can be modelled by probability distribution functions.

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Table 1 Critical success factors (CSFs)

	Type[a]	Evaluation
Financial and commercial factors		
There exists an accepted need for the service/product.	PS	+
There exists a near-monopoly condition for the service/product	PS	+
Realistic demand projections can be assessed to quantify long-term risks and revenues	CS	–, GA
Government provides revenue generation guarantees (no-second-facility guarantee, etc)	GA	Required
Government minimizes cash-flow risk through possible property development rights	GA	Not required
There exists a supportive market where enough debt and equity can be raised	CS	–
Project can attract foreign capital	PS	+
An attractive financial plan can be prepared (debt service with low interest rates, stand-by loans, subordinated loans, etc.)	PS	–, GA
Construction cost is within the limits that sponsors can afford	PS	+
Construction, operation and maintenance costs can be predicted with high reliability	PS	+
There exists a strong team of consortium members of diverse capabilities	PS	+
Project is capable of providing enough return on equity/investment	PS	+
Economic environment in the host country is stable	CS	–, GA
Project company has the ability to fund front-end costs	PS	+
Probability to be awarded the contract is high (number of bidders invited to bidding is low)	PS	+
Government provides guarantees against financial risks beyond the control of private investors	GA	Required
Political and legal factors		
Political environment in the host country is stable	CS	–, GA
Government has a high political will for the realization of the project	CS	+
Government is experienced in BOT schemes	CS	–
Procurement system of the government is adequate, transparent and clearly defined	CS	–
There exists a mature legal framework for the realization of BOT projects	CS	–, GA
Regulatory framework of the public institution is adequate	CS	+
The risk of expropriation is negligible	CS	+
Bureaucratic delays are negligible	CS	–, GA
Government's attitude towards private sector is positive	CS	+
Government provides guarantees for political/legal risks out of control of private investors	GA	Required
Technical factors		
Project size is technically manageable	PS	+
The potential contractor is experienced and reliable	PS	+
The potential operator is experienced and reliable	PS	+
The potential management personnel are experienced and reliable	PS	+
Personnel, materials and machinery are available in-house or can be imported at a reasonable cost	PS	+
Project does not require overly innovative construction/operation methods	PS	+
Project does not require unproved technology	PS	+
Social factors		
There is public acceptance of the project	PS	+
Project is consistent with the environment issues	PS	+
Prices of the services will be in the order of compatible services	PS	+
Government may subsidize the prices to avoid social reaction	GA	Not required

[a] PS, project-specific factors; CS, country-specific factors; and GA, government actions.

After modelling the problem with probability distributions and correlations between the variables, a random number generator is used to choose a value from each distribution. This procedure is repeated a number of times to obtain the probability distribution of the outcome variable. As a result of the fact that statistical information is necessary to determine the probability distributions of the variables, its use in the construction sector is limited, because objective data hardly exist. However, the choice of probability distributions based on subjective judgements, in the absence of objective data, does not create bottlenecks because judgements usually depend on expert opinion and some sort of objective experience (Pouliquen, 1970). Similarly, criticism of the presence of subjectivity in risk analysis techniques sounds inconsistent, since it implies that deterministic techniques which are based on single figure judgements do not include subjectivity (Perry and Hayes, 1985).

