Capital Budgeting and the AHP

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A common problem that corporations face on an annual basis is creating the capital budget for the next fiscal year. The creation of the capital budget for a company is an annual rite that often does not receive the scrutiny that it merits. Too often, the task of evaluating competing budget items comes down to a simple comparison of the IRRs (internal rates of return) for competing projects and a selection of those projects with the highest returns.

When companies do not spend as much time trying to quantify projects, the decision often comes down to "strategic" decision making on the part of the CEO or executive team. This strategy is often a gut feel from the executive team.

By institutionalizing a hierarchical decision making process, the company would be forced to think about what are the priorities of the company and to evaluate each alternative vis-a-vis all other projects.

AHP and the Priorities

The AHP model can be used to enforce the evaluation of projects. Typically, when asked which of his or her projects are most important during the next year, a department manager would respond – "all of them." At some level, all projects are important, but not equally important. Incorporating AHP into the budgeting process forces each department head to create priorities within the department. Obviously, there are ways to game the system, such as rating all projects equally important, but these strategies are hard to manage since the department head does not know how others are prioritizing their projects or how his or her department will be evaluated in relation to other departments.

Each level of the company will be rated by the person responsible for that area. For example, the Maintenance of Equipment department head will prioritize each of his department's projects. This department will then be prioritized in relation to the other departments in the operating company. The operating company will then be rated against the other operating companies. This process will occur at each company and each department. The decision process follows the organizational structure of the company.

The ratings will not be done by the same person in any case. The Union Railroad Maintenance of Way department head should be the most qualified to understand the needs of his department and would rate his department accordingly. This manager would not have the best information on the priorities of the Transportation department and the manager of that department would then rate each department within the operating company. This process continues for each department in each company.

Similar projects in different companies can have very different rankings within the overall corporate hierarchy. For example, the decision to purchase new crew vehicles at the EJ&E railroad and the Union railroad results in very different results. This is due to several factors including the fact that the investment in the EJE is a higher priority than investment in the Union, there are other projects in the transportation department at the Union that are most important than the crew vehicle replacement program while this

project is the most important within the department at the EJE, and lastly, the Transportation department is rated higher within the EJE department priorities than it is at the Union. The priorities can vary dramatically from operating company to operating company depending on the judgments of the ranker(s).

Project	Total (from AHP)	Cost (in '000's)	Effectiveness (Normalized)*100	Rank
EJE_24TRN_Replace 6 Crew Vehicles	0.123868	180	100.000	1
URR_45TRN_Replace 6 Crew Vehicles	0.003076	180	2.483	45

The value of the ranking system is in that the person most knowledgeable about each project has an input about the priorities of the department. The person who most needs the budget allocation has an input about the allocation.

Desirable\Expansion Projects

Expansion projects are projects that are not required for the continued operation of the company and, therefore, are subject to financial return evaluation. The financial return is measured in terms of NPV and IRR. This data can be directly entered into the model using the direct data entry feature. In this case, projects were ranked within the operating company and each project was then given a ranking and this was put into the model.

Results

Model results are given when priorities are calculated. The results are then ranked and normalized based on the priority of the highest ranked project (see attached excel spreadsheet below).

A linear program can then be created in order to maximize the effectiveness of the capital budget. The performance effectiveness of each individual project is based on the cost and the effectiveness established by the priority rankings. The linear program seeks to maximize the performance effectiveness within the constraint of the available budget.

Projects have been assumed to be all or nothing projects – that is, either “go” or “no go” projects. In this example, the linear program was changed so that the EJE Mainline track program was performed at 50% or more. Some projects could be made non-integer is appropriate.

The linear program was also changed so that two (2) specific WGN projects could not both be undertaken. It would not make sense for both to be pursued, and the program reflects this business situation.

Conclusions:

The value of the decision model lays in the process of setting-up the model and the steps of creating the comparisons. Utilizing a model forces the decision maker to look at all of the alternatives and to think about the value of each alternative vis-à-vis the other alternatives. This is especially useful in situations where quantifiable numbers do not exist for some projects.

