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ABSTRACT

This study investigated the effects of corporate financial support on the University of California Los Angeles (UCLA) School of Engineering and Applied Sciences (SEAS) curriculum. The study evolved out of growing concerns that many university educators have related to the mushrooming of university efforts to secure corporate financial support without controlling the limits of corporate pressure on university decision-making. Major areas considered were: (1) the concerns that UCLA/SEAS Industrial Associates (IA) have relative to the content and development of the UCLA/SEAS curriculum; (2) SEAS faculty concerns regarding impact of increased IA contributions on the content and development of the SEAS curriculum; and (3) evidence that faculty cite as negative curricular effects of increased corporate giving through the IA program. Among the findings (obtained from analyses of interviews and such documents as contract reports and minutes of various meetings) are those indicating that although both groups expect curricular change, SEAS faculty do not expect to implement change at the pace expected by the IA representatives, that IA organizations must more clearly define the nature and purpose of their relationship with SEAS, and that the IA liaison is appointed more often by role in the IA organization than by school affiliation. (JN)

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ENGINEERING CURRICULUM AS AFFECTED BY CORPORATE GIVING

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Paper presented at the annual meeting of the American Educational Research Association, March 31 - April 4, 1985, Chicago, Illinois.

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PURPOSE

In recent years, institutions of higher education have been expanding their efforts to secure funds from the corporate sector of the economy. Traditional sources of funds such as private donors augmented by the government in the past century are not providing sufficient support for many universities to maintain and expand educational programs. This study evolved out of the growing concerns that many university educators have for the unchallenged expansion of what may be referred to as the "educational-industrial" complex. Their concerns relate to the mushrooming of university efforts to secure corporate financial support without controlling the limits of corporate pressure on university decision-making.

Discussions with administrators in both university and corporate sectors and the faculty of higher education suggest that an inherent power struggle may exist among these three groups. The goals of these three groups are different. The university administrators are searching for funding which will maintain and expand programs under their direction; corporations are interested in supporting or developing educational and research programs which will provide trained personnel information for their purposes; and faculty are concerned with transmission of knowledge as well as the creation of new knowledge. Theory as shown in figure 1 indicates that there should exist an ideal situation in which the desires of all three groups could be fulfilled. However, values, perception, and concerns of these groups need to be examined so that a mutually harmonic balance can be secured. In order to study the existing tensions among these three groups, this study was undertaken. Analysis of colleges within universities indicated that schools of engineering were the most active in securing financial support from outside corporations. The UCLA School of Engineering was selected for study because this school has established a reputation nationally and internationally for a high quality program and because one of the researchers had been a participant observer of the development of their efforts to secure corporate support for the previous five years. This study had full access to meetings, information, administrators and faculty who participated in the activities of corporate support to the university during that time.

The purpose of this study was to describe the effects of financial support from the UCLA School of Engineering and Applied Science (SEAS) curriculum.

What are the concerns the UCLA/SEAS Industrial Associates have relative to the content and development of the UCLA/SEAS curriculum?

a) Is the category of support related in any way to the to the curriculum concerns of UCLA/SEAS Industrial Associates?

b) Is the amount of support related in any way to the curricular concerns of the UCLA/SEAS Industrial Associates?

c) Does the level of office of the corporation donor affect the curricular concerns of the donor?

d) Does the level of office of the corporation donor affect the category of support?

e) Does the level of office of the corporation donor affect the amount of support?

f) Is there a relationship between school affiliation and I/A support?

g) Does the amount of the I/A contribution relate to the degree of curricular impact?

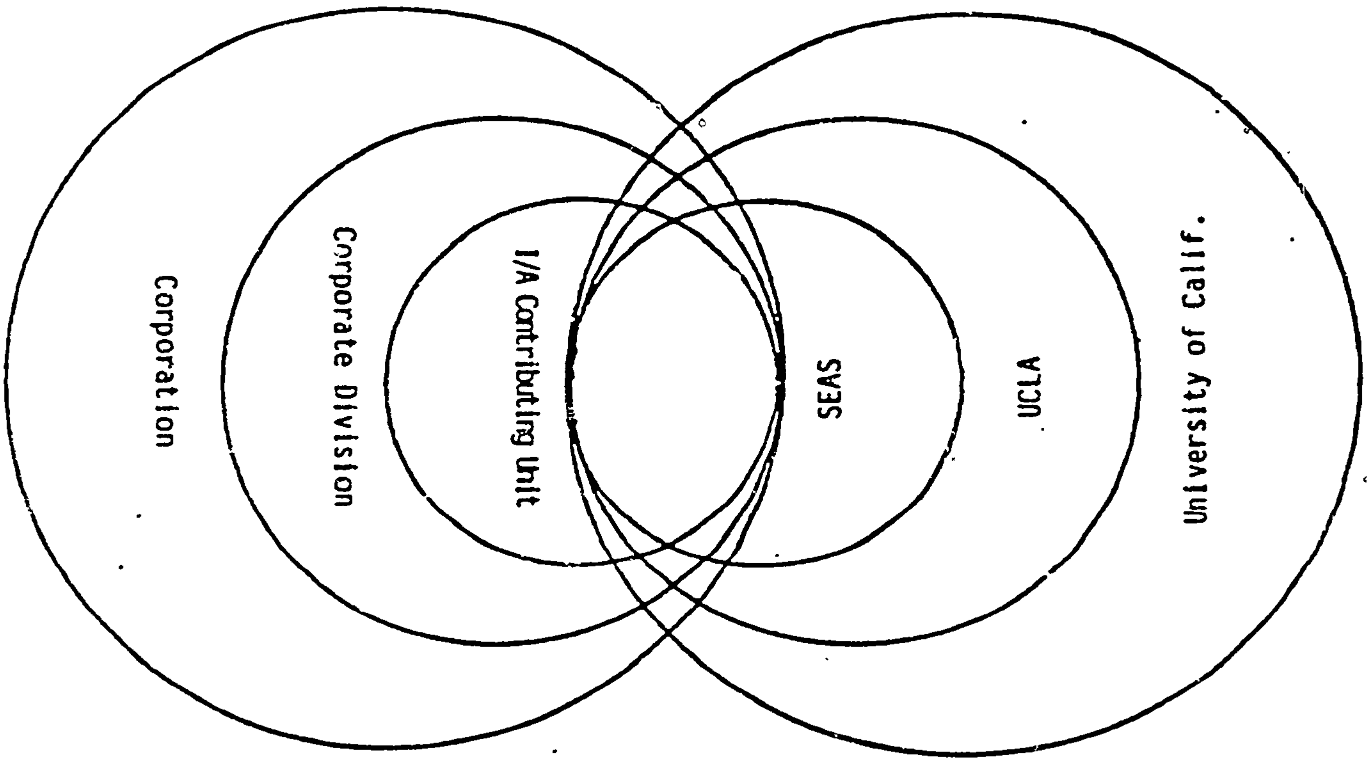
What are the SEAS faculty concerns with regard to the impact of increased Industrial Associates contributions on the content and development of the SEAS curriculum?

a) Is there any difference in the concerns of faculty regarding curriculum impact resulting from the expansion of the I/A Program between faculty involved in I/A support research and those not receiving support?

b) Is faculty rank a factor regarding faculty opinion about the curricular impact of increased corporate giving through the I/A Program?

What evidence do faculty cite as negative curricular effects of increased corporate giving through the I/A Program?

The model in figure 1 depicts the structure of the current interactive relationship between SEAS and its Industrial Associates.



