

Reusable Decision Models for Cost Effective Decision Making



presented by

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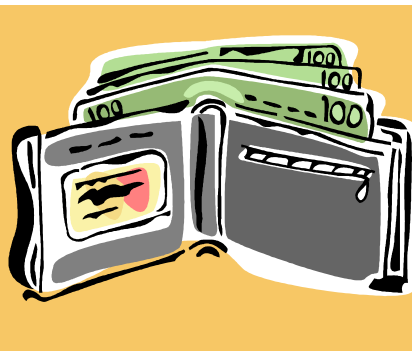
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The Value of Decision Analysis

- ❖ **Good decisions** can, and many times do, make the difference between success and failure.
- ❖ The **most important** task of business leaders is to make good decisions.
- ❖ **Decision analysis provides insights** that show the decision maker the best course of action.





The Cost of Decision Analysis

- ❖ Formal decision analysis includes modeling decisions, alternatives, uncertain events, outcomes and payoffs.
- ❖ Traditionally a decision model is built from scratch for each new situation.
- ❖ This is an **effective approach**, but it is **time consuming and expensive**.





Reusing Decision Models

- ❖ Each decision situation is unique, but it may have common elements with other situations.
- ❖ Sometimes you can use a model developed for another situation as a basis for modeling the current one.
- ❖ This may save some time and effort.
- ❖ **A better approach: to develop from the beginning a more general model.**

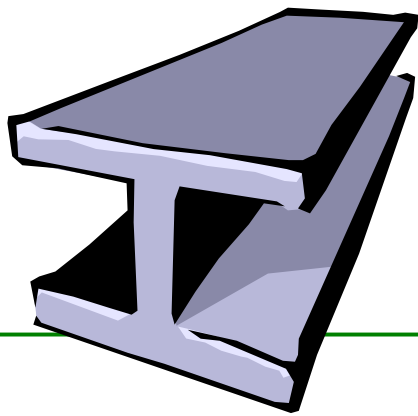




Reusable Decision Models for Cost Effectiveness

- ❖ **Objective of using reusable models: Decrease the cost of analysis of families of decision situations.**
- ❖ A *family of decision situations* is a group of actual or potential decision situations with a set of common elements and structural links.
- ❖ **A useful reusable model must be flexible** enough to let the analyst model new situations without modeling each situation from scratch.





Structure of Reusable Decision Models

- ❖ A reusable decision model includes a master model for the family of decision situations, and a guiding diagram for adapting the master model to fit a particular situation.
- ❖ The **master model** is an influence diagram that includes all the decisions, uncertain events, and value criteria that can be foreseen to be part of the family of decision situations.
- ❖ The **guiding diagram** directs the analyst in the process of adapting the master model to the specific decision situation, i.e., in the process of generating a particular model.





Building the Master Model

- ❖ The **master model** is an influence diagram that must **capture all available significant knowledge** about the family of decision situations.
- ❖ It should represent the **general structure** of the decision situation and the particular elements of all foreseeable cases.
- ❖ It includes the relationships of:
 - ❖ **Relevance** between uncertain events.
 - ❖ **Influence** between decisions and uncertain events.
 - ❖ **Precedence** between decision nodes.
 - ❖ **Impact** on the value node.





Building the Guiding Diagram

- ❖ This flow diagram helps the analyst **transform the master model into a particular model**.
- ❖ It starts by posing questions for checking that the situation **belongs** to the decision family.
- ❖ It checks that the decisions contained in the master model are **actual opportunities** open to the particular decision maker.
- ❖ It guides the analyst on verifying the **pertinence of uncertain events** and retaining only those events material to the particular value node.





It is Worth Developing Reusable Decision Models When:

1. The same kind of decision has to be made **recurrently** by an organization, or the decision is a typical one for a group of organizations.
2. The decision situation can be, to a great extent, **specifiable** in advance.
3. Conventional quantitative models (such as inventory and production models) **do not capture all** the important components of the decision.
4. The decision is **important** enough for the decision makers to justify formal analysis.