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Cash flow analysis

The contractor modelled the project's cash flow using predetermined elements of the financial package and the price estimates offered by the other project company members in return for their services. The project has an estimated cost of US$350 million. The maximum debt/equity ratio required by the Turkish Government in BOT projects is 85/15. As the cost of equity is higher than debt for the company, 85% of the total investment cost was financed by debt and 15% by equity. The dividend was decided as 10% of equity. The evaluation criterion set by the Turkish authorities is the average tariff rate for a given operation period of 25 years. A deterministic cash flow analysis based on 5 years of construction and best estimate values for each parameter was carried out, and the average tariff rate was calculated to be 4.94 cents/kWh. As the next step, in order to examine the effects of cost overrun and completion delays on the tariff rate, cash flow was modelled by Monte Carlo simulation. It has been reported that cost overruns, usually range from 5% to even 300% of estimated costs, and completion delays are as common as cost overruns, even extending to years in BOT projects (Tiong, 1990). In the analysis, risk factors that are outside the control of the contractor were assumed to be financed by contract works insurance that covers losses in or damage to project works during construction and testing periods. Also, the risk of variability in the geological structure was treated like a force majeure event, and it was assumed that cost changes due to this factor would be compensated for by adjustments to the tariff. The impact was calculated of the cost overruns and delays during construction that are under the reasonable control of contractor. The details and results of the Monte Carlo simulation are now summarized.

1. The project cash flow was modelled by probability distributions and correlations between parameters using computer software called Crystal Ball, a forecasting and risk management program designed by Decisioneering Inc. Crystal Ball forecasts the entire range of results possible for a given situation through Monte Carlo simulation. The software makes it possible to define correlated assumptions and assumption cell references. It also provides a wide selection of probability distribution functions and sampling methods. The probability distribution of a cost overrun was selected to be a triangular distribution which is skewed to the right where the minimum parameter is 0.90, the likeliest is 1.00 and the maximum parameter is 1.25, showing that the probability of a cost overrun is higher than the probability that the costs will be smaller than the best estimate value. The decision-makers were quite confident about the range of the cost overrun because of their past experience in similar projects. This increased the reliability of the analysis, since it has been proved that the results are more sensitive to the choice of occurrence ranges than to the shape of the distribution; if the same variable is modelled by normal, trapezoidal and triangular distributions in the same interval, then the changes in outcome are found to be marginal (Pouliquen, 1970). Also, the construction period had a custom distribution which was based on 4 single-point estimates of the construction period, specifically, 4, 5, 6 and 7 years, having relative probabilities of 0.05, 0.80, 0.10 and 0.05, respectively. Due to a lack of statistical data, it was impossible to calculate the exact correlation between the parameters. Based on experience gathered from previous projects, decision-makers assigned a correlation coefficient of 0.9 between the cost overrun and the construction period distributions. This is a strong positive relation stating that if the construction period increases, construction costs increase as well. This may be regarded as a sound assumption, as both variables are affected by similar types of uncertainty. After the cash flow was constructed using these assumptions, 3000 iterations were carried out and the probability distribution function of the average tariff rate was obtained. The probability distribution of the average tariff rate and the simulation results are given in Figure 2 and Table 2, respectively.

2. The mean of the average tariff rate was determined to be 5.22 cents/kWh and the coefficient of variation that indicates the risk level was calculated as 8%. The probability that the average rate would be higher than 4.94 cents/kWh (best estimate value) was calculated to be 70.63%, indicating that the best estimate value was highly optimistic. The results of the sensitivity analysis demonstrated that 82% of the variability of the average tariff rate originated from the variability of cost overrun. This is an expected result since, if the cost increases due to risks under the control of

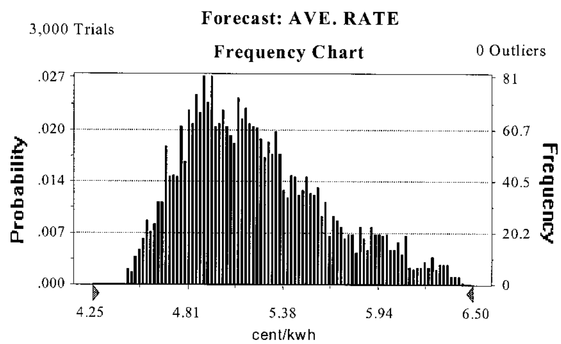

Figure 2 Probability distribution curve for the average tariff rate

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Table 2 Statistical findings about the average tariff rate