BACKGROUND OF THE STUDY

Forces of the Social System

Historically, engineering schools and private industry have collaborated closely with respect to the development and advancement of engineering education and research. This collaboration has revolved around the goals of producing the intellectual capital necessary to support the growth of a technology oriented social system.(1) Intellectual capital results from the basic activities of the university, which are basic research and teaching. The result of basic research is the creation of new knowledge, which Simon Ramo indicates, will determine the future of our social system.(2) The university also develops the knowledge worker who can implement this new knowledge.(3) In a social system where efficiency and productivity determine economic success, intellectual capital is its most important resource.(4) Kerr reiterates this by pointing out that "new knowledge is the most important factor in economic and social growth."(5) The university is vital because it is the only institution in the American social system currently structured to develop intellectual capital.(6) As well, it is the institution with major fiduciary responsibility for maintaining the social systems 'cognitive complex.' The cognitive complex is the infrastructure that provides the environment and processes to develop the intellectual capital.(7) Kerr fuses this discussion by pointing out that "knowledge may be the most powerful single element in our culture..."(8)

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The rapid acceleration of technology, as a result of the development of new knowledge, has generated increased needs for intellectual capital.(9) However, this technical expansion is occurring at a time when engineering schools have diminished capacity for maintaining concurrence with the acceleration of technical application. There are a core set of institutional and economic factors that are the causes of this incapacity; they are:

1. The widening gap between technology application experience required by industry, and the technology application experience attained by engineering graduates.(10)

2. The decreasing availability of State and Federal resources to support higher education in general, and engineering education in particular at public research universities, while the cost of increasing the number of graduates and the capacity of research has accelerated.(11)

3. The inferior capability of current laboratory facilities resulting from over ten years of insufficient resource allocation. (12)

4. The lack of resources to improve teaching and research laboratories resulting from diminished public sector support.(13)

5. The diminishing population of engineering faculty resulting from the decline of graduate enrollment since 1973.(14)

6. The increased demand for engineering graduates resulting from unparalleled expansion in high technology corporations.(15)

7. The restriction on increases in undergraduate enrollment resulting from insufficient resources, faculty and facilities.(16)

8. Minimal support from industry for public universities.(17)

Concern for the possible damaging effects of these conditions has resulted in a variety of meetings to consider redefining and strengthening the relationship between industry and engineering education, so that the resources required to ameliorate these conditions can be generated. Examples of those meetings include:

1. Meeting: Watsonville, California, involving the presidents of Harvard, California Institute of Technology, Stanford, Massachusetts Institute of Technology, University of California and the presidents of Beckman Instruments, Inc., Syntex Corporation, Ceetus Corporation, Cabot Corporation, Applied Biosystems Inc., Damon Corporation, Gillette Corporation, I.E. Dupont de Nemours & Company, and Genentech, 1982.

2. National Engineering Action Conference, involving high level leaders from industry, government and engineering education. April 7, 1982, New York City.

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3. Conference presented by the California Engineering Foundation concerning "Employer Needs and Policy Constraints." November 30, 1981, Pomona, California.

4. Regents Lecture Seminar on "The Technology Slip." Simon Ramo, presenter. April 22, 1982, UCLA, Los Angeles, California.

5. Seminar on technology. Governor Jerry Brown, presenter, March 15, 1982, UCLA, Los Angeles, California.

A former engineering dean indicates that the acquisition of additional resources from industry is critical to the survival of engineering education. Engineering schools, like UCLA, will not be able to continue to maintain effective programs without assistance from industry.(18) In support of this position, O'Neill outlines the reasons for the overburdening cost involved with maintaining a quality program. He maintains that the extraordinary cost at UCLA are related to:

1. Increased school enrollment beyond the capacity of the faculty and teaching resources,

2. Current age of lab equipment; (age of campus equipment is twice as old as the equipment used in industry),

3. Steadily declining resources available for the leasing or purchasing of equipment,

4. Reduction in equipment useful life span, related to

increased use and technology growth,

5. Increased updating and expansion cost after fifteen years of under-allocation.

The recapitalization of the engineering equipment at UCLA is certainly a task beyond the current resources available. In light of the diminishing resources from Federal and State governments, industry is the most viable source for increased support. Although currently a small percentage of the total resources is utilized to operate the university (3.6% at UCLA), industry seems to be the area where significantly increased support is most possible. This fact is another stimulus for closer collaboration between SEAS and its Industrial Associates. Table 1 charts the growth of corporate contributions to UCLA, 1979-1981.

Table 1
CORPORATE SUPPORT TO THE
REGENTS AND FOUNDATION OF UCLA

	1979-80	1980-81	% increase or decrease
Total UCLA Private Support	32,396,605	40,986,7532	+27
Total Corporate Support	6,479,321	9,836,820	+51

Viewing the aforementioned condition in engineering education as a crisis in California, the Governor initiated two programs that have the common goal of enhancing the capacity of engineering schools in California in collaboration with industry and the state government to develop the intellectual capital required by the high technology based economy of the state. One program, the Micro Program, has been funded to foster collaborative research between engineering schools and industry in the area of microelectronics. The second program, the Investment in People Program (IIP), has been funded to improve the recruitment and retention of students in California engineering schools.

Actions like these on the part of government point out the great concern that exists with regard to the possible erosion of quality in research and teaching in engineering schools. If these actions become indicative of attempts to ameliorate the crisis conditions, closer collaboration between industry and engineering schools is a very likely outcome. It therefore becomes important to consider the possible effects of this closer collaboration on the content and development of engineering curriculum.

One prominent engineering educator and corporate executive feels that the resource considerations are secondary to the pedagogical implications of more intense collaboration.(19) In this regard, a key issue that must be addressed is, how does corporate financial support to an engineering school exert pressure for that engineering school to conform to the curriculum goals of the corporate supporters? Another key issue is, how do engineering schools handle such pressure, while encouraging continued corporate support? The answers to these questions will certainly be critically important to curricular development in engineering schools.

Historically, engineering schools and industry have had a symbiotic relationship, in terms of engineering curriculum development. The intent of this study was to determine if there will be any substantial alteration in this relationship as a result of the previously mentioned fiscal problems currently affecting engineering schools. The analysis of this issue has further significance in relationship to the nature of corporate philanthropy. Many scholars of corporate giving indicate that it is typical for corporate philanthropy to be driven by optimization and measurability. (20) It is also expected that corporate giving will result in a tangible return on the investment.(21) It would seem that these factors could possibly result in pressure on engineering schools to accommodate the curricular demands of corporate donors. This study attempted to investigate the variables related to this possibility.

Currently, there is not evidence to indicate that research has been conducted to carefully identify and examine the variables related to the impact of expanded corporate support on the content and development of the curriculum of a particular engineering school or engineering schools in general. Therefore, in order to develop the baseline data regarding this impact, this study utilized the case study method to comprehensively examine the UCLA/SEAS environment. This environment was selected because it provides sufficient information and the motivation on the part of its administration and faculty to identify the variables in question. In the process of the identification and the analysis of the variables involved, this study also examined the subject areas of open systems, technical determinism, corporate philanthropy and curriculum planning in engineering education. Consequently, it is expected that this study has augmented the knowledge in these areas, as well as identified the variables that will assist UCLA and possibly other engineering schools in understanding the effects of corporate giving on engineering curriculum.

Open Systems

In an attempt to establish the appropriate framework for this study, it is important that the concept of systems, social systems and open systems be treated briefly. Novotney defines the term, by delineating a system as "interrelated components unified by design to achieve a single or multiple objectives."(22) A very prolific contributor to this subject, K. Boulding, felt that a system consists of successive states, i.e. s_0, s_1, s_1, where the change in one state to the next results from the impact of another. He labeled this characteristic "ecological succession." (23) Boulding also indicated that systems are ordered, regular, non-random and concrete. These characteristics allow systems to be altered by manipulation.(24) In the opinion of this study, the utilization of multiple definitions of the phenomenon of systems offers a more complete explanation of the term. Thus, from the various perspectives set forth above, it is apparent that systems are typically: dynamic, interconnected, interdependent, unified by design, concrete and goal oriented. Understanding the concept of a system is a prerequisite to understanding the concept of social systems.

Bickel and others describe the social system as "a system that functions to organize collective action, to maintain and transmit a shared belief system and coordinate the various sub-systems."(25) The social system has been defined by Loomis as, "a system that structures patterned interactions of sub-systems into interdependent reciprocal activities."(26) With regard to these definitions, as well as the previous system discussion, consideration of the American social system can proceed.

The American social system has developed from the cumulative experience of numerous differentiated sub-systems. Ferguson indicated, that the American social system, as a result of its components of Federalism, representative democracy, separation of powers, checks and balances, natural rights and citizen access and participation, is by design a system of interdependent inter-related sub-systems that share a causal and reciprocal environment.(27) The American social system was designed to be an open system. The following discussion supports this affirmation.