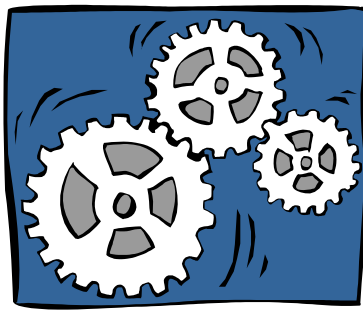


Unfitting Candidates for Reusable Decision Models

- ❖ **Truly unique** decision situations that will not be made again.
- ❖ **Very complex** decision situations that with the extra burden of generalization will produce an unmanageable model.
- ❖ New decision situations for which there is **not enough information** for the specification of an inclusive master model.

In these cases it is better to build a custom-made model





Reusable Decision Model for Major Equipment Acquisition

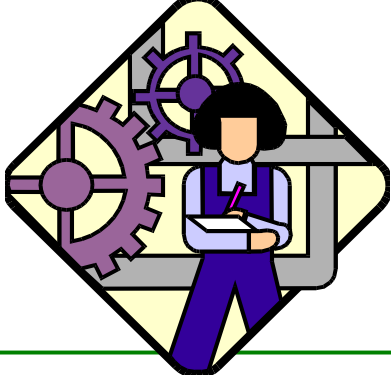
- ❖ This is a recurrent important decision in industrial firms.
- ❖ The motivation to buy equipment is to produce larger quantities, with better quality and/or more efficiently.
- ❖ The high cost of industrial equipment and its impact on usefulness of production facilities, make equipment acquisition a decision worth analyzing.

These decisions need to take into account:

- ❖ Expected demand of products.
- ❖ Technical specifications of the equipment.
- ❖ Cost of energy and materials to be processed by the equipment.
- ❖ Supplier of the equipment.
- ❖ Transportation and installation.
- ❖ Financing of the acquisition.

And many other factors.





Macro-Decisions in Major Equipment Acquisition

Technical specifications of equipment

- Technology on which the equipment is based
- Level of detail of technical study
- Capacity reserve margin of equipment
- Sophistication level of accessories
- Used equipment admissibility

Import, transport and installation

- Commercial terms (incoterms)
- Import responsibility (purchaser/supplier)
- Importing company
- Customs agency
- Transportation company
- Insurance coverage
- Insurer company
- Installation contractor

Equipment supplier

- Time of purchase
- Form of acquisition (purchase/rent)
- Specific supplier
- Alternative use of replaced equipment

Financing

- Percentage of cost to finance
- Financing terms
- Interest rate type (variable/fixed)
- Financing institution
- Tax impact

**22 decisions are grouped
in 4 macro-decisions**



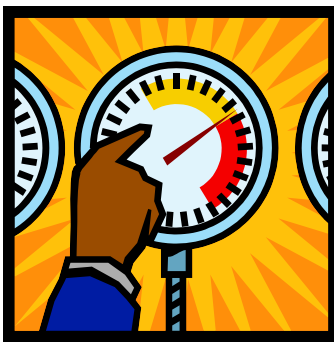
Strategy Table for Macro-Decision

“Technical Specifications of Equipment”

Individual decisions and possible alternatives

Strategy Themes	Level of detail of technical study	Technology on which equipment is based	Capacity reserve margin of equipment	Sophistication level of accessories	Used equipment admissibility
<i>The best money can buy</i>	Just copy specifications	Same technology we used before	Exact needed capacity	Bare bones equipment	Consider only new equipment
	Basic study	Most reliable and proved technology			
<i>The best value</i>		Technology leader of the market	Basic safety additional capacity	Basic instruments and accessories	Good used equipment is acceptable
	In depth study		Allow for moderate expansion		
<i>The most economical that works</i>		Innovative technology	Large capacity margin	The most complete set of accessories available	





Uncertain Events in Major Equipment Acquisition

Income generated by equipment

- Level of equipment utilization
- Price of service provided by the equipment
- Equipment economic life

Operation costs

- Equipment performance
- Equipment failure rate
- Maintenance cost
- Spare parts cost
- Materials/energy cost

