A Model For Socially Responsible New Technology Decisions

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Abstract

Firms use relatively unsophisticated techniques to incorporate the unique uncertainties associated with new technology into their capital budgeting decisions. Evidence supports that firms would prefer to have a more accurate and standardized method to make adjustments for these uncertainties. Proposed is a method of incorporating the uncertainties of new technology into the traditional NPV calculation via the use of a specially derived risk-adjusted discount rate.

Introduction

Evidence suggests that both the speed of development of new technology and the severity of the societal damage inflicted by some of that technology are increasing. Collins (1989) reports that in 1984 alone, there were 10,745 product liability suits filed in the United States, 5.4 million occupational injuries and illnesses, and 3,740 occupational fatalities in the private sector. These statistics neglect property costs and other financial and societal costs which are more difficult to measure, e.g., damage to a firm's prestige resulting in lost sales and difficulty in obtaining financing.

Legal costs may be high. For instance, a \$2.5 billion class action suit was filed against the Velsicol Chemical Company by 80 town residents (Gini, 1984) and the Manville Corporation estimates asbestos-related lawsuits will cost it between \$2 billion and \$10 billion (Johnson, Baliga, and Blair, 1986). Thus, firms interested in the maximization of long-run shareholder wealth should attempt to incorporate these costs into capital budgeting decisions.

Currently most firms either do not account for the risk of introducing new technologies, or use very limited subjective opinions of experts combined with arbitrary adjustments to the capital budgeting process. For instance, most firms use intuitive rather than economic decision rules when evaluating basic technological advancements (Cook and Rizzuto, 1989 and Evans, 1985; 1987).

Yet, financial managers are not satisfied with their current techniques. Managers desire more accurate and standardized methods of integrating the social impacts

of new technology into the capital budgeting decision (Evans, 1985; 1987). The purpose of this paper is to present a capital budgeting model which considers both long-run shareholder wealth maximization and social responsibility. The model, an adaptation of the net present value (NPV), includes the uncertainties of costs from new technology borne by the firm and by society. Before introducing the model, a discussion of the NPV and cash flow estimations is presented.

Net Present Value and Cash Flows

In its simplest form, the NPV is the difference between the cost of the investment and the present value of all future cash flows generated by that investment discounted at the firm's opportunity cost of funds. If the NPV is positive, the value of the firm and the wealth of the shareholders are increased, indicating a valuable investment.

Because all investment projects are not equally risky, firms often employ a risk-adjusted discount rate. Cash flows from higher (lower) risk projects are discounted at higher (lower) rates. R&D projects (those often employing new technology) normally command a substantial risk premium (Smith, 1988) because they involve large investment commitments, as well as long development times (Cook and Rizzuto, 1989). Neglecting the risk premium leads to overestimating the project's NPV. Thus, while the proposed model retains the traditional NPV framework, it provides a method of establishing a risk-adjusted discount rate reflecting the uncertainty of the impact of the new technology on social goals.

This approach is consistent with Mechlin and Berg's (1980) observation that a technological breakthrough can have multiple impacts in that it facilitates the creation of an adjustment factor, either positive or negative, that reflects the net effect of all anticipatory social consequences of introducing the new technology. Further, Robichek and Myers (1966) demonstrated that a risk-adjusted discount rate contains an implicit assumption that risk increases over time; this assumption is consistent with new technology applications.

Nevertheless, finance purists prefer the risk factor to be associated with the cash flows. Cost/benefit studies within the field of public welfare economics recognize differences in our ability to measure different types of costs and benefits (Sugden and Williams, 1978). Easiest to measure are costs and benefits of consumer market goods which have explicit market prices (e.g., the cost of equipment to produce the new technology). Costs and benefits of nonmarket consumer goods (e.g. noise introduced into a neighborhood as a result of the new technology) are more difficult to estimate because there are no market prices for them. Sugden and Williams suggest the use of opportunity costs; that is, measure the difference in property values between quiet and noisy neighborhoods in order to set a price on quietude. Measurements of this type are not very difficult because they measure the costs and benefits of consumer goods. Further, an individual often can choose whether or not to consume them.

There are, however, public goods about which an individual cannot make a consumption decision (e.g., wide-spread air pollution and radioactivity). Also, there exist merit goods which can be defined as those goods that society perceives differently than does the individual. For example, Sugden and Williams (1978) suggest that if the value of education were set at the price that each individual is willing to pay, there would be a wide diversity in values based on the individuals' abilities to pay. Society may put a different value on education than does the individual because society recognizes that the education of its individual members benefits the whole of society.