Statistics	Value
Mean	5.22
Median	5.15
Standard deviation	0.42
Variance	0.18
Skewness	0.65
Kurtosis	2.81
Coeff. of variability	0.08
Range minimum	4.46
Range maximum	6.45
Range width	1.99
Mean std. error	0.01
10% Percentile value (cents/kWh)	4.73
20% Percentile value (cents/kWh)	4.85
30% Percentile value (cents/kWh)	4.95
40% Percentile value (cents/kWh)	5.04
50% Percentile value (cents/kWh)	5.15
60% Percentile value (cents/kWh)	5.26
70% Percentile value (cents/kWh)	5.39
80% Percentile value (cents/kWh)	5.57
90% Percentile value (cents/kWh)	5.85
100% Percentile value (cents/kWh)	6.45

contractor, then the necessary debt financing also increases due to high interest rates associated with stand-by loans. One of the objectives in carrying out such an analysis was to check whether the tariff rate remained compatible with the current price in the market. According to the rules of the Turkish Government, the tariff rate should be fixed not to exceed 60% of average selling price of Government. Even under the worst case scenario, it was found that tariff rate was within acceptable limits.

3. Although the average tariff rate is used as the evaluation criterion by the host Government, levelling the tariff structure over the operating period is not justifiable because of timing effects. In fact, in the early stages of operation, the tariff rate is higher, because of the repayment of debt service and accumulated interest, whereas in later years the required tariff rate decreases. The contractor decided to examine the variability of the tariff rate in order to arrange necessary contingency funds, and a corresponding chart is shown in Figure 3. It is clear that variability of the tariff rate is higher in the initial stages of the operation period. Since the impact of risks is higher during the initial stages of operation, stand-by finance and contingency funds should be raised from lenders. However, it should also be noted that unexpected price increases beyond the control of the project sponsors were not incorporated into the analysis, based on the assumption that they would be financed by subordinated loans provided by government, and a variable tariff rate subject to escalation would be used.

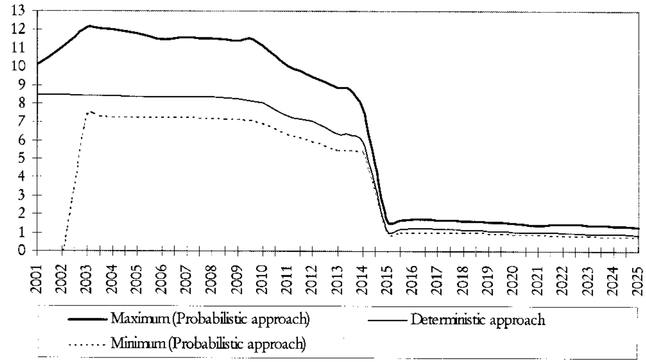

Figure 3 Change in the tariff rate with respect to time

Risk allocation between the parties

After each party had carried out a cash flow analysis and determined the impact of the risks, all the members came together to agree on the risk mitigation principles and final allocation of risks between the parties. Table 3 shows the final risk allocation constructed by the potential project company members involved in the hydropower plant project. The major idea was to identify risks, generate alternative risk mitigation methods, determine the party who would retain the risk and, finally, define the residual risk for the project company due to risks that can be compensated only partially. In the final scenario, all risks except country factors were retained by the project company, which were then transferred to one of the project company members. Some of the details about the risk management study are as follows.

1. One of the key challenges was to provide enough security to the lenders, who wanted to secure a smooth flow of capital and insisted on some kind of Government support such as subordinated loan facilities. Risk mitigation was achieved through the proper terms of contracts (e.g. a power purchase agreement that guarantees a revenue stream) and every risk addressed to the project company was planned to be financed either by insurance, penalties, subordinated loans or stand-by finance. Contingency funds were planned to be raised for a 10% over-funding.

