

# Reusable Decision Models for Cost Effective Decision Making



presented by

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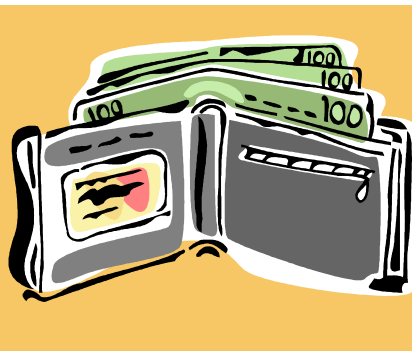
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# The Value of Decision Analysis

- ❖ **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.**

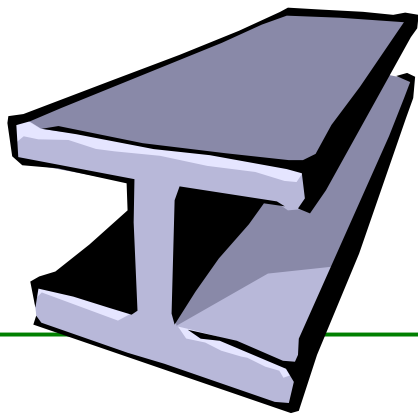




# Reusable Decision Models for Cost Effectiveness

- ❖ **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.



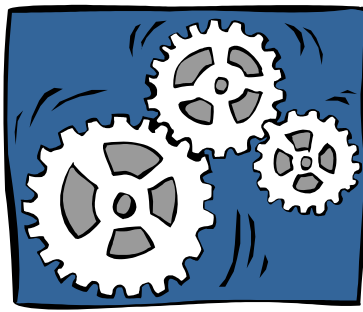


# Unfitting Candidates for Reusable Decision Models

- ❖ **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

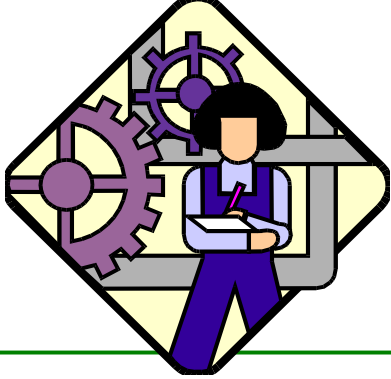
- ❖ This is a recurrent important decision in industrial firms.
- ❖ The motivation to buy equipment is to produce larger quantities, with better quality and/or more efficiently.
- ❖ The high cost of industrial equipment and its impact on usefulness of production facilities, make equipment acquisition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



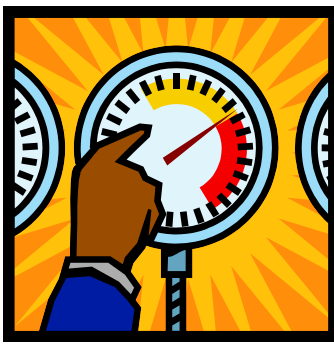
# Strategy Table for Macro-Decision

## *“Technical Specifications of Equipment”*

### *Individual decisions and possible alternatives*

<b>Strategy Themes</b>	<b>Level of detail of technical study</b>	<b>Technology on which equipment is based</b>	<b>Capacity reserve margin of equipment</b>	<b>Sophistication level of accessories</b>	<b>Used equipment admissibility</b>
<b><i>The best money can buy</i></b>	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			
<b><i>The best value</i></b>		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		
<b><i>The most economical that works</i></b>		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