Financial factors

- Interest Rate
- Exchange rate
- Credit approval
- Inflation rate

Intangible costs

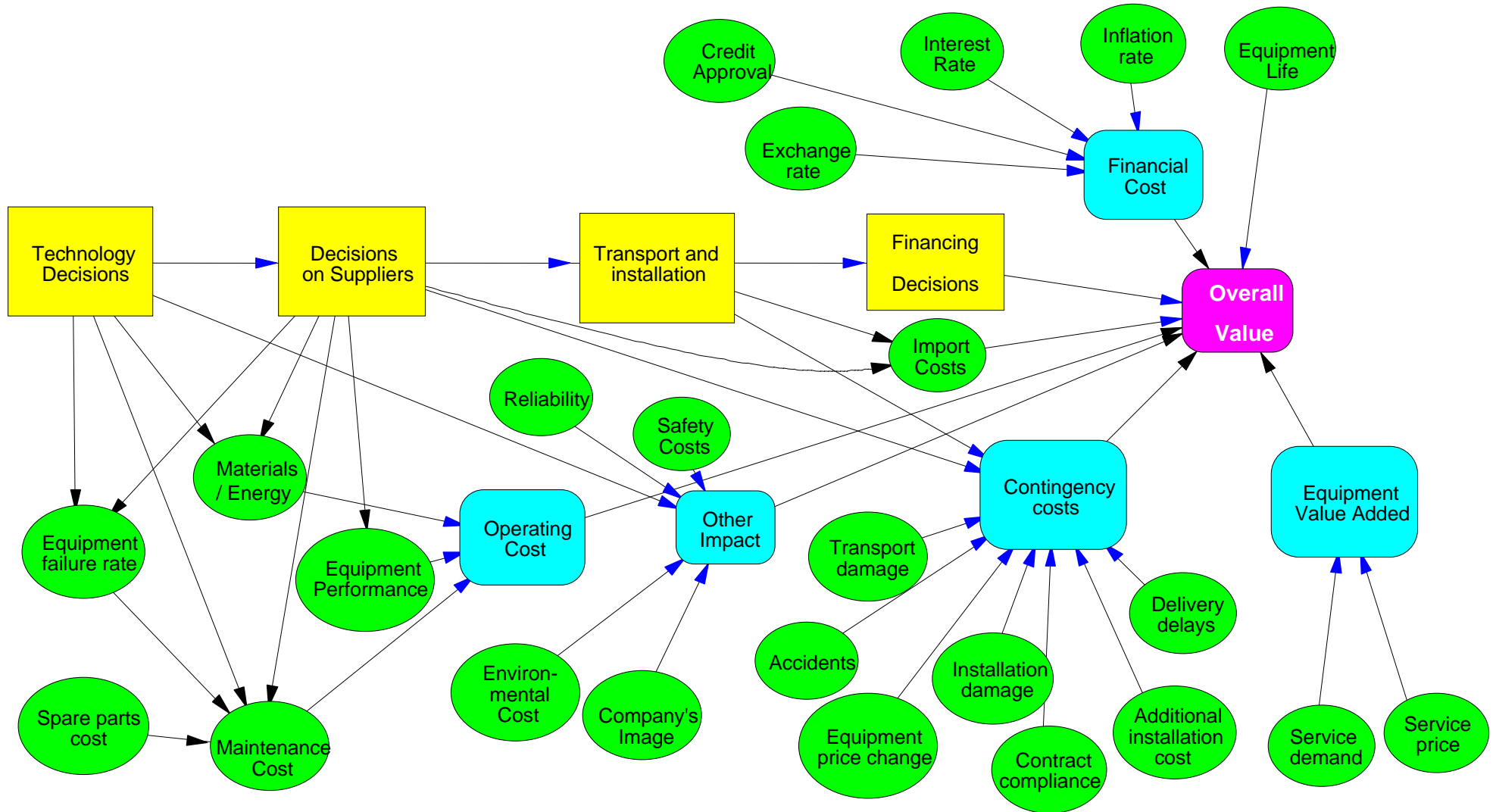
- Environmental cost
- Safety cost
- Production reliability cost
- Public image cost