2. In developing countries, project developers should find ways to protect the required level of profit against high levels of inflation and any devaluation of local currency with respect to foreign currencies. In a typical BOT project, potential rewards to lenders and investors are not great enough to compensate for inflation and foreign exchange risks. The major risk mitigation vehicle against those financial risks that are outside the control of the private sector is the provision of an escalation formula for the tariff rate. Although the aim of tariff escalation is to provide compensation for both lenders and investors, the real costs for investors usually are not

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Table 3 Risk identification and mitigation table

Risks	Risk mitigation vehicle(s)	Government guarantee[a]	Risk allocation	Residual risk on project company
Market risks				
Demand risk	Power purchase agreement (PPA) Treasury guarantee	Minimum revenue guarantee under predefined purchase conditions	Government	Errors in the construction of electricity production programme (price and volume)
Supply risks	A long-term fuel supply contract Compensation clauses in PPA against events out of control of project company		Project company	Inability to produce agreed amount of electricity at predetermined cost due to reasons within the control of project company
Financial risks				
Inflation risk	Tariff rate escalation		Project company	Difference between actual inflation and escalation index can create extra costs
Foreign exchange risk	Tariff rate escalation An international escrow account with hard currencies (An escrow agent agreement)	Government should guarantee to make its payments in a basket of currencies to match the payments to foreign lenders and local costs	Project company	Costs due to keeping accounts in local currency
Currency inconvertibility/ unavailability risk	Treasury guarantees	Government guarantees to convert local currency earnings into foreign currency, keep enough currency and remit foreign currency abroad	Government	
Interest rate risk	Tariff rate adjustment		Project company	Difference between changes in interest rates and adjustment index
Political risks				
Political instability Expropriation Cancellation of concession Bureaucratic delays	Compensation clauses in the implementation agreement A strong consortium of international members A tight time schedule for project development phase	Government should guarantee to provide subordinated loans to finance additional costs due to unfavourable Government actions Guarantees against risks of expropriation, military events and nationalization	Government	Although extra costs can be compensated for to decrease cashflow risk for lenders, profits may erode. Cost of delays and opportunity costs may be substantial

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Table 3 continued

Risks	Risk mitigation vehicle(s)	Government guarantee[a]	Risk allocation	Residual risk on project company
Legal risks				
Changes in law and regulations Delays in dispute resolution	Compensation clauses in the implementation agreement	Subordinated loan arrangements to finance cost of changes in laws	Government	Compensation may be partial and project company profits may erode
Construction risks				
Delay and cost overrun risks within the control of contractor (e.g. low productivity)	A firm date, fixed price turnkey contract with the contractor Liquidated damages provision, performance and completion guarantees in construction contract Stand-by loan arrangements		Project company (Contractor)	Risks are transferred to the contractor but project company is liable for the faults of contractor
Delay and cost overrun risks outside control of contractor (e.g. force majeure events)	Definition of force majeure events in the implementation agreement Tariff rate adjustment Insurance during construction period	Subordinated loan arrangements to finance costs of force majeure	Government	Compensation can be partial and it may not meet the real cost of project company
Operation risks				
Cost overrun risk within the control of operator (e.g. poor management)	A fixed price operation contract having penalty provisions for the operator Long-term agreements for the supply of raw materials, fuel and spare parts Arrangement of guarantees from the equipment suppliers Stand-by loan arrangements		Project company (Operator)	Risks are transferred to the operator but project company is liable for the faults of operator
Cost overrun risk outside control of operator (e.g. force majeure events)	Definition of force majeure events in the implementation agreement Tariff rate adjustment Insurance during operation period	Subordinated loan arrangements to finance costs of force majeure	Government	Compensation can be partial and it may not meet the real cost of project company

[a] Government guarantee implies a *suggested* Government action that is necessary to increase the viability of a project. However, it should be noted that they are always subject to negotiation between parties, resulting in possible changes in assumed risk allocation scenarios and, consequently, changes in price of services.

