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**Future Trends in Engineering Careers  
A Career Concept Approach**

**CEO Publication  
G 82-2 (21)**

**Michael J. Driver  
University of Southern California**

**May 1994**

**Presented at I.E.E.E. workshop on Careers, Denver, Colorado, October 22, 1981**

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FUTURE TRENDS IN ENGINEERING  
CAREERS: A CAREER CONCEPT  
APPROACH

by

Mike Driver

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ABSTRACT

Social and technological trends in American society suggest that engineering careers stressing a linear, upward movement concept are headed for problems. Instead it is suggested that engineering careers need to be designed to reward such non-linear career concepts as the steady state notion of life long professional competence or the spiral concept of shifty fields every decade.

## FUTURE TRENDS IN ENGINEERING CAREERS

### Basic Trends Affecting Engineering Careers

Four major societal factors appear to be shaping the future of careers in the Engineering field:

1. Increasing emphasis on technology as the basis of a very large number of human activities.
2. Stagnation of movement in middle to senior management as the impact of the baby boom generation emerges.
3. An increasing rate of change in technology.
4. Increasing need for creativity and capacity to deal with complexity as technology evolves.

Each factor will be explored and a particular type of Career Management System will be proposed to deal with issues raised by the factor. The Career Management Systems are grounded in the existence of at least four distinct Career Concepts and related Career Cultures which can be used to generate a Career Management System.

Career Concepts<sup>2</sup> are defined as enduring, inner views of the meaning of a career. The basic components of a Career Concept are:

1. Stability of career choice--is it stable for life or expected to change.
2. Direction of movement in career--is it upward or sidewise.
3. Duration in any given career area--Does one stay 2 years, 5 years, or even longer.

As will be seen below four specific Career Concepts have been identified. In addition, four comparable Career Cultures can be defined which are organizational extensions of Career Concepts. The prevailing Career Culture in an organization may not fit well with individuals who hold divergent Career Concepts. Career Cultures are also frequently out of phase with societal forces resulting in often tragic misuse of human capacities with resultant organizational failure.

The main thrust of this paper is to suggest that Career Management Systems can be rationally designed to fit strategic needs of organizations and prevailing Career Concepts of key personnel. Designed Career Management Systems can thereby create Career Cultures which support rather than frustrate individual and organizational goals.

The Continued Rise in Technology Dominance and Linear  
Career Management Systems

Almost all forecasts <sup>13</sup> of the near future predict a continued penetration of technology into all sectors of life and an increase in the rate of this penetration. The growth of information technology alone is drastically changing the technological base of relatively low technology areas such as finance, government and even service industries.

One strong implication of this trend is the increasing need for engineering experience in middle and senior management. As an industry's basis becomes more technological, experience in technology becomes a premium for managers. In high technology industries such as aerospace, engineering dominance in senior management has already occurred. The current trends, especially in data processing, suggest that engineers will seek and be sought for as managers even in previously low technology areas.

However, as may be seen in many high technology firms today, engineers as managers can create many problems. The most poignant problem is that many engineers do not really want to go into management. They are quite happy doing engineering yet they go into management because of social pressure or restricted rewards for staying put. Unfortunately, such moves are often disastrous to themselves and everyone around them. This is not quite the Peter Principle--since they move up against their own better judgment.\* Even some who want to move into management encounter great problems because they lack the concepts and skills needed to deal with human problems. In many cases, these deficiencies could be remedied by effective training. In some cases even training cannot eradicate the mismatch of the engineer to the management job.

A crucial issue seems to be the identification of managerial potential in engineers. Ideally management potential is defined empirically in an organization by careful assessment of management jobs, which then leads to a set of traits termed "potential". Some traits would need to be current in a person while some could be related to a capacity to learn. Short of an empirical analysis, some traits already stand out as critical in most management jobs. Grimalley's<sup>8</sup> research points to the importance of energy and verbal ability. Research on Decision Styles (learned habits in information processing) stresses the need for a fast, action oriented, "Decisive" style at lower levels and a more complex, creative, Integrative style at middle levels.<sup>5,6</sup> Motivational studies suggest the importance of needs for achievement, affiliation and power.<sup>9</sup>

\*Perhaps this should be called the Michael Maxim--Competence in technical work leads to unwanted promotion to management--and frequent failure.

One way of summarizing the known data is to suggest that a person with management potential must have a Linear Career Concept. A Linear Career Concept is defined as one in which a person works their way up a career ladder in a chosen field. Research has shown the Linear Concept to be strongly related to power needs and high information decision styles.<sup>10,11</sup> Identification of engineers with Linear Career Concepts and related traits via questionnaires and resumes<sup>2,6</sup> should aid in finding those engineers who want to move up and can probably benefit from management training.