Contingency costs

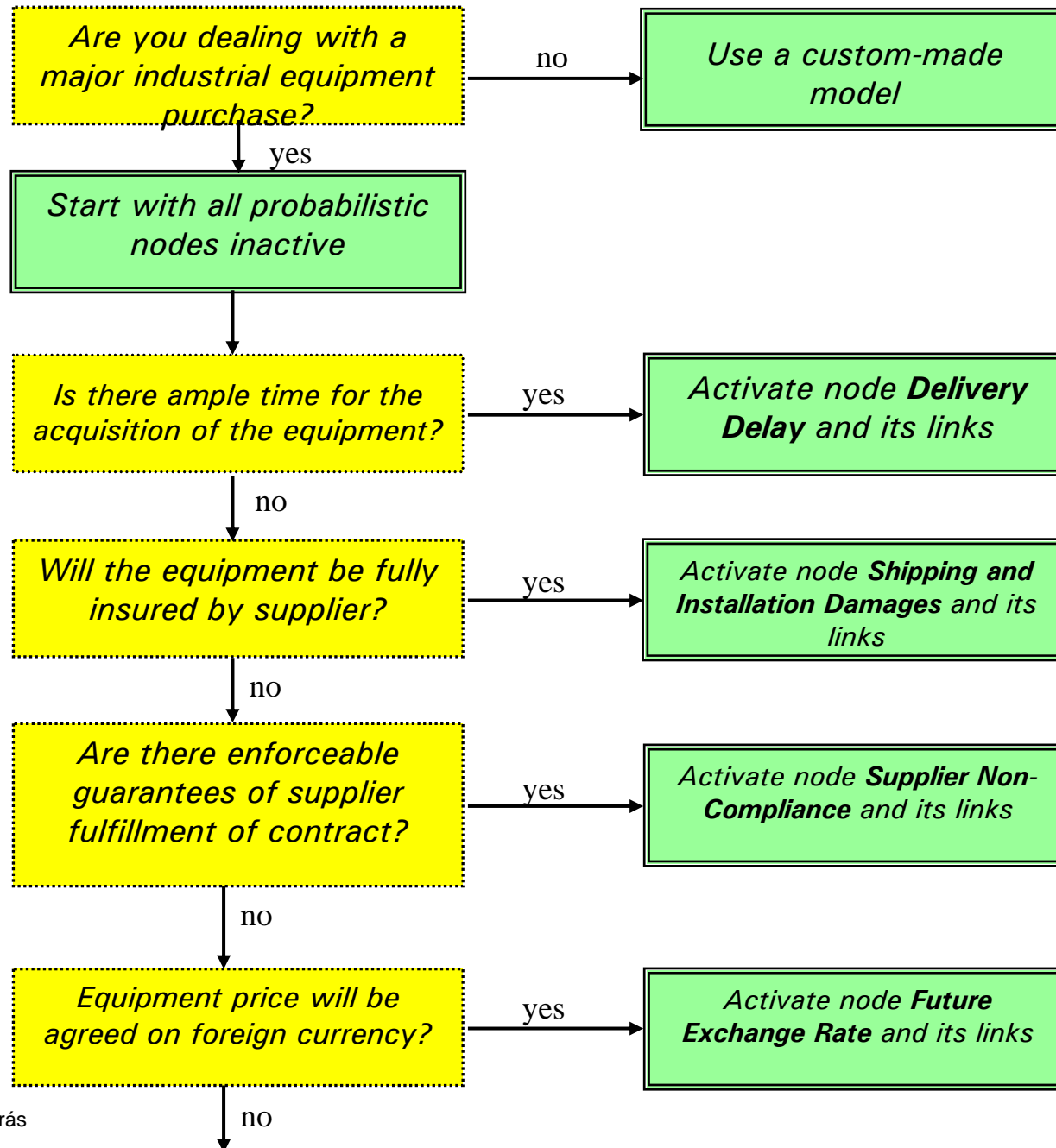
- Delivery delays
- Transport or installation damage
- Equipment price changes
- Financial difficulties
- Contract compliance
- Additional installation costs
- Additional import costs