Therefore, opportunity costs and market prices are not legitimate estimates of the benefits and costs of merit and public goods. Thus, the traditional NPV cannot fully incorporate the societal effects of new technologies as cash flows.

One macroeconomic implication of excluding these inestimable costs and benefits from the investment analysis is that resources may be inefficiently distributed within the economy, since in a competitive environment

economic theory posits that resources will be efficiently distributed only when marginal price equals marginal cost. Thus, when costs are underestimated, prices are set too low, encouraging too much production in a technology with bad effects. On the other hand, if the new technology creates benefits, production will be too low when such benefits are not included in the analysis (Gould and Ferguson, 1980).

A microeconomic problem associated with excluding social costs from capital budgeting stems from the assumption that shareholders' wealth is maximized if the firm undertakes projects which maximize its NPV (Copeland and Weston, 1988). The standard methods of analyzing projects disregard the high probability that most new technologies will have social externalities which are not incorporated into the cash stream forecasted by the company. Further, shareholders will be affected differently by these externalities. (Externalities are one of several conditions under which the Fisher separation theorem and the unanimity principle do not apply. See Copeland and Weston (1988, pp. 14-15, 20, 124-127)). For instance, if a shareholder sustains no externalities from a firm which has manufactured asbestos, his wealth may simply be his equity share in the firm. On the other hand, if a shareholder is an employee who is exposed to the asbestos, her wealth from the firm includes the value of her equity share less the loss of her health, her family's health, and the psychic impact on the family (Litzenberger and Sosin, 1979).

Therefore, if a firm's objective is to maximize shareholder wealth, it must somehow consider the social impacts on the shareholders. And since the individual shareholders constantly change through secondary market transactions, the firm should maximize shareholder wealth constrained by the external costs to the public as a whole.

Excluding social costs in capital budgeting can affect the stock value by changing the demand for the stock. For instance, the growing popularity of "ethical investing" increases demand for the stock of firms perceived as socially responsible (Brooks, 1989 and The Wall Street Journal, 1990). Also, demand could be affected by other investors' responses to changes in demand instigated by ethical investors.

While it seems very important to include the uncertainties associated with new technology in capital budgeting decisions, there is no obvious way to identify the cash flows associated with the social costs and benefits. The next section introduces a model for capturing the uncertainties in a risk-adjusted discount

rate to be applied in a traditional NPV calculation.

New Technology Capital Budgeting Model

The six steps involved in the model are as follows:

1. Calculate the NPV in the traditional way. If the NPV is negative, stop at Step 1. If not, continue to Step 2.
2. Identify important social goals.
3. Forecast the impact of the proposed technology on the social goals.
4. Develop the factor that represents this impact.
5. Apply the factor to the discount rate used in Step 1.
6. Interpret the results of the analysis.

Each step is described separately below, then an example employing the technique is given.

Step 1: Calculate the NPV

Conduct a traditional capital budgeting analysis to determine whether the NPV is negative. If so, no further analysis is necessary because no firm should undertake a value-decreasing investment in new technology even if it has some social benefits. If the NPV is positive, proceed to Step 2.

Step 2: Identify Social Goals

The firm should periodically conduct a survey to obtain social goal rankings. Naturally, responding individuals will not agree to the same rankings. To circumvent the lack of consensus, the rankings can be analyzed via Multiple Dimensional Scaling (MDS) to provide social goals on a unidimensional scale. That is, the social goals of individuals are arranged in an overall group rank order with attached values that indicate the relative importance of one goal compared to another.

By preparing an exhaustive list of social goals and having successive random samples of people select the more important goals, the analyst produces a list of goals worthy of further analysis. This reduced list is then administered to a random sample of individuals to rank the goals in their order of importance. The number of times a particular goal is preferred over the other goals is thus determined. Using the example below (where 1 is most important) goal 3 is preferred over Goal 1 by 3 of 5 scorers (Scorers 1, 2 and 3); Goal 3 is preferred over Goal 2 by 4 of 5 scorers (Scorers 1, 2, 3 and 4).

	Goal 1	Goal 2	Goal 3
Scorer 1	3	2	1
Scorer 2	2	3	1
Scorer 3	2	3	1
Scorer 4	1	3	2
Scorer 5	1	2	3

A matrix is then constructed of these preferences which becomes the data used in the MDS procedure to produce a unidimensional scale of the preferences for the social goals. The matrix for the example above shows that goal 3 (in vertical list) is preferred to goals 1 and 2 (horizontal list) by 3 and 4 scorers, respectively.