What are the characteristics of the open system and how does it behave? Various scholars of the American social system have answered these questions. Griffiths and McWhinney have identified the significant characteristics of an open system operating in the American social system. They are:

1. The ability to exchange information, matter and energy with the general environment, within its own environment and with the environments of other open systems,

2. A reactive reciprocal relationship to the general environment,

3. The tendency to seek dynamic equilibrium,

4. An orientation toward equifinality,

5. A hierarchical orientation,

6. An orientation towards multiple goals,

7. A predisposition towards expected outcomes.(28)

How do these basic characteristics relate to the specific behavior of open systems in the American social system? Easton indicates, that the open system is stimulated into activity as a result of inputs provided from other open systems in a shared or general environment; or it can be stimulated into activity from within the system.(29)

This reactive state assumes that the systems have boundaries that are permeable. This characteristic provides one system access to another. This access makes it possible to mutually exchange energy, matter and information. It is important to note that this researcher feels the reaction of a system to input and its reciprocal output are linked in a linear relationship. This means that the intensity of the input determines the intensity of the output, as well as the overall effect the input has on the entire system. There are two types of actions possible related to the intensity of the input. One action is defined by Loomis as interaction. He defines interaction as an event where one system influences the actions of another system.(30) The second type of action is interpenetration, which is an action where the input of one system to another is expected to alter or change the system in some way.(31) This distinction between interaction and interpenetration is critical to understanding this research. Interaction allows for the exercise of free will, whereas, interpenetration does not. Change is a possible outcome with interaction. Change is an expected outcome with interpenetration. Although the distinction is subtle, understanding the distinction is critical at the time system goals are considered in depth.

An open system tends to seek equilibrium with regard to its various environments. More explicitly, open systems seek dynamic equilibrium. Dynamic equilibrium is a state of balanced flow of energy, information and materials in and out of the system. In other words, the system reacts to input and reciprocates with output.(32) Loomis indicates, this double contingency creates dynamic functioning continuity within the system.(33)

Equifinality is the tendency of open systems to expect similar results to a mutually identified problem, subsequent to interaction or interpenetration.(34) It must be noted, however, that Griffiths, in his treatment of the concept of equifinality, did not account for instances where each system is seeking dissimilar results to a mutually identified problem, subsequent to interaction or interpenetration. Therefore, it would seem helpful to introduce the term divergentfinality to account for this occurrence. In those instances where the concept of divergentfinality is relevant to the discussions, this study will use it.

The majority of theorists in this area agree that open systems are hierarchical. This characteristic relates to the fact that there are sub-systems that contribute to the processing efforts and resulting output of any system. This characteristic contributes another element to the discussion of system goals. The hierarchical nature of open systems results in the generation of multiple goals. These goals are generated by each sub-system and directly affect the systems orientation toward equifinality or divergentfinality. McWhinney, in his experiments, discovered that each sub-system often relates to different sub-environments. This characteristic also contributes to systems having numerous goals.(35) McWhinney clarified another characteristic of an open system. He ascertained that, as a result of the sub-environment in which they are embedded, systems can be classified and expected to exhibit certain general behavior. He classified the environments as:

1. <u>Distributive Reactive Environment</u> - Clusters of similar systems and sub-systems in a common environment.

2. <u>Random Interactive Environment</u> - Systems and sub-systems operating in an environment where interaction and interpenetration directly affect another system.

3. <u>Placid Randomization Environment</u> - Systems and sub-systems in a nondynamic environment that interact if they inadvertently come into proximity.

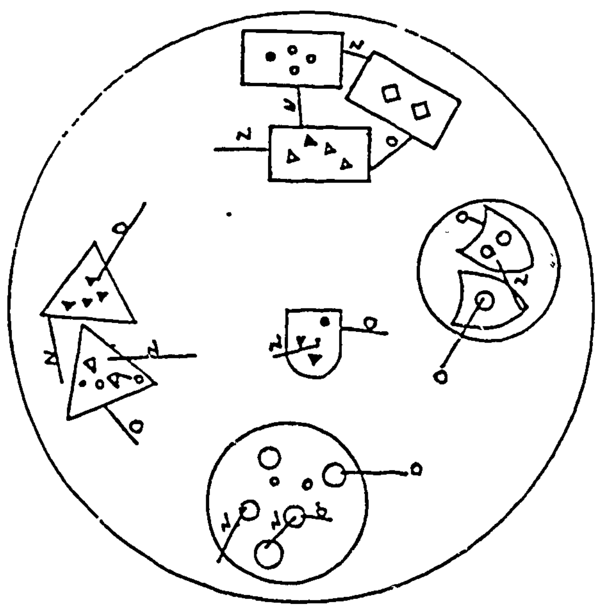
4. <u>Placid Cluster Environment</u> - Systems and sub-systems in a nondynamic environment that interact as a result of proximity and commonality.

5. <u>Turbulent Environment</u> - An environment in which systems and sub-systems are in constant activity and subject to rapid change and alterations.

The open system and its sub-systems have characteristics related to their environment that directly affect the nature of their actions. This environmental analysis provides a useful framework for the analysis of the behavior of an open system within the American social system.

In an effort to further clarify the complexities of the concepts previously set forth, the models in figures 3, 4, 5, 6, and 7 have been provided. The models represent various possible relationships between systems and environments. Cyert has vigorously demonstrated that more model development is needed in social science research for explanation and prediction purposes.(36) Models provide a visualization of the connectivity of the systems and sub-systems.(37)

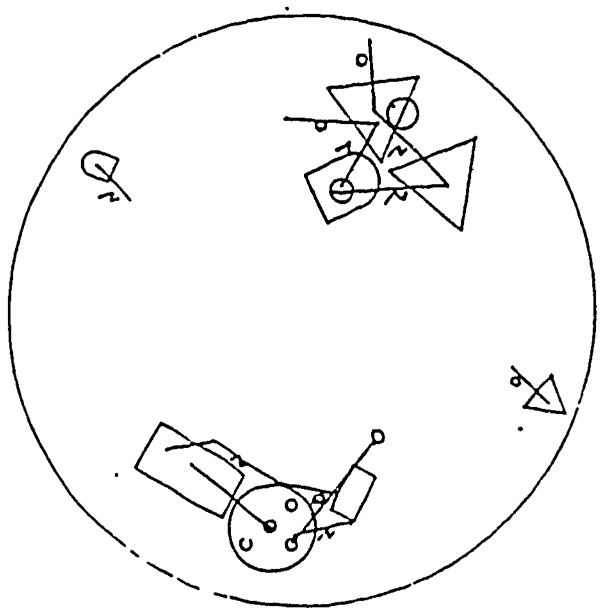
N = input



0 - output

Fig. 3 Distributed Reactive Environment

N = input



0 = output

Fig. 4 Random Interactive Environment

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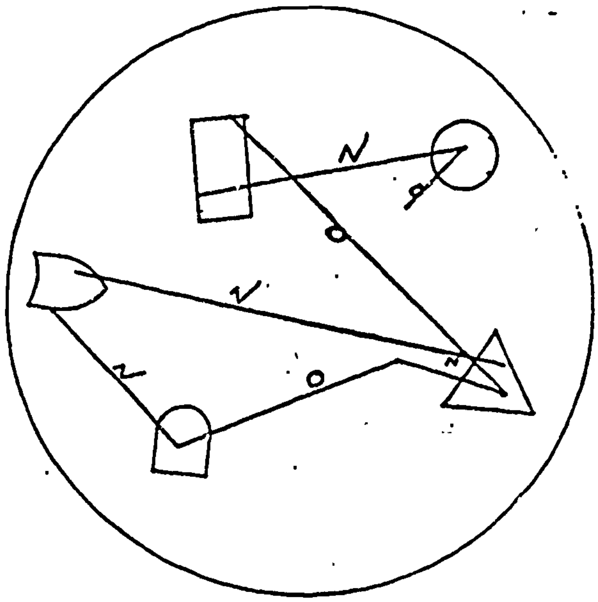
N = input