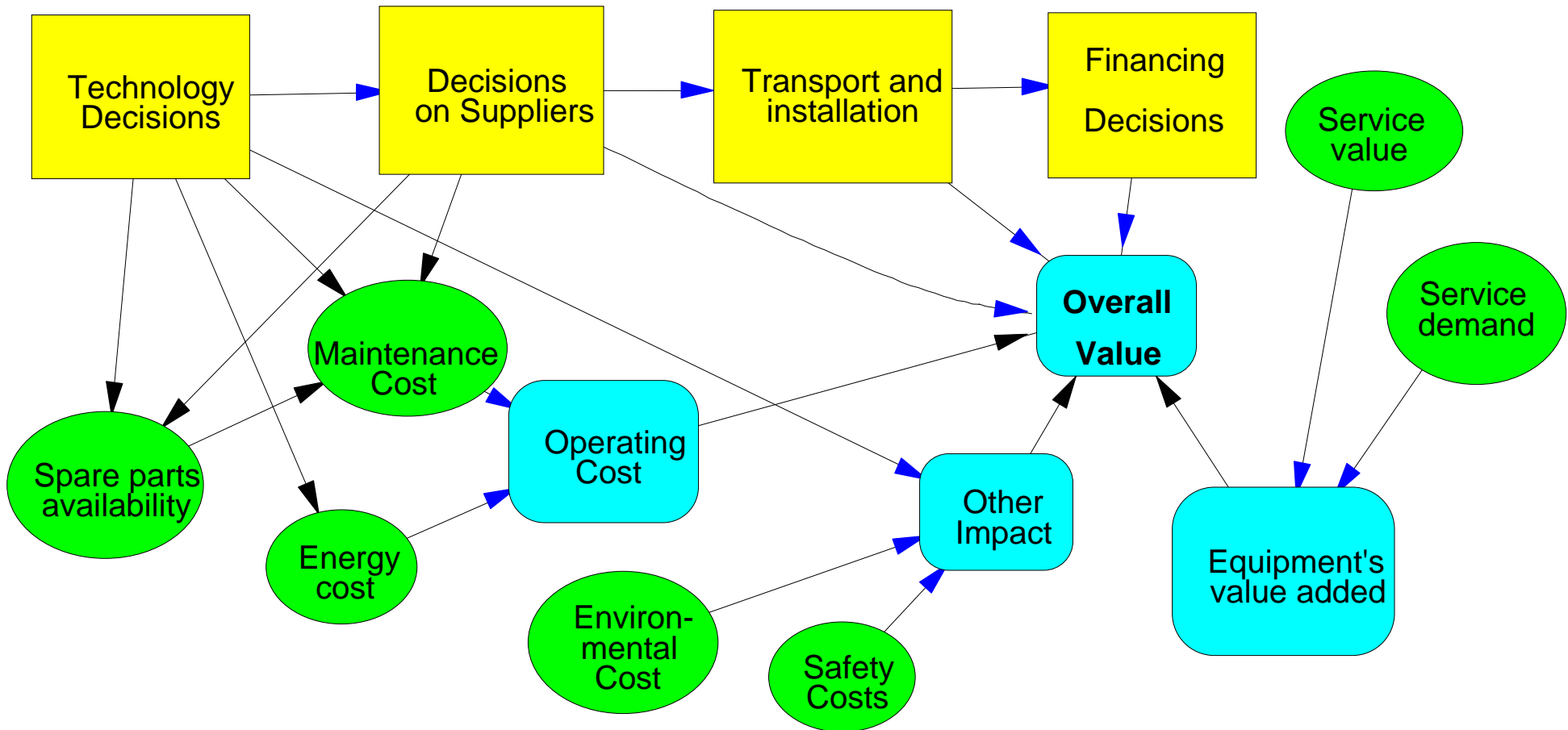
Master Model for Major Equipment Acquisition