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covered. Tariff escalation results in incomplete compensation due to timing effects. Generally, price adjustments are allowed only periodically, lagging behind actual inflation. In this project, which was financed mainly by foreign loans (75% of investment cost), the debt service payments together with the accumulated interest, equity payments and a portion of O&M and construction costs were in US dollars. In order to decrease the risk exposure due to any devaluation of the Turkish lira (TL) with respect to the US dollar, the project company decided to propose that the Government should make its payments in a basket of currencies according to the currency of the cost/payment, using an escrow account. Also, the project company decided to use the leads and lags principle in order to decrease the adverse effects of foreign exchange rates, by accelerating payments of accounts payable which are denominated in the strengthening currency (US dollars) while delaying the payments in the weakening currency (TL). Due to the necessity of keeping the accounting records in TL, and the devaluation of the TL with respect to foreign currencies, huge amounts of tax burden are created at the transfer stage as the book value becomes different from the real value. Finally, it should be noted that because not all risks can mitigated, the risk premiums were added to the prices of services for retaining the residual risks.

3. The tariff structure provides the major guarantee for the project company and lenders. It is proposed that the tariff structure should include a capacity fee to meet the investment costs and a variable fee for the amount of electricity actually produced (*BOT Guidelines*: UNIDO, 1996). The tariff structure decided by the project company is given in Table 4. The project company proposed that the tariff rate should be adjusted with respect to cost increases that are outside the control of the project company. Also it was proposed that the total investment costs should be escalated using the USA Construction Price All Item Index.

4. Force majeure risks were either not insurable at a reasonable cost or not insurable at all. Political risks and legal risks, treated like force majeure risks, were transferred to the Government and planned to be financed by subordinated loans. However, it should always be kept in mind that a Government guarantee against political risks is only as good as the Government that gives it.

The final risk allocation scenario was decided using the principle that the party which can bear the risks at the lowest possible cost should retain them. One of the major pieces of reference information for the project company in the preparation of realistic risk sharing scenarios was the previous practices of the Turkish Government in similar kinds of energy project.

As a result of the planning stage, the project company had a risk allocation scenario on which the tender could be based. The next stage is tender preparation, where the major concern is to make the tender more competitive in order to maximize the probability of being awarded the concession.

Conclusions

In developing countries where economic and political instabilities are high, effective risk allocation between the parties is vital for the success of a BOT project. In this paper, the utilization of a decision support framework (DSF) in the planning stage of a hydropower plant project is presented. The project company systematically identified the risks, quantified their impacts, defined the effective risk mitigation vehicles and determined the level of Government guarantees required for a viable project, and their tender was based on a realistic estimation of the tariff rate under a reliable scenario. The project company used as the basis of their tender the mean of the average tariff rate (stochastic analysis result), which took into account risk impacts, instead of a highly optimistic best-estimate value (deterministic analysis result), that did not include risk premiums associated with alternative scenarios. This made it possible for the project company to prepare a realistic tender and system-

Table 4 Tariff structure

Type of charge	Accounts	Explanation
Scheduled charge	Return account (RA) = Reimbursement of paid equity + Agreed returns on equity	Periodical payments to shareholders.
Operating charge	Debt service reserve account (DSRA) = O & M costs + Management costs + Insurance + Funds for DSRA	Funds are collected until it adds up to 1 year debt service. If any deficiency occurs in CIA, DSRA serves as the security account.
Capital charge	Current instalment account (CIA) = Amount equal to proceeding debt service + Interests	All capital charges are collected in this account as long as the responsibility to pay debt service remains.

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atically calculate the appropriate risk premiums. After the company was awarded the concession, they knew what to demand from the Government and negotiations between the Government and the project company were based on a risk allocation scheme assumed in the calculation of tender price. Risk identification and allocation studies carried out in the planning stage also provided help in the preparation of contracts (called the security package), and the risk mitigation table appeared to be an effective tool that facilitated negotiations between the project company members and the Government at the contract stage. This kind of analysis also helped the Government to understand the variability of the project outcome as a result of alternative scenarios and the impact of their actions on the viability of the project. Consequently, the DSF used by the project company provided important inputs at the negotiation stage, serving as an effective communication tool and saving time during the contract stage.

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