	Goal 1	Goal 2	Goal 3
Goal 1	0	4	2
Goal 2	1	0	1
Goal 3	3	4	0

The MDS procedure provides two measures of goodness of fit: Young's s-stress and R^2 . A rule of thumb is that an s-stress value of less than 0.20 is a very good fit. The MDS procedure produces positive and negative coordinates of the goals on a number line (unidimensional).

By adding a value to each coordinate sufficient to make the most negative coordinate a +1, the analyst will have the coordinates in a usable form. Adding all the coordinates provides the total weight. Dividing the value of each coordinate by the total weight provides the relative weight of each goal.

Step 3: Forecast the Impact on Social Goals

Any model which tries to incorporate the social consequences of a new technology must have access to good predictions of those consequences. The Delphi forecasting method is the proposed source of these predictions, since forecasting the social ramifications of new technologies is not possible through the use of objective data, no matter how sophisticated the model. The necessary historical data simply do not exist. Thus, the subjective opinions of knowledgeable judges are required as a basis for calculating the adjustment factor proposed in this model.

The Delphi approach incorporates forecasting features which have had superior performances in empirical tests. Armstrong (1975) describes these features. Because Delphi judges never meet nor are their opinions associated with any individual, there is no way for judges to put direct interpersonal pressure on each other. Fur-

ther, the Delphi approach eventually leads to a consensus, and consensus forecasting has demonstrated superiority to individual forecasts, even if that individual is an "expert." In fact, Armstrong reports that experts have not proven to be good forecasters, which makes the most popular current methods of adjusting for project risk even more suspect. Delphi judges, with some minimum level of expertise and with varying backgrounds, provide better accuracy.

The social goals, their relative weights, a rating scale, and a request for comments are distributed to the Delphi judges (Plebani and Jain, 1981). The judges record their opinions of the overall negative or positive impact of the technology on each social goal (on a scale from -1.0 to +1.0) adding their explanatory comments. The analyst summarizes the opinions seeking a consensus. If no consensus is reached, the analyst returns the distribution of the opinions along with a summary of the judges' comments to the judges. The judges reevaluate their opinions based on the responses and comments of others. This procedure is repeated (usually between two and five times) until a consensus is reached.

Step 4: Develop the Factor

The analyst is now faced with a relatively easy computational task; that is, he or she multiplies the judges' consensus score of the impact (on a -1.0 to +1.0 scale) by the social weight of the goal. The sum of these products is the factor to be applied to the pre-determined discount rate. For example, suppose the analyst derived the following consensus ratings:

Goal	Weight	Score	Product
1	.25	+1.0	.250
2	.65	-0.5	-.325
3	.10	0	0
	1.00		Factor = -.075

The calculated factor would be -.075. The sign of the factor indicates whether the technology will have a positive or negative impact on social goals. The value of the factor should be interpreted as a percentage. Hence, in the above illustration the technology would have a negative impact with a magnitude of 7.5%.

Step 5: Apply the Factor

The social goals factor is applied to the capital budgeting discount rate to adjust that rate for the net

impact of the new technology on society. A positive factor will **reduce** the discount rate by the factor percentage rate. A negative factor (as in this example) will **increase** the discount rate by the factor percentage rate. For example, if the discount rate was typically 15% for an investment in new technology, application of the negative social goals factor would adjust that rate to 16.125% [$15\% \times (1 + 7.5\%)$]. Note that the risk-adjusted discount rate is bounded by 0% and by twice the normally used discount rate because the social goals factor is bounded by -1.0 to +1.0.

Step 6: Interpret the Results

If the social goals factor reduces the risk-adjusted discount rate, the firm has additional investment incentives. Not only will the project generate financial rewards for the shareholders, it will also produce an improved social environment. If the discount rate is unchanged, the firm has provided support for its investment. The investment gives a good financial return and has been shown not to harm the shareholders' environment on the whole.

If the discount rate is unchanged or reduced, the original NPV developed in step one should be used in the capital budgeting decision since the firm's position would be, at worst, unchanged for introducing the new technology. However, if the discount rate is increased, the adjusted NPV should be used. If the NPV becomes negative with the inclusion of the social goals factor, the firm should seriously consider not producing or using the new technology due to the negative social implica-

tions. Otherwise, at least some of the shareholders will suffer a decline in their wealth due to the negative impact on society; and all of the shareholders may eventually experience wealth reduction, or at least not receive wealth maximization, as the public reacts negatively to any publicized social irresponsibility.