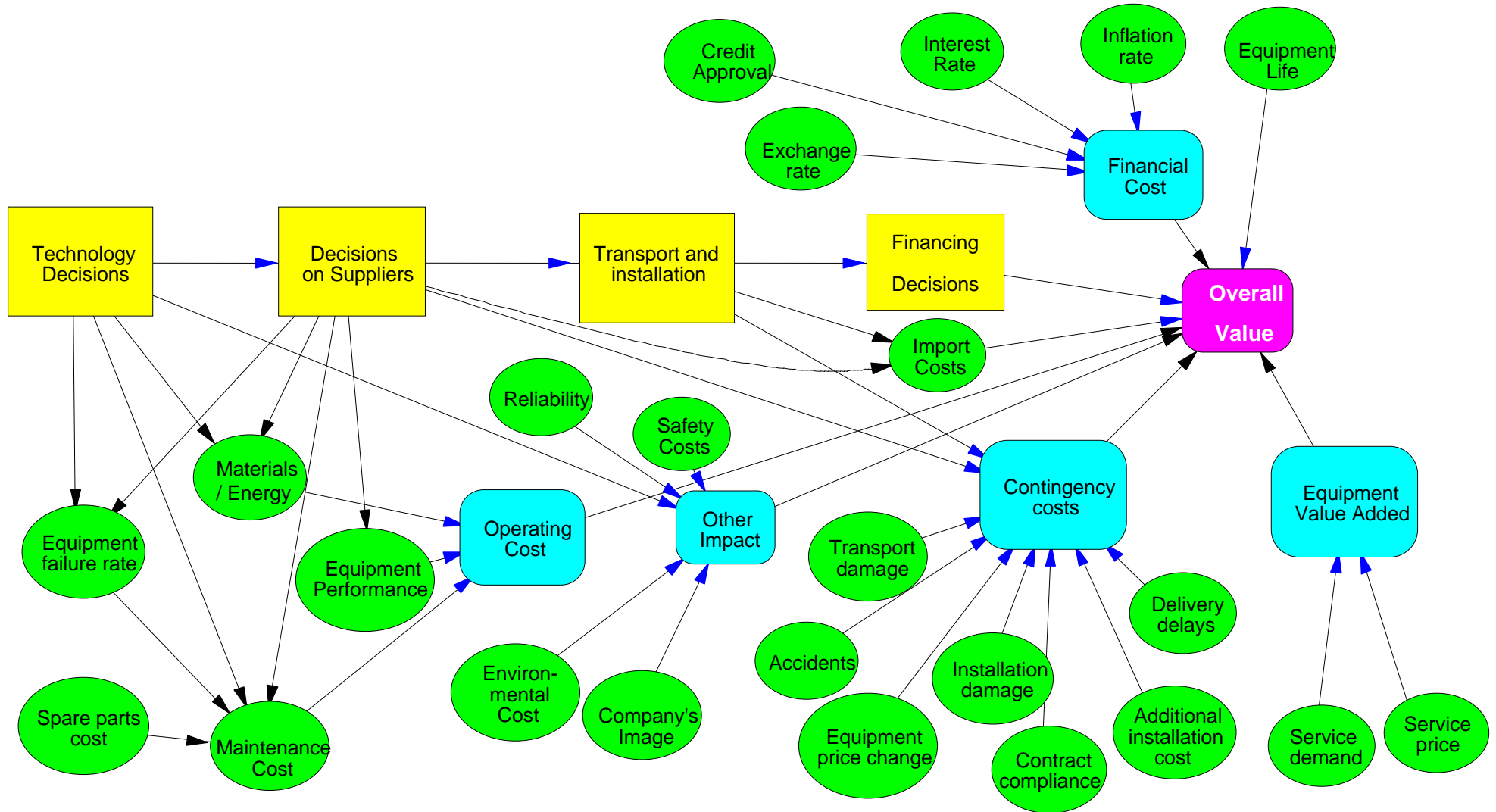
- Environmental cost
- Safety cost
- Production reliability cost
- Public image cost