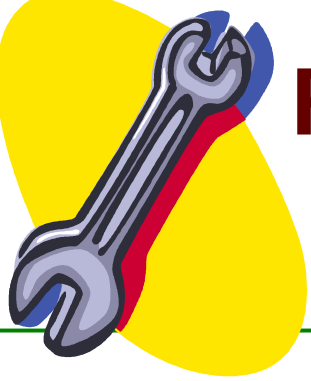


Guiding Diagram for Major Equipment Acquisition (fragment)



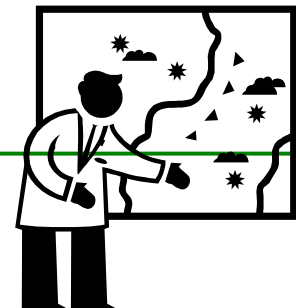
Particular Model for Major Equipment Acquisition

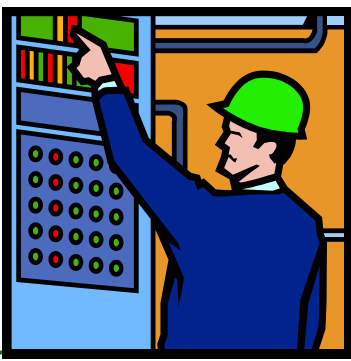




Reusable Decision Model for Opening Remote Maintenance Centers

- ❖ Industrial firms have found that outsourcing specialized equipment maintenance makes good business sense.
- ❖ This has led to the creation and growth of many industrial maintenance firms.
- ❖ Successful maintenance firms tend to expand its operations over extensive geographic areas.
- ❖ They face the dilemma of serving their clients from their headquarter or opening remote service centers.





Decisions for Opening Remote Maintenance Centers

1. **Performing the formal analysis** (by checking performance indicators).
2. **Opening of the service center** (the main decision).
3. **Fiscal status of the service center** (legal and tax considerations).
4. **Financing of the initial investment** (own money vs. external funds).
5. **Interest rate type** (fixed vs. variable).
6. **Size and equipment level of new center** (area, instruments and tools).
7. **Place of servicemen recruitment** (local or from headquarters location).
8. **Advertising campaign** (to attract new clients in the area).
9. **Formal market study** (to get more reliable information).
10. **Specific location of service center** (location in the remote city).
11. **Price structure for services** (how to compete in the new market).