To illustrate the application of the proposed model, a short example follows.

Example

This illustration evaluates the financial and social impacts of robotics technology. Obviously, a "real" analysis of the subject is not within the scope of this paper, but the following example is useful for illustrative purposes.

Step 1: Calculate the Traditional NPV

Without having actual data on the possible costs of robotics, assume the following three different projects (all values in millions of dollars):

Investment cost in first year
Discounted Annuity at 25%*

NPV

* Annuity for years 1 - 10

The analyst should continue the analysis on Projects 1 or 2 but should stop if faced with Project 3 because it has a negative NPV.

Step 2: Identify Social Goals

To establish social goals a broad sample from the population is required. For the purpose of this illustration a list of twenty social goals was presented to one class of thirty students in an upper-level financial management class with instructions (Appendix A) to indicate what they felt were the ten most important goals. If a goal they wished to select was not listed, they were instructed to add it to the list. The ten goals which received the most votes then were incorporated into a new list for ranking.

Another section of 32 financial management students then ranked the ten remaining social goals in the order of their personal concept of importance (See Appendix B). The rankings were transformed into a 10 by 10 (10 goals) matrix of goal preferences which was submitted to the MDS procedure in SAS using the unidimensional

scale option. The results of the goal rankings and their weights in order of their relative importance are shown in Table 1.

For simplicity in the remainder of the analysis, the list was pared to the five most important goals. Hence, the weights also are listed for those five goals. In practice, however, the social goals list should not be reduced since many of the goals may be independent and deserving of analysis.

Step 3: Forecast the Impact on Goals

For illustrative purposes, five people educated

Project 1	Project 2	Project 3
\$150	\$150	\$150
\$250	\$150	\$100
\$100	\$ 0	\$(50)
\$ 70	\$ 42	\$ 28

through the Master's degree level were chosen as the Delphi judges. Four of the judges were working toward their Ph.D.s in the disciplines of accounting, economics, finance, and management. The fifth judge possesses degrees in physics and astronomy.

Appendices C and D contain the information given to the judges. They were given the five most important goals, the relative importance of the goals, a scaling system, and space for comments. The results were tabulated with fairly good consensus on the last four goals (See Appendix E). The judges received feedback on their forecasts and were asked to reevaluate their decisions. Table 2 presents the results of their decisions in both rounds.

Step 4: Develop the Social Goals Factor

The social goals factor to be applied to the discount rate is derived by adding the products of the weights and the scores.

Goal	Weight	Score	Product
1	.241	-0.1	-.0241
2	.221	0.4	.0884
3	.197	-0.2	-.0394
4	.186	0.6	.1116
5	.155	0.2	.0310
	1.000	Factor =	.1675

Thus, the discount rate is reduced by 16.75%.

Step 5: Apply the Factor

Referring back to Step 1 in this example, remember that only Projects 1 and 2 receive further analysis. Because the derived factor was positive, the discount rate used in the NPV calculation is decreased to 20.8% [$25\% \times (1 - 16.5\%)$]. Thus, new NPV calculations indicate that the NPV of Project 1 improves to \$136 Million, while that of Project 2 improves to \$21 Million. Note that new calculations actually need not be made in this example because the results obviously would be more favorable.

For discussion purposes, the NPVs can be recalculated assuming the discount adjustment factor were a negative 0.1675. In this case, the discount rate would increase by 16.75% to 29.9% [$25\% \times (1 + 16.75\%)$]. The NPV under Project 1 becomes \$71 Million and under Project 2 becomes \$(17) Million.

Step 6: Interpret the Results

The positive factor improves the NPV for both projects providing the firm with further assurance that investment in the robotics technology will return both financial and social rewards. On the other hand, if the factor were negative, the NPV would be reduced in both

TABLE 1

Summary of Social Goal Scaling

GOAL	UNI-DIMENSIONAL SCALE FACTOR	POSITIVE ADJUSTED SCALE FACTOR VALUES	WEIGHTS (ALL 10 GOALS)	WEIGHTS (TOP 5 GOALS ONLY)
Promote world peace	1.51	4.21	0.156	0.241
Improve education	1.19	3.89	0.144	0.221
Increase employment	0.76	3.46	0.128	0.197
Promote efficient use of resources	0.57	3.27	0.121	0.186
Provide a crime-free environment	0.02	2.72	0.101	0.155
				1.000
Ensure political freedom	-0.04	2.66	0.099	
Protect the environment	-0.12	2.58	0.096	
Eliminate discrimination	-0.90	1.80	0.067	
Improve health	-1.30	1.40	0.052	
Protect consumers	-1.70	1.00	0.036	
		26.99	1.000	