Once identified, Linear engineers need to be involved in a Linear Career Management System. Some of the elements of such a system could include:

1. Special managerial training--emphasizing people related concepts and skills.
2. A carefully designed pattern of early temporary assignments in management slots.
3. A planned career path with the potential for frequent upward movement--(this requires a tall, vertical organization structure).
4. Occasional movement into temporary nontechnical areas for grounding in other aspects of a business.
5. Frequent MBO type performance reviews with equal emphasis on both current performance on the job and in potential related activities (e.g. temporary assignments, training).
6. Rewards based on enhanced power, status and recognition--with pay tightly linked to management level.

While Linear systems are quite familiar to many organizations they often are undercut in high technology organizations by slow movement, inadequate managerial training and inappropriate rewards--e.g. benefits. For maximum nurturance of Linear engineers a Linear Career Management System is essential.

Two problems in particular beset Linear Systems:

(a) Many engineers do not have (and do not want to have) Linear Career Concepts--therefore feeling threatened, demotivated or left out by Linear Career Systems.

(b) In many environments, Linear Systems are out of tune with socioeconomic factors to which we now turn.

The Coming Stagnation of Management Careers  
and "Steady State" Career Management Systems

Demographic data <sup>4</sup> suggest that in the coming decade a deluge of people will invade middle and senior management. Opportunity for promotion should steadily decrease. Delayed retirement and low economic growth further support the notion that the need for Linear people and systems is going to be quite limited.

This data suggests that only in a few high growth areas will we need all-inclusive Linear Systems. In most organizations, only a very small percentage of technical and managerial people would need to be involved in Linear Systems. What then would happen to the rest?

One suggestion is to continue the emergent trend in some high technology firms toward building consistent "Steady State" systems for managing careers. A Steady State career concept is defined as one in which a field is chosen as a person's lifelong vocation. It is clearly a concept widely



held among professionals--including engineers.<sup>1</sup> It is a concept well suited to a person who desires to become highly competent or an expert in a field of sufficient challenge to sustain lifelong adherence.

A Steady State Career Management System could include:

1. Careful initial career assessment to assure optimal person-career fit
2. Continued in-field training to offset obsolescence
3. Program of Mentoring new hires (to the benefit of both)
4. Performance Review based on current performance and general expertise (depth--not breadth)
5. Pay grades equal to Linear management grades
6. "Promotion" based on seniority and competence but with little increase in management power
7. Increased centrality (in Schein's sense)<sup>12</sup> with seniority. (e.g. involvement in critical task forces)
8. Strong program of benefits and security (tenure)
9. A flat, multidepartment organization structure.

Such systems do exist at least partially in some firms. But often they too encounter problems. Frequently they are accorded "second-class citizen" status in organizations whose power remains in the hands of a Linear managerial group. A remedy here consists of building a mutually tolerant and supportive pluralistic career culture organization--as will be suggested below.

Another sort of problem occurs when the Steady State system becomes dominant. Clearly the Linear types in such a system become very

frustrated and may either cease to function or leave. This loss of energy for change and expansion (typical of Linear) can lead to an increasingly closed and stagnant system. Given the next trend to be discussed, stagnation is a particularly dangerous state.

Rapid Rate of Change in Technology and  
"Transitory" Career Management Systems

The threat of obsolescence or diminished technological "half life" is getting stronger constantly. As Toffler<sup>14</sup> pointed out some time ago change rates seem on an exponential curve. Furthermore, societal values and forces seem to be less and less stable. Witness the gyrations of the space program.

What these trends point to is the need for individuals and systems with a "Transitory" orientation. This is defined as a Career Concept in which frequent change (every 2-4 years) is seen as a way of life -- with no need for stability or upward movement. Variety and challenge are the key motives. Ironically, given the turbulence of engineering industries, the Transitory Concept may be least prevalent among engineers. This low frequency may be due to the highly structured nature of engineering work-- which clearly favors a more stable Career Concept such as Steady State.

What would be highly useful would be a systematic survey of Career Concepts among engineers. This would indicate what types of Career Management Systems are currently suited to existing people. Such data could also point to possible needed changes in engineering recruitment and education at universities. In the absence of this kind of data base, it can only be suggested that some Transitory engineers may exist. If so, special Transitory Career Management Systems can be designed where high instability of project or technology is expected.

A Transitory Career Management System could include:

1. Temporary team organization
2. Training on state of art and "coming" topics
3. Performance Appraisal on current output only
4. Out-placement service with potential for rehire
5. Rewards centered on immediate payoffs--e.g.. bonuses tied to monthly performance levels. Benefits made portable or not emphasized at all.

Transitory Systems are probably more identifiable in areas such as entertainment or financial speculation yet they could thrive in high technology environments, especially where stability is extremely low. At present, however, Linear and Steady State systems or cultures seem most prevalent. Here again, to foster Transitory Systems tolerance and support from more traditional groups will be needed.

A criticism of the Transitory approach is that its time focus is too short to foster competence or creativity in very complex fields. Transitory approaches may prove useful in moderately complex, well understood, and unstable projects but still another career approach may be needed in the frontiers of extremely complex technology.