Capital Budget Allocations

Project	Total (from AHP)	Cost (in '000's)	Effectiveness (Normalized)*100
EJE_24TRN_Replace 6 Crew Vechhicles	0.123868	180	100.000
EJE_10MEC_Purchase 100 Replacement Wheels	0.101342	90	81.815
URR_39MOW_Rebuild 6 Culverts	0.059612	42	48.125
EJE_9MEC_Purchase 160 Wheelsets	0.055916	400	45.142
EJE_16MOW_Redeck Joliet Bridge	0.053572	345	43.249
EJE_20MOW_Replace Bridge Inspector Truck	0.047003	165	37.946
EJE_5TRN_Build Turnout to Ford S. Chicago	0.042407	1,200	34.236
WGN_50TRN_Upgrade Radar Systems on Tugs	0.037440	216	30.226
EJE_11MEC_Major Rebuild 8 Locos	0.032680	360	26.383
EJE_7MEC_Rebuild 120 Coil Cars	0.030771	1,440	24.842
URR_36MOW_Mainline Track Replacement	0.030729	670	24.808
EJE_22MOW_Replace Tamper	0.025547	180	20.624
WGN_49TRN_Replace 2 Tug Engines	0.024317	170	19.631
EJE_14MIS_Replace Mainframe	0.024216	140	19.550
EJE_8MEC_Rebuild 28 Box Cars	0.022333	112	18.030
EJE_2MEC_Convert 30 Gons to Coil Cars	0.021203	360	17.117
EJE_13MEC_Purchase Stake Truck	0.019277	85	15.563
EJE_21MOW_Pruchse Tie Crane	0.018192	95	14.687

WGN_46TRN_Convert 8 barges for Woodchips	0.017316	280	13.979
EJE_4TRN_Automate Interlocking @ Joliet & Gary	0.014136	300	11.412
URR_38MOW_Replace 300 yard ties	0.012653	28	10.215
EJE_17MOW_Replace 16 Turnouts	0.012255	640	9.894
EJE_6TRN_Build Turnout to Haley Plant	0.010602	160	8.559
URR_40MOW_Purchase Tie Machine	0.068634	145	55.409
EJE_15MOW_Mainline Track Replacement	0.010067	1,450	8.127
EJE_12MEC_Purchase 3 Used Mainline Locos	0.009917	900	8.006
URR_32MEC_Purchase 80 Wheelsets	0.009260	200	7.476
URR_37MOW_Replace 8 Turnouts	0.009199	320	7.426
URR_43TRN_Replace Control Room Display System	0.009189	10	7.418
WGN_47TRN_Purchase 8 Dedicated Woodchip Barges	0.008658	3,400	6.990
URR_33MEC_Purchase 100 Replacement Wheels	0.008590	90	6.935
EJE_3MIS_Replace Tie Line Hub	0.008481	80	6.847
URR_41MOW_Replace 2 Heavy Work Trucks	0.007243	170	5.847
EJE_1MEC_Purchase Automated Welder	0.007068	45	5.706
URR_42MOW_Purchase 1 Front -end Loader	0.006307	140	5.092
WGN_48TRN_Replace 6 Barges	0.006280	2,400	5.070
URR_28TRN_Build Turnout to Snavley Lumber	0.006234	145	5.033
EJE_23MOW_Replace 4 Work Crew Hi -rail trucks	0.006219	240	5.021
EJE_19MOW_Regrade Hump Yard	0.005551	180	4.481
EJE_18MOW_Replace 1000 yard ties	0.005505	84	4.444
URR_35MEC_Purchase 2 Used Switcher Locos	0.005174	300	4.177
WGN_51TRN_Rebuild Drydock #2	0.004086	350	3.299
URR_30MEC_Rebuild 80 Hopper Car Sides	0.003533	180	2.852
URR_25MEC_Purchase Automated Welder	0.003117	45	2.516
URR_45TRN_Replace 6 Crew Vechhicles	0.003076	180	2.483
URR_34MEC_Major Rebuild 4 Locos	0.002151	180	1.737
URR_27MIS_Replace Tie Line Hub	0.002078	40	1.678

URR_26MIS_Expand WAN	0.001558	35	1.258
URR_44TRN_Replace Control Tower at "J"	0.001373	220	1.108
URR_31MEC_Rebuild 16 Cabooses	0.001347	128	1.087
URR_29MEC_Replace Shop Overhead Crane	0.001138	60	0.919