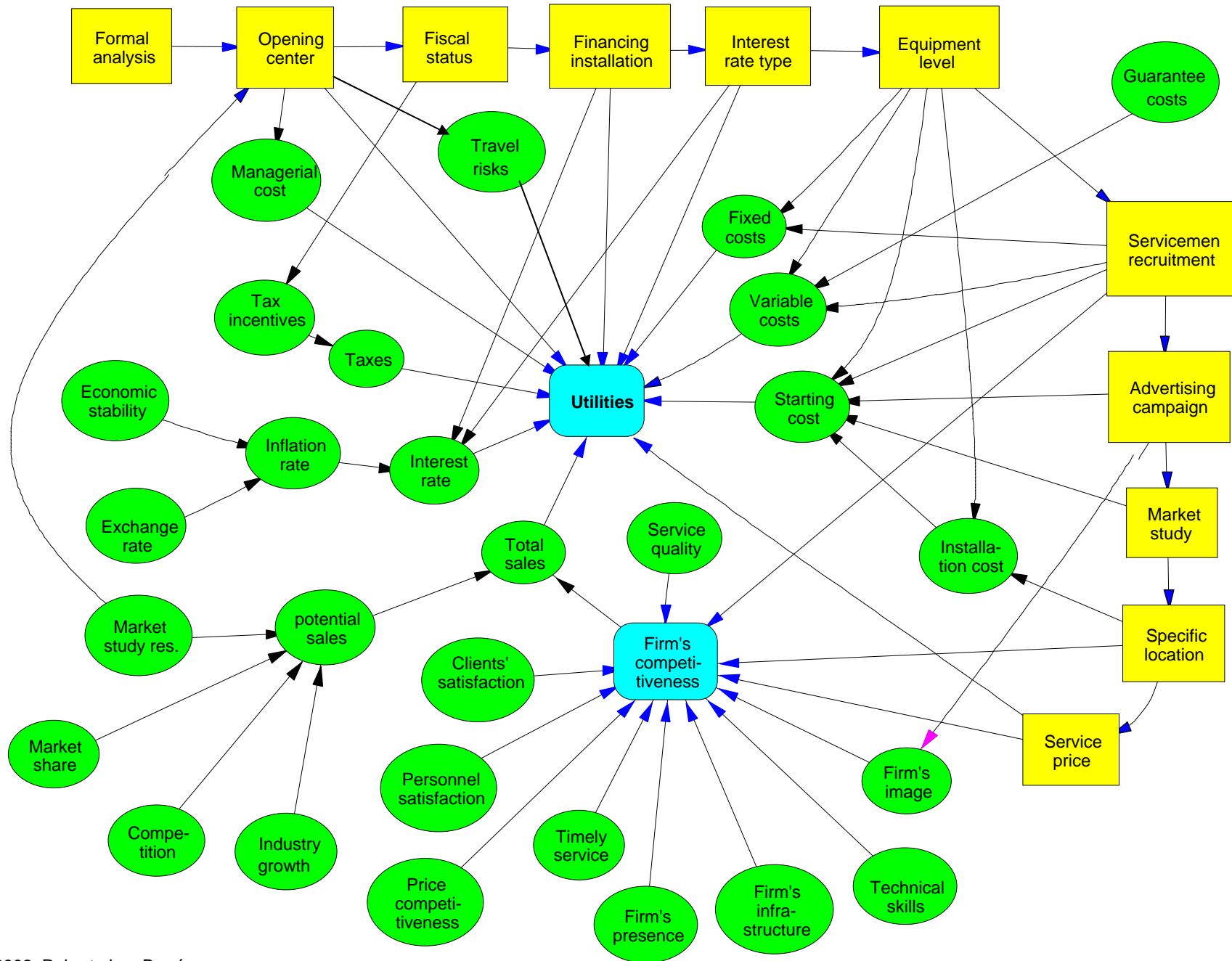
Uncertainties for Opening Remote Maintenance Centers

- a. Demand for services in the new region.
- b. Actual installation costs.
- c. Operating costs with the new service center.
- d. Actual interest rate to pay.
- e. Productivity of service personnel.
- f. Managerial effort with new center.
- g. Client satisfaction.
- h. Potential additional clients.
- i. Economic growth of the industry serviced.
- j. Decrease of traveling risks.

Among others



Master Model for Opening Remote Maintenance Centers

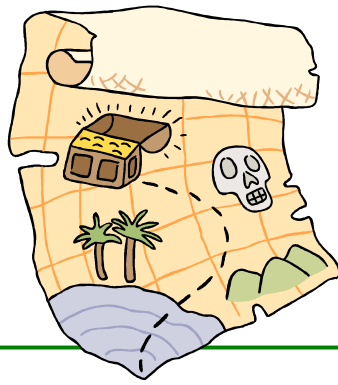




Other Applications of Reusable Decision Models

- ❖ Selection of marketing strategy for industrial products.
- ❖ Specification of expansion's size of production capacity.
- ❖ Definition of annual sales strategies.
- ❖ Expansion into new geographic markets.
- ❖ Launching of new products.
- ❖ Selection of production technology.
- ❖ Selection of distribution channels.





Final Remarks

- ❖ Reusable decision models provide a way of **transmitting knowledge** about a family of decision situations **using the precise and logical language of influence diagrams.**
- ❖ The pair *master model – guiding diagram* works like a **high level checklist** of what to include in a decision model for each situation.
- ❖ The joint use of the master model and the guiding diagram for building particular decision models is a new way of modeling that **saves time and money.**



Contact Information and Acknowledgements

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