Rising Need for Complexity and Creativity and  
"Spiral" Career Management systems

Technology is not merely changing--it is trending in a direction of increasing complexity. This complexity requires longer study and immersion than a Transitory Approach may permit. Simultaneously greater creativity than ever is needed to fan flagging productivity in America.

These trends suggest a need for "Spiral" career concepts. The Spiral concept defines careers as 5-10 year cycles of involvement in a changing

array of career fields. In a Spiral career, people get deeply immersed in a field for a fairly long period until no more inner development occurs, then they withdraw for a time and discover a new direction in which to grow. The new direction may build on previous strengths or be a totally new departure. An essential aspect of such careers is a steady growth of inner complexity and a strong reliance on creativity.

Spiral career concepts lend themselves readily to areas of technology which are very advanced, unclear, and which require intense prior experience in related fields.

In the 60's, it appeared that the frequency of Spiral concepts was on the rise; including among engineers.<sup>1</sup> However, current patterns suggest the Spiral pattern is receding.<sup>4</sup>

Spiral Career Management Systems could involve the following elements:

1. An "open systems" type organization in which hierarchy is minimized, roles are not permanent and rotation laterally is the major career process
2. Training is offered in totally new fields--including managerial
3. Performance appraisal is based on creativity and breadth of knowledge
4. Rewards are aimed at facilitating growth e.g., sabbatical leaves, new assignments in and out of the organizations, more creative projects
5. Management is of temporary project leader type--not permanent. Participation is maximal.

Systems of this type have been tried in some degree--yet they appear to be fairly fragile, especially when they confront the values of powerful Linear or Steady State people. Frequently such systems are too threatening and are eliminated, despite fairly good track records of productivity in many instances.<sup>9</sup> One solution is to surround or "buffer" Spiral systems by individuals or units who can relate to more traditional persons.

Ultimately the above considerations suggest that no one Career System is always optimal. Clearly, Career System design is contingent on both environmental and individual factors.

### Strategic Considerations in Selecting Career

#### Management Management Systems

The selection of a Career Management System can depend on a variety of factors:

1. Project structure and strategy
2. Technology employed
3. Nature of customer/client Career Concepts
4. Current Career Concepts among employees

For instance, if a project is of short duration a Transitory system would seem optimal, all else equal. If a project is long term and very stable, a Steady State System would seem most appropriate. If a project is expected to steadily expand in scope over a long time, a Linear System is indicated. Finally if a project is expected to be of moderate duration and possibly spin off new projects, a Spiral System should be best.

If the technology involved is essentially the maintenance of a well established process then the Steady State System would fit best. If the

technology involves the creative evolution of new ideas, the Spiral approach would be optimal. Exploration of current technologies in new areas would argue for the Linear System. Finally, if one seeks a rapid application of new technology the Transitory pattern would be preferred.

One might consider the relationship with one's client/customer. The hypothesis would be that similarity would be optimal. For instance, a Linear customer organization might view a Steady State System as lethargic. A solution here would be to develop external contact units/persons with Career Concepts appropriate to their contacts.

Finally, in any design effort one should consider the current state of Career Concepts among employees. If fit between the desired Career system and current employee concepts is poor, training could be employed to alter Career Concepts. At present no forecast can be made as to how successful this would be. Reassignment of poor fits and hiring of better suited employees can also be considered. Costs associated with employee loss or misuse have to be considered in strategic Career planning. At times strategic consideration may have to yield to employee realities.

#### Pluralistic Career Management Systems

Given the variety of strategic factors involved, it is not likely that a given organization can emerge with a single preferred Career Management System. More probable are either different systems for different departments or a mixed pluralistic system for the entire organization.<sup>3</sup>

The first approach might be illustrated by imagining a company whose Research unit is Spiral, with a Steady State manufacturing unit, a Transitory marketing unit and a Linear top management. Yet again one

might argue for combinations, e.g., a mix of Steady State depth and Spiral breadth in an R & D unit. In the extreme case, one might opt for pre-determined proportions of each type in all units.

This pluralistic approach would require careful assessment of individuals and informed self-determination by employees as to which of the four distinct Career Management Systems they would like to associate with. Top management would have to approve of all four systems overtly and with roughly equivalent monetary rewards to avoid equity issues.

#### Conclusion

The strategic factors cited above suggest the need for Non-Linear Career Management Systems--particularly in frontier technology areas. Yet current data on career concept frequencies in America <sup>4</sup> suggest that a massive growth of the Linear concept is currently occurring. What this trend suggests is that management will increasingly employ the already highly prevalent Linear approach to careers--to the exclusion of all other approaches. This development could produce a traumatic reduction in technological productivity among the engineering profession. What is needed in addition to managerial involvement in this issue is an approach by the engineering profession itself which could include:

1. Assessment of current and projected concepts among varied type of engineering fields.
2. Analysis of career systems currently in use, (especially non-Linear systems) as to their effectiveness in varied strategic settings
3. Development of awareness among engineers and managers of the technique of strategic Career System design and resultant pluralistic solutions--especially in areas of advanced technology.

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