0 = output

Fig. 5 Placid Randomization Environment

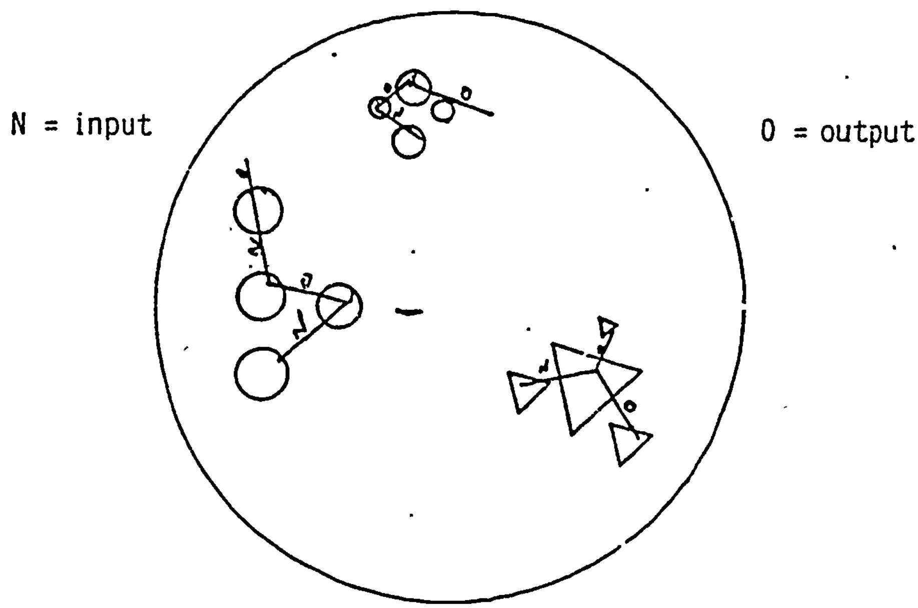


Fig. 6 Placid Cluster Environment

N = input

O = output

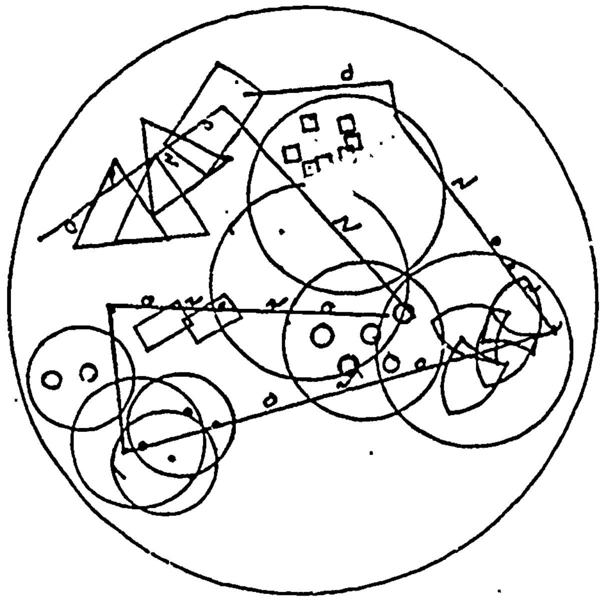


Fig. 7 Turbulent Environment

The foregoing discussions provide a framework for the analysis of the nature of systems, social systems and open systems, so that these can be applied in the context of this study.

The Impact of Technology

In reviewing the history of technology and its impact on the American social systems and sub-systems, it is clear that technology has been a compelling force in the American system of production. This is a common view that has developed from the analysis of various social theorists. One of the best known evolutionary theorists, whose observations evolved out of a comprehensive study of the Enlightenment, to link technology and its impact on a social system, was Karl Marx. He indicated that technology directly influences the nature and structure of economic and organizational relations.(38) A.C. Bolino indicated, that technology is a fundamental dimension of the American social system that has always been on the agenda, particularly with regard to the system of production.(39) Veblen, with regard to technology, indicated that many fundamental values of the American social system have been altered by technology.(40) The importance of technology is further acknowledged by a contemporary historian of technology in America, who suggests that the structure of the American social system has evolved from technological change woven into the development of politics, economics and social relations of the system.(41) Boulding indicated, that technology is a logical outgrowth of increased information and knowledge.(42) He maintained that knowledge in the American social system doubles with each generation.(43) Therefore, technology and its impact on the social system can be expected to expand.

Many economists view technology as a means of production in a capitalist system. It is one of the primary aspects of economic life through which the associated components of the social system are interconnected.(44) Capitalism and its demand for efficiency, productivity, knowledge and optimization, has been a significant factor in the expansion of the role of technology in the American social system.

Another key factor in the viability and profitability of a capitalist system is manpower. Manpower is a key resource in a society significantly impacted by technology.(45) The development of the knowledge worker is a critical task, since without the knowledge worker a production system, dependent on technology, could not proceed. The basic consequence of the lack of intellectual resources would be the demise of the system.(46) Boulding reiterates the importance of the knowledge worker by indicating, that a social system that creates knowledge at such a rapid rate, the persistence and development of the system are inexorably linked to the capacity of its intellectual resource. Boulding further indicates that this relationship results in the interpenetration of the needs of technology into the educational system. Elaborating on this concept, Boulding and others point out that educational activities and programs must support the needs of production if the social system is to persist and develop.(47)

The interpenetration of technology into and the interaction of technology with the key components of the economic success of the American social system has intensified the impact of technology on the system. Although technology is not a primary factor in the development of the American social system, its significance is becoming more pervasive.(48) The changes that result from technology are derivative changes that result from the adaptations of interacting and interpenetrating systems and sub-systems, rather than direct cause and effect relationships.(49)

The foregoing discussion suggests that change in the American social system is not, in all cases, directly linked to technology. However, technology does often affect the general direction of the change, but not the specific configuration it will take. This configuration would depend on the interactions of various systems and sub-systems within the social system.(50) Nonetheless, it is clear that technology is what Boulding labels as "accelerator" in the American social system. As an "accelerator" technology in the American social system will induce input and produce increased output (change) in the direction of the acceleration. Thus, technology as an accelerator has impacted American higher education in general and engineering education particularly.

Some Curricular Considerations

According to Parsons, education is the American institutional system with the major fiduciary responsibility for the formulation of the programs and processes that develop the competence required by a social system significantly influenced by technology. Curriculum is the cornerstone of this institutional system.(51) In a social system that must contend with accelerated change and the maintenance of technical competence, the educational system is vitally important.(52) Since curriculum is a critical factor in the infrastructure of this institutional system, curriculum development is a subject that requires elaboration. Firth et al indicated, that curriuclum results from a complex interaction of people and things in a dynamic setting. This interaction encompasses the questions to be debated, the forces to be rationalized, the goals to be illuminated, programs to be activated and the outcomes to be evaluated.(53) The key concept in his discussion is interaction. Many other scholars have commented on this notion of interaction. For instance, Tyler, by his utilizations of the three data sources to determine education goals and related structure, 1) subject matter experts, 2) contemporary society, 3) the learner, provides all concerned sub-systems and individuals with access to interact in the total curricular process.(54) Goodlad discusses this interaction in his explication of the ecological relationship between education and society.(55) Francis Chase, in his study of the impact of the environment on the curriculum, identified the key factors that affect the purpose, content and form of the curriculum. These factors are:

1. The rapid growth and pluralization of the environment;

2. The increasing demand for skilled and technically literate workers, resulting from technical development;

3. The constant acceleration of the rate of change.(56)

Chase, by his discussion, points out that curriculum is defined as a result of its interaction with the sub-system in the social system that impact the institution where the curriculum is in operation.(57) Hiatt and others have indicated, the curriculum is affected by a totality of environmental, psychological and educational forces.(58) This educational premise represents a more dynamic view of the political process of curriculum change than the screening processes depicted by Tyler. However, Apple points out, in this interaction process, another key variable that determines what the curriculum actually becomes. This variable is the perception of reality of the teachers, as defined by their specialization and ideology.(59) When the teacher and their perception of reality encounters the learner, the resulting interaction is what finally determines what the curriculum evolves to be.

The university curriculum is certainly a result of its interaction with the environment. This interaction affects the purposes, goals, ideology and structure of the university curriculum. This interaction and its effects have been commented on by various scholars of higher education. The current president of the first university to be established in America, relates the responsibility of the university as having "to take the needs of the social system into account and address those needs through the functions of research and teaching."(60) Parsons, in his seminal work elaborated on this interactive relationship by indicating, that the responsibility of the university is as "trustee and developer of the 'cognitive complex' and its associated interests."(61)

A brief historical discussion will provide a framework for analysis of the environmental factors in the American social system, that have influenced university curriculum in general and engineering curriculum in particular. The literature that chronicles the university curriculum is less voluminous than the literature that addresses the pre-school, primary and secondary school areas. However, there are several contributions that should be noted. Levine, in his historical synthesis, indicates, that the key factors to consider, relative to the content and development of university curriculum, are several historical eras, as well as the current environment. There are three historical eras of major importance. The first era lasted from 1636 - 1870. It was an era based on standard Christian theology and the cultural heritage of Western civilization. The second era emphasized new knowledge and program development based on that new knowledge. This era lasted from 1870 - 1960. The third and current era has existed since 1960. This era is a combination of the previous two eras with an emphasis on the student as client. Levine pointed out that, although these eras significantly influenced the content and development of university curriculum, the impact of the contemporary environmental factors were quite significant as well. He indicates, this interaction usually fostered ad hoc growth, conflicting educational purposes, as well as imprecise institutional structure.(62) In spite of the boundless contradictions and imprecise institutional structure, Kerr felt it was important to continue to refine the interactions between the university and its environment.(63) Since the university is an institutional system with a tendency to be an open system, this continued interaction ought to ultimately reduce the contradictions and incongruences.(64) Consequently, interaction would be expected to intensify to curtail the aforementioned contradictions and incongruences as well as to satisfy the academic needs of technology.