## Contingency costs

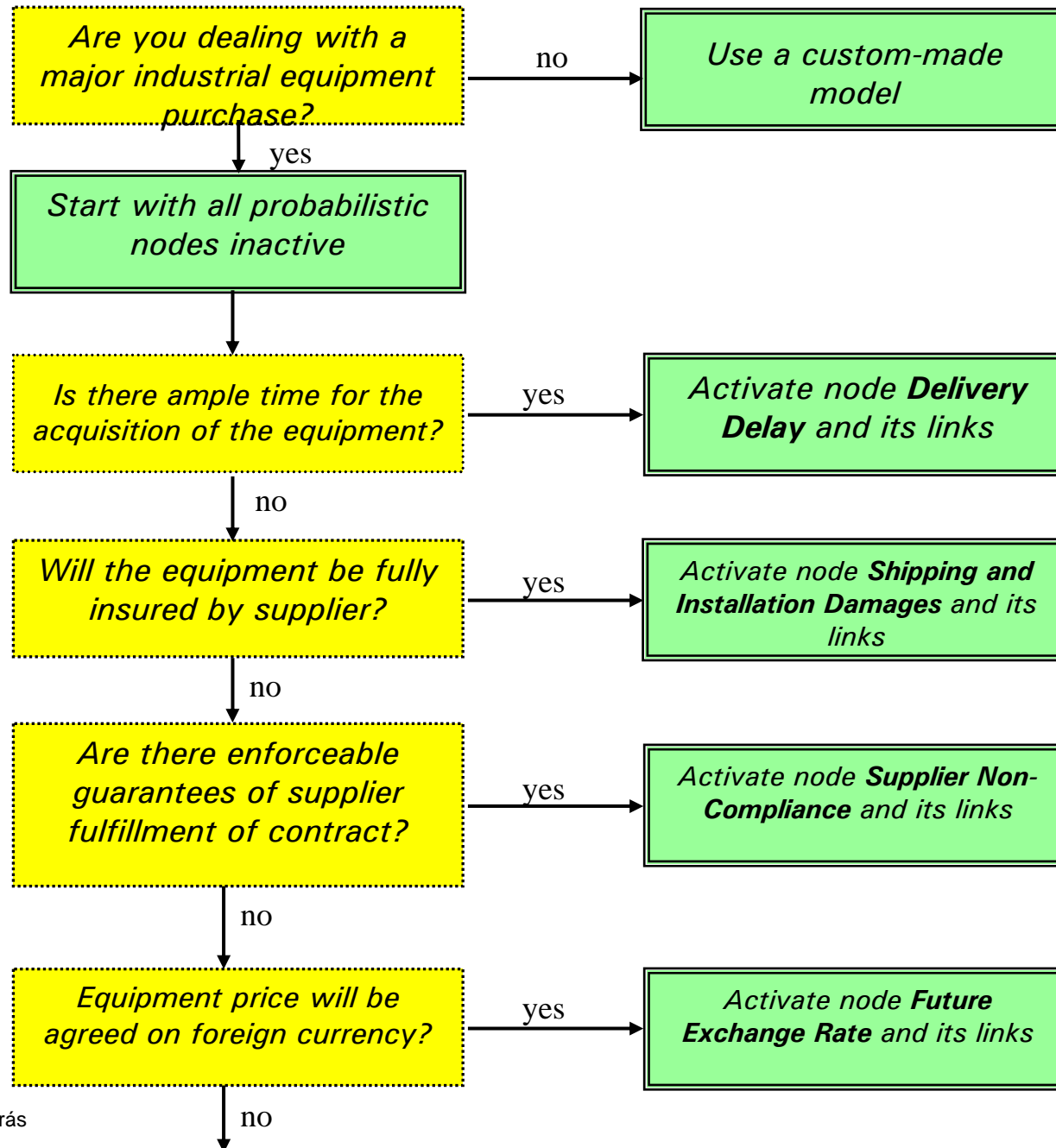
- Delivery delays
- Transport or installation damage
- Equipment price changes
- Financial difficulties
- Contract compliance
- Additional installation costs
- Additional import costs



