Continuing Discussion of Reward Systems for Engineers & Scientists and Intro to Structuring the PD Organization

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Proportion of Engineers & Scientists in Ten Organizations Choosing Each of Three Possible Career Paths

<table>
<thead>
<tr>
<th>Career Path</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANAGEMENT</td>
<td>32%</td>
</tr>
<tr>
<td>TECHNICAL LADDER</td>
<td>20%</td>
</tr>
<tr>
<td>PROJECT ASSIGNMENT</td>
<td>48%</td>
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</tbody>
</table>
Career Preference as a Function of Age
(N = 1,402)
Career Preferences of Technical Ladder Staff as a Function of Age (N = 351)
Career Preferences of Managers as a Function of Age
(N = 374)
Organizing for More Effective New Product Development
The Basic Process of New Product Innovation

• What are we fundamentally trying to do?
  – A very simple model.
The Process of Innovation

INNOVATION

Technology

Market
Organizing the Process

• There are many ways in which this process can be organized.
  – However there are really only two basic structures that can be combined in many ways.
  – Product Development managers have been very innovative in combining these two forms into very elaborate organizational structures.

• There has, however, been very little rational basis for choosing among these structures.
Departmental Organization

Technology

Strong technology connection

Market

Weak market connection

D1 D2 D3 D4 D5 D6

Very difficult coordination problem
But coordination is less necessary, given sufficient time.

- Some industries have managed to lessen coordination needs by extending development time.
Time & Coordination

• The biggest problem with departmental organization is the difficulty in coordinating the work across the different departments.

• But coordination is less necessary, given sufficient time.
  – Some industries have managed to lessen coordination needs by extending development time.
One Approach to Managing Departmental Organization

Technology

D_1 → D_2 → D_3 → D_4 → D_5

Market
Time & Coordination

- Time can always be substituted for coordination!
- and the converse...
- Better coordination can reduce development time.
Time & Coordination

Diagram showing the relationship between time and coordination.

- Less time, more coordination.
- More time, less coordination.

Axes:
- Time
- Coordination
An Alternative Approach

• Beginning with Aerospace and large scale computers, many industries learned how to do this.
Project Team Organization

Technology

Weakened technology connection

Market

Strong market connection

Coordination

P1 P2 P3 P4 P5 P6

Weakened technology connection
The ‘Downside’ of Project Team Organization

• Isolation from disciplinary colleagues.
• Team ‘Aging’.
Project Performance as a Function of Team Age
(45 Chemical Industry Projects)
Matrix Organization

Technology

Market

D1  D2  D3  D4  D5  D6

P1  P2  P3  P4  P5  P6  P7  P8
The Basic Tradeoff and Dilemma in Product Development Organization

- **Departmental Organization**
  - Departmental structure is more closely mapped to the structure of the supporting technologies.
  - It thereby provides a better connection to those technologies and better ongoing technical support to the project effort.
  - This is, however, accomplished at the cost of much greater difficulty in coordination of the project tasks and less responsiveness to market change.

- **Project Team Organization**
  - Project Team structure groups people from different disciplines together in a single team all reporting to a common manager.
  - It thereby provides better coordination of the project tasks and increased sensitivity to market dynamics.
  - This is, however, accomplished at the cost of a separation from the disciplinary knowledge underlying the project effort. When this is carried to an extreme, it will gradually erode the technology base of the organization.
The Basic Tradeoff and Dilemma in Product Development Organization

• **Departmental Organization**
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If departmental organization enables closer contact with the technologies supporting a given development, are all technologies equal in the degree to which we must stay in close contact? If the answer is ‘No’, then what determines the degree of contact that we must maintain with different technologies?
First Dimension

\[ \frac{dK}{dt} \]
The Basic Tradeoff and Dilemma in Product Development Organization

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Determinants of Coordination

• Are all projects equal in the amount of coordination that they require?
• If the answer is ‘No’, then what makes the difference?
  – Why would one project require more coordination than another project requires?
The Second Dimension

\[ \frac{dK}{dt} = \text{rate of change of knowledge} \]

\[ I_{ss} = \text{subsystem interdependence} \]

Project Team

Departments
The Third Dimension

$T_i = \text{Duration of project assignment.}$
Structuring the Organization

• **Standard Industrial Practice**
  – Ignores the rate at which technologies are developing (despite the fact that this can often be measured).
  – Usually ignores the interdependencies in project work (seasoned project managers are an exception).
  – Focuses on project duration (and usually makes the wrong decision on this parameter).
The Fourth Dimension

\[
\frac{dM}{dt}
\]


\[
\frac{dK}{dt}
\]

Project Team

\(I_{ss}\)

Department

\(T_i\)
Matrix Connections to Market and Technology

Referee to manage priorities

Competition for Resources

DRIFT
Imbalance

• What is the problem when power, authority and credit drift to the project side of the product development matrix?
  – Project managers are in a high pressure role.
    • Pressure emanates from the Marketing function and from key customers.
      – The competition already has their next generation out. Where is ours?
    • This can tempt project managers into premature clearance of the product.