The development of engineering curriculum reflects the conflicts, contradictions and incongruences that exist in curriculums of the American university. The curricular foundation of the American university evolved out of two European academic traditions. The first tradition was the study of the Trivium, which was a set of designated learning experiences; grammar. logic and rhetoric. The second tradition is the study of the Quadrivium, which was a set of designated learning experiences in geometry, astronomy, arithmetic and music. These experiences were supplemented by a substantial amount of Bible study. As a result of this academic rationalist orientation, engineering curriculum content has historically been out of phase with the technical development of the American social system.(65)

As literature reveals that the formal study of science at the university level began at Harvard in the 1800's. It emphasized the use of science as an instrument of human understanding and the contemplation of the divine.(66) As a result of the preponderant influence of the humanities, philosophy and religious study in the early American universities, the study of science began its existence constantly justifying its academic integrity and importance. This fact drastically slowed down the process of focusing scientific study on application instead of philosophy. Scientific literacy and applied skills were not priorities in the classical American universities like Harvard. However, in 1815, Harvard recognized the need to explore the application of science. As a result of this recognition, a series of lectures were developed to consider the utility of the physical and mathematical sciences for the improvement of the useful arts, the extension of industrial prosperity and the happiness and well being of society.(67) David Noble chronicles the impact of this effort on the development of the engineering curriculum.(68) In 1816 the Erie Canal project revealed the inadequacies of the science education of the day. In 1823, Rensselar was established. It was the first time an institution was dedicated to the study of science and its useful applications. This was a major move towards greater academic legitimacy of the study of the applied sciences. Yale, in 1846, and Dartmouth, in 1851, reoriented their science curriculums toward application. By 1862, and the passage of the Morrill Act, the impetus for interfacing the study of the laws of science and the study of the application of those laws, for current and future needs, firmly established the foundation for the development of the engineering curriuclum as it currently exists.(69)

Engineering curriculum, as it has evolved from the study of the philosophy of science to the study of applied science, has been interpenetrated by the technology needs of the social system. Parsons indicates, that it is the responsibility of the university, through engineering and the natural sciences, to extend the technical capacity of the social system.(70) Parsons felt the interactive relationship between the university and the social system is a key factor in accomplishing this task. The interaction between the university and the environment was emphatically articulated by White, who stated that, "there is some analogy between the college and the manufacturing plant which receives partially fabricated metal, shapes it and refines it somewhat, and turns it over to some other agency for further fabrication. The college receives raw material...It must turn out a product which is saleable...The type of curriculum is in the last analysis not set by the college but by the employer of the college graduate."(71)

R.R. O'Neill, a former Dean of engineering, indicates, it is mandatory to maintain concurrence with the technological advancements of society.(72) Thus, the curricular process in engineering schools accepts interaction, as well as the possibility of interpenetration.

However, in light of the aforementioned pressures facing engineering education, the rapid growth of technology, and the solicitation of more extensive corporate support, there could be an erosion of internal control of the curriculum development process. Consequently, the impact of corporate philanthropy on the curricular process in engineering schools certainly needs to be critically examined.

Philanthropy

In the American capitalist economic system, corporate philanthropy has been a process utilized to reinvest a portion of the profits back into the social system. corporate philanthropy has been described as a spirit of good will demonstrated by enlightened efforts to promote the welfare of the social system.(73) This tradition of investment in the society can be traced back to the founding of the early American universities. It's certain that without philanthropic efforts, higher education would not have come into existence or flourished in America. For instance, the first college to be established was Harvard in 1663. Initially, it was totally supported by community contributions. This support resulted from the need of the social system to train clergy and men of law. This philanthropic effort represented the people of means supporting efforts that were felt, at the time, necessary for the social system to survive and grow. From this foundation, philanthropy became an important factor in the growth of American higher education.

The subject of philanthropy has been given considerable consideration in the literature. However, the subject of corporate philanthropy has received less treatment. More specifically, little has been written about the interpenetration and interaction of corporate philanthropy with the social system and its sub-systems.(74) The basic guidelines relative to corporate philanthropy were clearly outlined by Drucker. He points out that the nature of the social system requires corporate participation in the advancement of the social system and that responsibility must be structured to consider the following:

1. The social responsibility of a corporation extend only into the social, political, economic milieu, where the organization has a valid interactional relationship;

2. The overall responsibility of the corporation is to maximize profits. Corporate giving must be concurrent with profitability;

3. The philanthropic effort must protect the conditions in the social system that insure economic stability;

4. The philanthropic efforts must not violate the value system

of the organization;

5. The resources given are not given in perpetuity;

6. The philanthropic efforts must have measurable goals and be well planned;

7. The resources allocated must contribute to the success of the receiving organization;

8. The gifts will be monitored as to their goals;

9. Must not be based on tax benefits;

10. The investment extends beyond the current scale of time.(75)

Drucker further indicates, that the organization is responsible for the impact of its actions on the social system. This responsibility dictates that the effort be utilitarian and well managed. Corporate philanthropy is not a one-way charitable contribution. It is an investment that is made to enhance the dynamic equilibrium of the social system.

Drucker presented a general orientation to the concept of corporate philanthropy. Ramo discusses the subject from the point of view of the high technology company. Although Ramo often reiterates Drucker, his perspective is also important to this discourse. Ramo indicates, that the philanthropic efforts of high technology companies must:

1. Contribute to the maximization of profits and the increasing

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market value of stick;

2. Contribute to maintaining the technological position of the company:

3. Contribute to the acquisition of manpower;

4. Contribute to the support of basic research outside the company that can be useful and productive;

5. Satisfy the investors and constituents that the corporation is acting as a responsible citizen of the social system;

6. Prioritize the philanthropic process to be concurrent with current and overall corporate objectives;

7. Expand efforts when market share increases;

8. Expect a return on the investment with regard to trained people or new knowledge;

9. Turn dysfunction, with regard to technology, into a productive situation.(76)

Again, the objectives are not altruistic. They are practical and are propelled by the technical needs of the organization. Although there are those who have the opinion that charity is good business, corporate philanthropy is an investment in the social system with an expected return.

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Obviously, corporate philanthropy, in the American social system, is not a unilateral transfer of resources. It operates in congruence with a basic economic theory, The Exchange Theory. The Exchange Theory is based on reciprocal transfers of resources between two organization.(77) A gives X to B and expects B to give Y to A--$\frac{A\ x\ B}{A\ y\ B}$. It should be noted that the return is not expected at the time the resources are given: however, in the

The exchange of resources and services between the technology based corporation and engineering schools is not a new phenomenon. The first model for this exchange resulted in the development of the Mellon Institute in 1913.(78) The model was the Industrial Fellowship model. The major aspects of the relationship were:

1. To have university affiliation;

2. The ability of industry to collaboratively define the focus of the research;

3. Support personnel to conduct the research;

4. To keep the university researcher up to date on applied research and the needs of industry;

5. To maintain up to date research facilities on the university campus.

The researchers at the Mellon Institute were given two year followships to work on extending the innovation inventory of industry. The developer of this concept, Duncan, vigorously advocated university industry research collaboration.(79) Research and development became the major impetus for the development and advancement of technology in the early 1900's. The engineering schools had the manpower with the research skills, and as a result, were quite well supported.