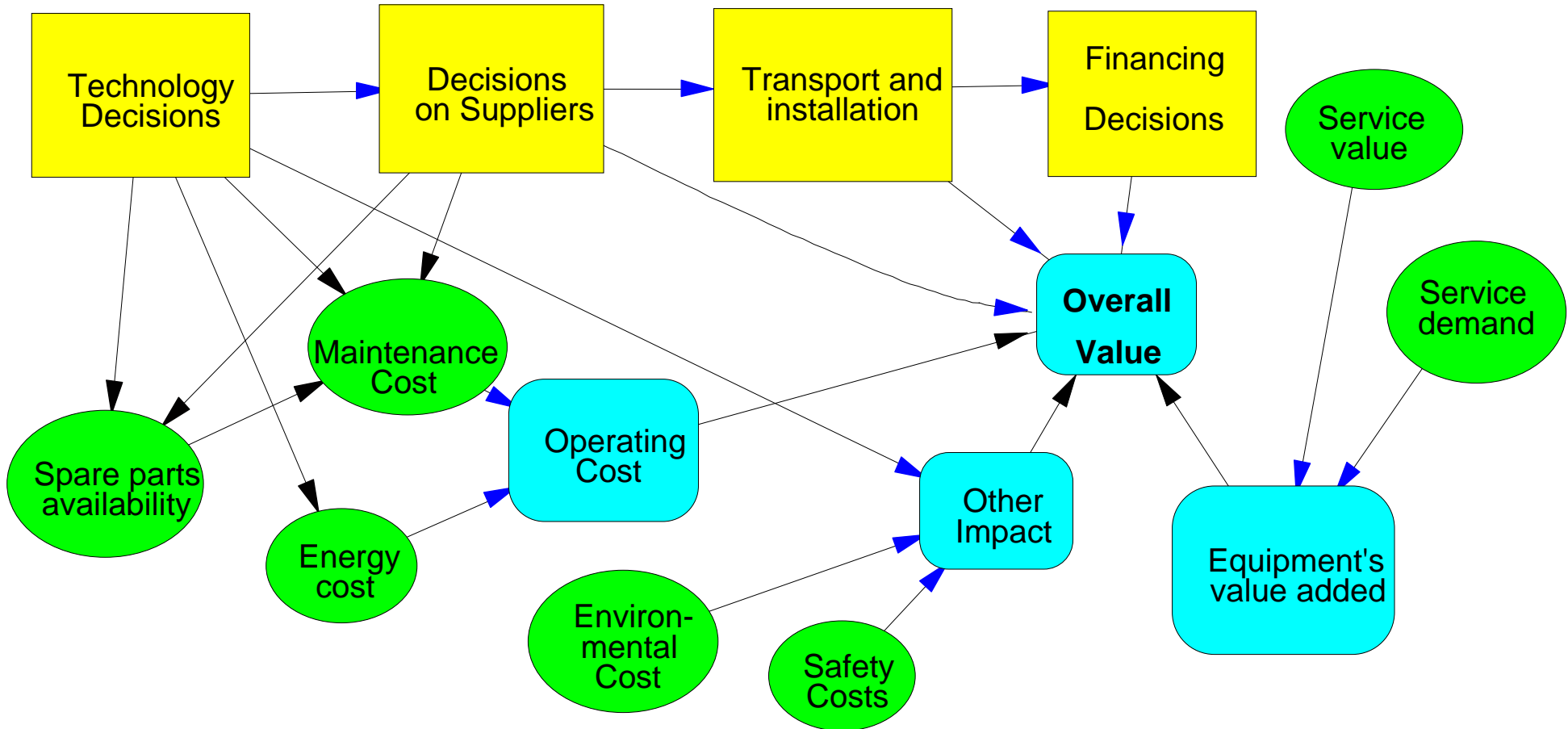
# Master Model for Major Equipment Acquisition

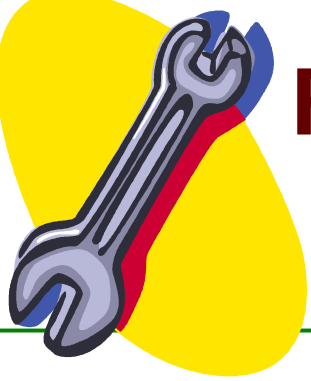


# Guiding Diagram for Major Equipment Acquisition (fragment)



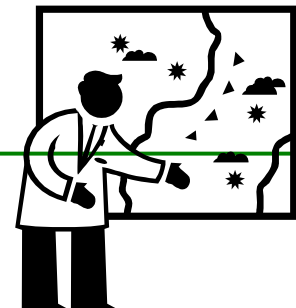
# Particular Model for Major Equipment Acquisition

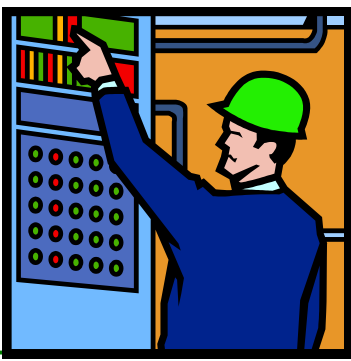




# Reusable Decision Model for Opening Remote Maintenance Centers

- ❖ 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).