TABLE 2

Delphi Judges Scores

GOAL	ROUND 1 AVERAGE SCORE	ROUND 2 AVERAGE SCORE
Promote world peace	0	-0.1
Improve education	0.5	0.4
Increase employment	-0.2	-0.2
Promote efficient use of resources	0.5	0.6
Provide a crime-free environment	0.2	0.2

projects. Only under Project 1 would the NPV remains positive. The factor that makes the NPV of Project 1 breakeven is -0.8, a very large negative factor. With this information, the firm attains added security for its decision to undertake the project. In Project 2, however, instead of being indifferent to the project (zero NPV), the social harm outweighs the possible financial return. The project would require at least a zero adjustment factor to remain viable. Hence, the firm should decide to not undertake that project.

Discussion and Conclusion

It has been documented that firms desire to have more accurate and standardized methods of incorporating the uncertainties of new technology into their capital budgeting decisions (Evans, 1985, 1987). The purpose of this paper was to develop and explain a capital budgeting model which eliminates some of the limitations of the traditional NPV with respect to the creation or use of new technology. Hopefully, the proposed capital budgeting model for new technology provides direction for future control over new technology while simultaneously maximizing long-run shareholder wealth and minimizing government intervention.

The model may be used to make investment decisions (as illustrated in the paper) or it may be used in a post-selection audit. R&D by-products which are quantifiable can be included in the cash flows. By-products that are more difficult to quantify can be captured in the risk-adjusted discount rate using the Delphi technique described here.

There exist both advantages and disadvantages of a model of this type. The disadvantages arise mainly from

the limitations of the model. The advantages come from the benefits to both society and the firm.

The normative nature of the model can be a disadvantage because it uses arbitrary factors in ways which are not subject to testing. In addition, more empirical validation of the Delphi forecasting method (or any forecasting alternative) is needed. Although there is no *a priori* reason to expect non-stable social goals, there is no direct empirical support for stability either. However, if we can assume that individuals' stated social goals reflect their attitudes toward multi-item social issues, we have some evidence that social goals may be more stable than not. In fact, most social psychologists agree with Allport's (1935: 799) suggestion that "attitudes are learned predispositions to respond to an object or class of objects in a *consistently* favorable or unfavorable way" (emphasis added).

However, the proposed capital budgeting model for new technology offers several benefits to the capital budgeting process. First, by having a fairly clear view of the goals of society, business can direct its technological research towards acceptable new products. Second, a firm can determine some possible drawbacks of a technology before committing itself to the production phase. Thus, a firm can prevent future legal liability and negative social reaction by not investing in the technology, or management can minimize negative social effects by reformulating the technology to better match the discovered social goals. In this way, the model provides assistance in maximizing the future wealth of shareholders. Finally, the model is not technically difficult to implement since it involves simple calculations as a bridge to operationalize common capital budgeting and Delphi techniques.

APPENDIX A SELECTION OF SOCIAL GOALS

Please read the complete list of possible national social goals. Then mark 10 of the goals which you feel are the most important. You do not have to rank the goals you selected.

☐ Protect consumers
☐ Define the role of government
☐ Promote the efficient use of resources
☐ Improve health
☐ Eliminate discrimination
☐ Prolong quality life
☐ Promote world peace
☐ Improve education
☐ Eliminate poverty
☐ Control the use of drugs | ☐ Provide a crime-free environment
☐ Raise the standard of living
☐ Promote community cohesion
☐ Ensure political freedom
☐ Promote the arts
☐ Define the role of religion
☐ Improve family life
☐ Increase employment
☐ Control population level
☐ Protect the environment |
|---|--|
-

Society may also benefit from the proposed capital budgeting process. First, society may benefit through better protection from the large-scale impacts of new technology. Some control may be established on the introduction of new technology by forcing technology to fit into the value system of society rather than technology molding the values of society. Improvement in the quality of life should be a result. Further, if social impacts are included in businesses' investment decision-making process, society will generally benefit by more efficient allocation of resources which should improve our standard of living.