In 1936, M.I.T. established another model. It was called the Technology Plan. The Technology Plan included:

1. Collaborative research;

2. Clearing house of information on technical subject matters;

3. Contribution of manpower prepared to meet the challenges of the technical corporations.

The nature of the relationships that have evolved from these models have basically addressed two issues;

1. Technical innovation through research; and

2. Preparation of technical manpower capable of maintaining and advancing technology.

Research has been the area where there is most corporate satisfaction with the results. The area of manpower development has been less acceptable. It has been less acceptable because there is a gap between the training required by industry and the training received in the engineering schools. The gap is, in fact, widening because of the rapid explosion of technical knowledge and the limited resources available to engineering education. Engineering education is seen as the critical process through which the human parts of the technology apparatus are generated. It must be coaxed into closer approximation of the skill needs of industry.(80) It is likely that the degree of industry and engineering school interaction regarding the future academic affairs of engineering schools will be significantly influenced by the future manpower needs of industry.

Currently, this interaction of the university and industry has been expanding. The following list of relationships between major research universities and industry is an indication of this expansion. The relationships include:

1. Carnegie Mellon with Westinghouse (robotics);

2. University of Minnesota with G.E., 3M, Honeywell, Sperry Univac; (microelectronics);

3. M.I.T. with I.T.T., General Motors (polymer processing);

4. Rensselar with IBM, G.E., Grumman, Lockheed, Bethleham Steel; (interactive graphics);

5. Harvard with Monsanto (genetic research);

6. University of Washington with Mallinckrodt, Dupont (agri-business);

7. Stanford with Hewlett Packard, TRW, G.E., Fairchild, Texas

Instruments, IBM, ITT, GTE (microelectronics).(81)

Another philanthropic relationship generated by industry's need for manpower and information is the "key school" concept. This concept can be more easily understood by utilizing a specific example. The example exemplifies the application of the exchange theory to corporate philanthropy. The Lockheed Key School Program has, as its major objective, the maximization of its investment in education, in relationship to the current and future needs of the company. Maximization results from: 1) creating a positive recruitment enviornment, 2) influencing the development of the curriculum. The criteria for the identification of a key school are:

1. It has been a long term source of hired graduates;

2. It has been a source of faculty hired as consultants;

3. It has been a source of part-time employment;

4. The faculty interaction has been accessible and relevant;

5. There is receptivity to advice on curriculum planning;

6. It is a source of summer hires.

It is evident that Lockheed expects their investment return in manpower. It is interesting to note as well, that there is an enumerated goal of involvement in an unspecified way in curriculum planning. This most certainly is a result of industry's perception, relative to the widening gap between engineering school preparation and the skill needs of industry.(82)

The current concerns, with regard to the nature of the existing and developing collaborative relationships, can be categorized into two groups. One group of educators are concerned about the structure of the relationships. They were the group that recently met at Watsonville, California to discuss this issue. They were: Derek Bok, Harvard; Marvin Goldberger, Cal Tech; Paul Grey, MIT; Donald Kennedy, Stanford and David Saxon, University of California. The statement issued at the end of the meeting indicated, that the university must be concerned with the "preservation of the independence and integrity of the university and its faculty when faced with unprecedented financial pressures and complex commercial relationships."(83) As repositories of public trust and with the fiduciary responsibility for the cognitive complex, the university has an obligation to remain steadfast in their devotion to research and teaching. (84) They further stated that this concern should not limit the university's interest in "facilitating the transfer of technology from discovery to use"(85) This collaboration contributes to the technical productivity of the social system. However, the economic conditions of engineering schools, particularly, and the pressing technical needs of industry, have created a unique situation that has resulted in, as mentioned above, a lot of new relationships. It is critical that the new relationships be structured and managed so as to not drastically alter the academic prerogatives of engineering education. At the conclusion of the Watsonville meeting, the participants indicated, "we do not view this summary statement as the end of the process of the deliberation on these important issues. Rather. we offer it as a contribution to further considerations in meetings of other groups and in many individual institutions."(86) The concern of the presidents of five major American universities validates the significance of the efforts of this study to consider this issue. In the structuring of these relationships there needs to be criteria established for the acceptance of a gift. As well, the institution must be certain to maintain balance in the exchange. The university must not accept arrangements that compromise autonomy, threaten basic societal roles or affect its ability to conduct research and teaching effectively. (87) Thus, the structure of the relationship is the critical variable to consider.

Another group observing this process is not concerned with how to structure the relationship; they are concerned with whether or not the institution has the right to enter these relationships at all, without public input. Noble terms corporate access to the university as "privileged access" and asks these questions with regard to that access: Who will control the flow and form of scientific research and education? Whose ends will it serve? Whose needs will it meet?(88) These questions resulted from the arrangements of MIT's affiliation with the Whitehead Institue, a research institute of the Revlon Corporation. In exchange from a 7.5 million dollar contribution and an and expectations of corporate giving in a social system significantly affected by technology. This study intends to look at this phenomenon in the context of a particular institution, so that primary data will be available for analysis.

endowment of 100 million dollars, the Whitehead Institute received:

1. The authorization to make faculty appointments that will be joint appointments for the Institute as well as MIT;

2. Top graduate students to work with appointed faculty;

3. The ability to offer MIT tenure to any Director appointed from outside the university;

4. Share in all resulting patents;

5. Transfer all of the funds generated by institute faculty to the institute.

Noble asks, "has financial support resulted in the loss of autonomy? Has MIT surrendered its traditional prerogatives? Was the Whitehead gift philanthropic?"

Generally applied, these questions still remain without answers. However, they have created an abundance of issues to consider with regard to philanthropy and divergentfinality. The university goals of preparation of students capable of participation in a social system impacted by technology and generating knowledge that extends technology, can certainly be influenced by relationships that violate the academic independence of the institution. Affiliations and relationships that are oriented toward divergentfinality must be discerned and carefully evaluated. Thus, it is critical to identify and assess the goals

METHODOLOGY AND FINDINGS

In order to meet the purposes of this study, it was structured as a case study. The case study method was selected because of its utility in providing data that describes the chronological and situational forces involved in contingency relationships. As well, it provided the opportunity to employ a variety of data collection techniques. The data used in this case was obtained utilizing various data collection methods. The data inspection method was used to analyze key SEAS documents as well as I/A contribution patterns between school years 1978 - 1982. Additional data for this study was also collected from observational notes compiled from meetings relevant to this study that this researcher attended during the 1981 and 1982 school year. Another major source of data were the interviews conducted with I/A representatives and SEAS faculty and administration.

The documents inspected were organized into an index card file under the categories of curriculum concern, research collaboration interest, support category preference and miscellaneous. The observational notes were organized in an index card file chronologically by type of meeting. The interview instruments evolved from the curricular issues that were evident from a careful analysis of the documents and meeting data.

The interview data was coded by three coders who completed this task in the following sequence. Initially, the coders were oriented to the coding categories initially established by this researcher for data tabulation. Subsequently, the interview results were coded. The coders and researcher met again to refine the categories by combining and clarifying categories. The coders then recoded the interview results. A third session was held to again refine the coding categories before final coding. The interview results were coded in final form. This inductive coding process facilitated the development of the categories that were most appropriate.

The documents inspected from the Dean's office included the: Contact Meeting minutes, Dean's Office Contact Reports, Development Office Contact Reports, the I/A Annual Meeting Reports, files pertaining to the Manufacturing Engineering and Micro Programs, Accreditation Reports and updates, Dean's Delta minutes, Dean's Council minutes and files pertaining to the SEAS Faculty Retreat.

The contact group meeting is a bi-monthly meeting whose attendees are the SEAS administrative staff and the Dean's. Over the five year period covered by this study, there were 120 contact meeting minutes inspected. In 67 of those meetings (56%), there was some reference to the I/A Program, it's expansion as well as its potential impact on SEAS. There were three facts that continuously surfaced during the examination of the contact group minutes. They were:

1) the expectation to continue to expand the I/A Program,

2) the overwhelming need for unrestricted support to provide flexibility in the utilization of the funds,

3) the need for more collaboration by various SEAS administrative offices to accomplish the expansion of the I/A Program.

The Dean's office contact reports were reports that documented any Dean's office contact with I/A's or I/A prospects. The reports became formal input to the University Development Offices Prospect Management system. There were 600 contact reports available to review. Included in the data inspected from Dean's office files related to I/A companies, the engineering crisis in the U.S., the state of the school, and the development of the I/A Program. The total documents inspected from the Dean's office files were 886. In examining the contact reports, it was observed that many I/A curriculum concerns had not been discussed in any kind of open forum. Forty percent of the contact reports made reference to I/A's desiring additional input into SEAS program development. The pertinent files and contact reports provided insight into many I/A curriculum concerns. As well, many recurring issues pertinent to university corporate relationships were pointed out. These concerns and issues were incorporated into the interview instrument so that they could be examined.