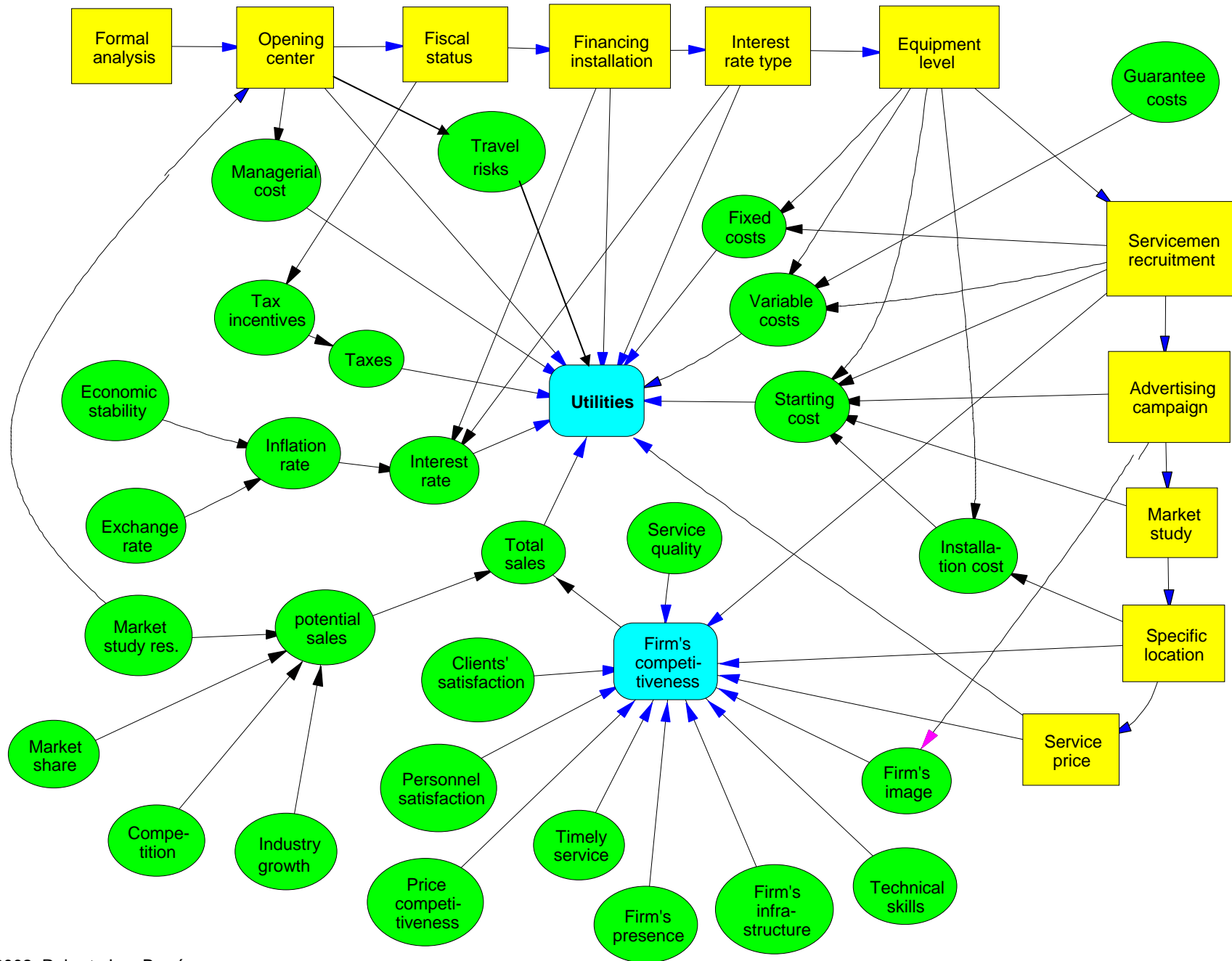
# Uncertainties for Opening Remote Maintenance Centers

- 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

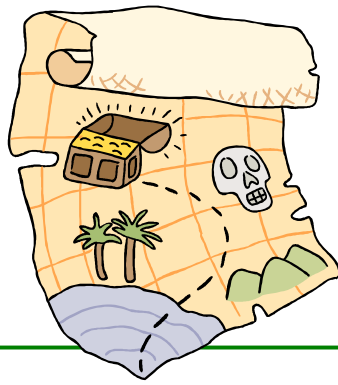




# Other Applications of Reusable Decision Models

- ❖ 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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