Suggestions For Future Research

An important step in the development of risk-adjusted discount rates for new technology decisions is the establishment of social goals. The United States government does not establish nor does it rank any national goals. Goals would provide insight into the social and environmental areas of foremost concern to the public thus simplifying the formidable guessing task facing the firm. Unfortunately, national goal setting is not a straightforward task and probably not one to be soon adopted by the federal government. It is inherently political in nature. Research on methods to identify goals, methods to rank them, determining how different the goals are among subgroups, and the stability of goals over time would provide a base against which new technology could be assessed.

The area of capital budgeting needs research on how to handle the following: (1) irreversible impacts, (2)

impacts occurring many years after project adoption, and (3) qualitative impacts.

APPENDIX B RANKING OF SOCIAL GOALS

Please read the complete list of possible social goals. Then rank the goals from 1 to 10 with 1 being the most important and 10 being the least important.

- ☐ Increase employment
 - ☐ Provide a crime-free environment
 - ☐ Eliminate discrimination
 - ☐ Improve education
 - ☐ Protect the environment
 - ☐ Promote the efficient use of resources
 - ☐ Ensure political freedom
 - ☐ Protect consumers
 - ☐ Improve health
 - ☐ Promote world peace
-

Another useful study would approach new technology projects from the perspective of insurance firms. Interesting questions include: (1) What types of coverage do insurance firms presently give which are especial-

ly useful to new technology firms? (2) What types of impacts are insurance firms considering covering in the future? (3) What are the problems inherent in estimating the risks assumed by insuring new technology firms?

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APPENDIX C LETTER TO DELPHI JUDGES

TO: Delphi Members

FROM: _____

SUBJECT: Purpose and Instructions

The purpose of my study using the Delphi process is to demonstrate how social goals can be incorporated into investment decisions involving new technologies. As a demonstration the social goals and their relative importance have been selected by University of Arkansas students, primarily juniors and seniors. Your task is to consider all the ramifications of the new technology of robotics and to determine how these ramifications affect the social goals.

Attached is the first Delphi scoring sheet which I need completed and returned within 7 days. The sheet lists each goal with its relative weight. Select a score (see detailed instructions on the score sheet) which reflects your perception on how robotics will affect each goal. Please add your comments to explain why you feel this way.

When all the members have returned their scores, I will summarize the scores looking for a consensus. If there is none, I will then ask you to reevaluate your opinion based on the summary (no one member's opinion will be identifiable).

Should you have any questions, please ask. Thanks for your help.

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APPENDIX D DELPHI SCORING SHEET

Proposal: Start a firm to manufacture robots which can be programmed for many uses.

Scoring Instructions: Circle the score which best reflects the type of impact you feel the proposal will have on each social goal. Also, please comment on the reasons for your chosen score.

-1.0 = very negative
 -0.5 = somewhat negative
 0 = no impact
 +0.5 = somewhat positive
 +1.0 = very positive

Social Goals	Weight	Score				
Increase employment	.20	-1.0	-0.5	0	+0.5	+1.0
Comments:						
Provide a crime-free environment	.16	-1.0	-0.5	0	+0.5	+1.0
Comments:						
Improve education	.22	-1.0	-0.5	0	+0.5	+1.0
Comments:						
Promote efficient use of resources	.18	-1.0	-0.5	0	+0.5	+1.0
Comments:						
Promote world peace	.24	-1.0	-0.5	0	+0.5	+1.0
Comments:						

Delphi Judge _____

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APPENDIX E

SUMMARY OF DELPHI JUDGES' SCORING AND COMMENTS

Scoring Criteria and Comments	Avg. Score	Histogram
1. Increase employment: -1.0 Robots will replace humans in the workplace. -0.5 Gains in employment in robot industry will be offset in other industries. 0.5 Robot industry will create more jobs than it eliminates.	-0.2	
2. Provide a crime-free environment: -0.5 Loss of employment will increase crime. 0 Crime is related to social values unaffected by robotics. 0.5 Robots used in surveillance to replace tedious manual work.	0.2	
3. Improve education: 0 Will only help advanced research, not basic education. 0.5 Robots can be a teaching tool. 1.0 Due to wide use of robots, they will be included in education as vocational tool.	0.5	
4. Promote efficient use of resources 0 No effect unless dislocated labor can be used more efficiently. 0.5 Less error and waste. 1.0 Less human error and waste.	0.5	
5. Promote world peace: -0.5 Robots will be used in advanced weaponry increasing world tension. 0 People, not robots, affect peace. 0.5 No comment given.	0	