The Dean's Delta is an advisory group of alumni who have made a significant contribution to SEAS, either in service or financial support. The group met once per quarter. The minutes from the meetings indicated that their discussions usually focused on the resource issues facing SEAS presently and in the future. The information from their minutes offered suggestions for strategies that could be used to relieve current and anticipated SEAS resource deficiencies. One of the suggestions that continually surfaced was an expansion of the I/A Program.

The Dean's Council is another support group. It consists of faculty, alumni and industry executives who are interested in advancing SEAS, with regard to program and financial support. The meetings varied and usually occurred once, sometimes twice, per year. The total number of meetings, between 1978 - 1982, were 10. The minutes from the Dean's Council meetings pointed out concerns and issues similar to those indicated in the SEAS contact reports.

In 1978, there was a Faculty Retreat that was specifically focused on industry support for SEAS. The report that evolved from the retreat, was another reflection of the concerns pertaining to expanded industry support of SEAs.

The Development Office files provided a wealth of documentation that was important to the development of this study. The Development Office I/A Contact Reports were quite comprehensive. They documented all interactions with I/A or prospective I/A's. The reports reviewed totaled 1500. Forty-six percent of the reports made a reference to more access for I/A companies to SEAS for collaborative research and program development. The

Development Office also provided files on each I/A company. As well, they provided files on all I/A events that occurred between 1978 - 1982.

The Legislative Assembly meets monthly to consider curriculum changes and accreditation issues for SEAS. The minutes from the 60 meetings that occurred between 1978 - 1982 pointed out that, a fundamental concern for curriculum change, related mostly to design content. That concern was pointed out by various accreditation teams that visited SEAS during this period. The Legislative Assembly minutes also provided additional insight into the evolutionary process involved in curriculum change. All aspects of a given curriculum change were thoroughly considered by the Legislative Assembly before it was approved or disapproved. This deliberate process is indicative of SEAS faculty's attempt to thoroughly consider all aspects of curriculum change.

The accreditation reports and updates indicated that, the SEAS undergraduate curriculum needed more design units. The units would provide undergraduate students with more hands-on experience, than currently exists in the SEAS curriculum. This was a recurring issue in the three reports examined.

The SEAS Annual Report and SEAS catalogue provided information related to the actual program changes. There were five documents inspected in each category. The catalogues were useful in determining the changes in courses available, relative to new programs initiated by I/A support. The Annual Reports provided

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information regarding school funding and I/A contributions between 1978 and 1983. The data from these documents is presented in tables 2, 3, and 4.

The manufacturing Engineering Program (CAD/CAM) was formulated in 1978 in response to a need expressed by several I/A organizations to be able to hire more engineers with expertise in this emerging technical area. The program was implemented in 1980 as a result of I/A contributions of equipment and software. As well, I/A contributions provided graduate students and support staff. The I/A contributions to the Manufacturing Engineering Program for the period covered by this study exceeded $250,000.

The manufacturing Engineering major field option was the only major field added to the SEAS undergraduate curriculum during 1978-83. Table 2 provides information regarding curriculum change resulting from I/A contributions. Manufacturing Engineering is also a graduate option. This option became available also as a result of I/A contributions for fellowship and research laboratories for the program between 1978-79 and 1982-83.

The Development Office monthly reports were examined over the five year period, 1978 - 1982. The 60 reports examined provided an opportunity to assess donor giving patterns, in terms of contributions and categories. These reports were also helpful in relating increased contributions to program changes.

TABLE 2

SEAS UNDERGRADUATE CURRICULUM BY CATEGORY AS AFFECTED BY I/A CONTRIBUTIONS 1978-79 TO 1982-83

Category	1978-79	1979-80	1980-81	1981-82	1982-83
Lower Div. Total Units	93	93	93	93	93
Core Units	32	32	32	32	32
Units to Complete Degree Requirements	185	185	185	185	185-190
Major Field Additions	-	-	-	1	-

Tables 3, 4 and 5 provide and indication of I/A contribution patterns. It is important to point out in Table 3 that except for 1979-80, the amount of I/A support has contributed no more that 5% of the SEAS annual budget. This resulted from major gifts of equipment and cash to support the Manufacturing Engineering Program and the Crump Institute for Medical Engineering. Tables 3 and 4 point out that I/A contributions have been for specific purposes. The largest percentage of I/A contributions are in the restricted area. There was not one academic year covered by this study where the unrestricted I/A contributions exceeded 28%.

Discussion of Findings: Observations

The meetings that were observed that contributed data to this study included the SEAS Contact Group, the Dean's Council meetings, the I/A Annual meetings, Dean's meetings, Department Chairmen meetings, Dean's Delta meetings and corporate meetings that focused on support for engineering education. During the 1982 and 1982 school years, various meetings were attended when the agenda was relevant to this study.

The SEAS Contact Group meetings took place twice per month during the Fall, Winter and Spring quarters. The total meetings attended, were 40. These meetings were briefing meetings for Deans and Directors in SEAS. They were meetings that had no pre-published agenda. However, at various times, topics important to this study were discussed. The most important information that pertained to this study, discussed at these contact meetings, related to the current status of the SEAS development efforts. In 80% of these meetings, some discussion of I/A support took place.

The Dean's Council meetings consisted of various supporters that discussed corporate support for SEAS. These meetings were general but provided important background information that identified subjects and issues that needed to be examined in support of this study. These meetings occurred once each Fall, Winter and Spring quarter.

TABLE 3

SEAS BUDGET COMPARISON BY CATEGORY AND PERCENTAGE OF I/A CONTRIBUTION 1978-79 TO 1982-83

Budget Category	1978-79	1979-80	1980-81	1981-82	1982-83
Total University Allocation	$7,348,793	$8,164,571	$9,281,881	$10,181,802	$10,942,923
Contracts & Grants	$5,562,571	$7,130,716	$10,028,270	$9,649,636	Approximately $11,000,000
I/A Contributions	$ 70,450 (5%)	$2,151,050 (12.3%)	$ 668,750 (3.3%)	$ 252,300 (1.3%)	$ 462,700 (2.1%)
Total	$12,981,841	$17,446,337	$19,978,901	$20,083,938	$22,405,673

TABLE 4
TOTAL I/A CONTRIBUTION
1978-1979 TO 1982-83
BY GIFT CATEGORY

Year	Research General	Fellowship	Instruciton/ Seminar	Dept. General	Scholarship	Program Support	Equipment	Public Service	Endowed Chair	Various I/A Membership Yearly Assessments	Total
78/79	$6,800	$24,050	-	$11,000	$85,000	-	-	$1,000	-	$29,000	$70,450
79/80	-	62,700	$5,000	9,100	5,000	$2,000,000	$10,000	6,000	-	53,250	$2,151,050
80/81	24,000	41,900	-	6,100	4,000	101,000	150,000	-	$251,450	90,300	668,750
81/82	-	65,000	-	11,500	75,000	43,000	-	-	$2,500	55,300	252,300
82/83	30,000	43,700	-	4,000	10,000	250,000	-	-	-	125,000	462,700
Total	$60,800	$237,350	$5,000	$41,700	$102,500	$2,394,000	$160,000	$7,000	$253,950	$352,850	$3,605,250

The I/A annual meeting took place once each year and was primarily a briefing by the Dean that described the state of the school. These meetings provided the most accurate perception of school needs and the category and amount of I/A support that would satisfy these needs.

The department chairmen met once per month during the Fall, Winter and Spring quarters. Seven out of 20 meetings (30%), had specific agenda items that concerned issues involved in this study. The information that resulted from these meetings was, in most instances, related to faculty concerns about expanded corporate support. It was evident that these concerns, relative to the SEAS I/A, needed to be comprehensively examined.

The SEAS Deans also met once each month during the Fall, Winter and Spring quarters. Five meetings out of the 20 (25%), that took place had specific agenda items related to this study. These meetings were important in pointing out the need for information that related to the opinions, concerns and perceptions of I/A's regarding SEAS.

The Dean's Delta meetings occurred three times per year. They were usually focused on strategies for developing corporate support for SEAS. These meetings were important because they pointed out the key topics related to this study, that required probing.

During 1981 and 1982, a total of 35 corporate meetings were attended where the primary issue was support for SEAS. In each case the meeting took place at an I/A company site. These meetings pointed out the concerns about SEAS that I/A representatives had, as well as other corporate participants felt needed to be addressed.

Discussion of Findings: Interview Results

The foundation of this discussion will be related to descriptive findings of each of the two major research questions and their sub-questions derived from interview data. The first major research question posed by this study was:

What are the concerns that the UCLA/SEAS Industrial Associates have, relative to the content and development of the UCLA/SEAS curriculum? The general categories of curriculum concern indicated by the I/A respondents were:

1. The opportunity for meaningful input. This category of concern was indicated by 20% of I/A representatives interviewed. They felt that the curriculum would reflect more integration of up-to-date technical application if there was more opportunity for input from industry. The I/A representatives pointed out a need for the development of a formal mechanism for this input. One I/A respondent related this concern by indicating, "The opportunity must exist for I/A's to provide occasional insights on the more current developments in industry."

TABLE 5

I/A CONTRIBUTION BY RESTRICTED AND UNRESTRICTED GIFT CATEGORIES 1978-79 TO 1982-83

Category	1978-79	1979-80	1980-81	1981-82	1982-83
Total Unrestricted(1)	40,000	$62,350	$96,500	$66,800	$129,000
% of Total	5%	3%	14%	26%	28%
Total Restricted(2)	$30,450	$2,088,700	$572,350	$185,500	$333,700
% of Total	43%	97%	86%	74%	72%
Total	$70,450	$2,151,050	$688,750	$252,300	$462,700

(1) Unrestricted gift categories include Department general and I/A membership assessments.

(2) Restricted gift categories include Research General, Fellowships, Instruction/Seminar, Scholarships Program support equipment, public service and endowed chair.

2. The development of courses related to the manufacturing needs of I/A companies. I/A representatives cited course additions as a critical need in an ever changing technical environment (17.5%). Those additions should reflect major trends in technology. Particular emphasis was placed upon the technologies related to Computer Aided Manufacturing (CAD/CAM). The following quote is representative of those concerned with major changes in 'real world' applications like CAD/CAM: "Addition of more courses that can be applied to 'real world' problems."

3. The formalization of pre-professional experience in the undergraduate curriculum. This category of concern was mentioned by 27.5% of those interviewed. They favored formalization of the pre-professional experience in the curriculum. Most of the I/A representatives involved in human resources management indicated that, a formal Cooperative Educational Program would give the UCLA B.S. graduate more applied experience and a better sense of the world of work. One representative, with regard to this concern, indicated, "UCLA needs to recognize the value of the cooperative education experience."

4. The addition of more applied laboratory experience in the undergraduate curriculum. The concern for more application of technology experience in the SEAS curriculum was a category mentioned by 15.5% of the I/A representatives

interviewed. The responses in this area pointed out that there is a general feeling that applied lab experience is not well integrated into the SEAS curriculum. Although there was no expectation for SEAS to become like a school of engineering technology, additional applied lab experience to the content of the SEAS curriculum would be endorsed by many I/A organizations. Typical of the responses related to this concern was: "Attrition of the capability of graduates is accelerated because of a lack of design in lab experience."

5. The development of more sophisticated computer skills for all graduates in all disciplines and degree levels. I/A representatives expressed a desire to have computer skills be extended beyond fundamental programming. Many respondents (15%) emphasized the need for computer skills to become a more integral part of all SEAS major fields. It was pointed out that the interdisciplinary nature of engineering practice requires that engineers use the computer as a tool. It was emphasized that this skill would be in greater demand in the future. The I/A feelings in this area were pointed out by this response, "UCLA must provide the opportunity for all engineering majors to take upper level courses in computer science."

6. Providing more opportunity for collaborative research opportunities. Collaborative research was revealed as a priority in 12.5% of the concerns indicated by I/A respondents. This

was the method indicated whereby technology transfer will occur most directly. In any case, where I/A organizations and SEAS faculty and graduate students work together. the anticipation was that collaborative research will affect the curriculum in specific ways. Those pointing out this area as important felt that collaborative research would generate course additions, an opportunity for input, the need for more applied lab experience and the development of oral and written communication skills. Collaborative research would provide the opportunity for two institutional systems to become more convergent in terms of curriculum content, development and goals. One representative opinion in this area was, "Collaborative research is an area that needs to be formalized and expanded. It is the key link in our relationship."

7. Providing opportunity for faculty exchange in industry. One way of directly affecting curriculum development would be to bring faculty to private industry for the summer and during sabbaticals. In this way, faculty could directly experience the new technologies in private industry. I/A respondents (1%) felt this would accelerate technology transfer. Suggestions made in this area included, "Firsthand experience for SEAS faculty with industry could take place through the summer employment of faculty."

8. The development of additional courses to enhance the oral

and written communication skills of all graduates at all degree level. I/A respondents (1%) felt that oral and written communication skills should be integrated into as many courses in the SEAS curriculum as possible. This would offer graduates the opportunity to polish their communication skills during the process of their course work. This was pointed out by I/A respondents as invaluable to improving the initial productivity of SEAS graduates in industry. The following quote is an example of the aforementioned suggestions: "The development of course experiences that provide the opportunity to give graduates more training in written and oral communication is critically needed."

These concerns and the quotes are examples of I/A responses certainly point to various opportunities to affect the SEAS curriculum. In order to more comprehensively analyze the research question to which they relate, the following sub-questions were asked so that the relationship between certain critical variables could be more directly investigated. See table 6.

I. Is the category of support related in any way to the curriculum concerns of UCLA/SEAS Industrial Associates?

The first research sub-question attempted to determine whether the category of support is in any way related to the curriculum concerns of I/A respondents. It should be noted that the data indicates 65% of the I/A respondents who favor some form of restricted support also identified some sort of curriculum

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TABLE 6

I/A CATEGORIES OF CURRICULAR CONCERN

Categories of Curriculum Concern	Frequency of Response in %	Frequency of Response
Opportunity for input	20.0%	10.0
Course additions	17.5%	8.75
Preprofessional experience	17.5%	8.75
Applied lab experience	15.5%	7.75
Computer literacy	15.0%	7.5
Collaborative research	12.5%	6.25
Faculty exchange	1.0%	0.5
Communications skills	1.0%	0.5
Total	100.0%	

concern. When curriculum concern was indicated, regardless of the category of support favored, 90% of the respondents had curriculum concerns.

TABLE 7

I/A GENERAL SUPPORT CATEGORY PREFERENCES RELATED TO I/A CURRICULUM CONCERN(S)

Support Preferences	Curriculum Concerns Yes	Curriculum Concerns No
Restricted	26	10
Unrestricted	0	4

See table 7. The aforementioned I/A quotes are indicative of those concerns.

II. Is the amount of support related in any way to the curricular concerns of the UCLA/SEAS Industrial Associates?

The second research sub-question attempted to determine the extent to which the amount of support is related to curriculum concerns. It should be noted that the contribution totals only included amounts contributed beyond the various I/A membership assessments during the years 1972 - 1978. This method of calculation had a significant effect on the data, since only 52% of the I/A organizations made contributions above the I/A membership assessment. Fifty-nine percent of the I/A organizations made contributions of $150,000. or less with 48% of those gifts being in the $10,000. or less range. See Table 8 .

TABLE 8

TOTAL AMOUNT I/A SUPPORT RELATED TO CURRICULUM CONCERN(S)

Amount of Support in Dollars	Curriculum Concern(s) Yes	Curriculum Concern(s) No
0 - 10,000	12	8
10,000 - 50,000	8	0
50,000 - 100,000	2	1
100,000 - 150,000	3	3
150,000 - 200,000	1	1
200,000 - 250,000	1	-
250,000 - 300,000	1	0
300,000 +	1	0

III. Does the level of office of the corporation donor affect the curricular concerns of the donor?

The third research sub-question attempted to determine the extent to which management level is related to I/A curriculum concerns. On the basis of the data in Table 9, it is significant to note that at all levels of management, 79% of the respondents indicated some type of curriculum concern. There was no one management level more significantly represented than others.

IV. Does the level of office of the corporation donor affect the

TABLE 9

I/A MANAGEMENT LEVEL RELATED TO CURRICULUM CONCERN(S)

Management Level	Curriculum Concern(s) Yes	Curriculum Concern(s) No
High level corporate affiliation	10	5
Mid-level corporate affiliation	6	2
High level division affiliation	5	2
Mid-level division affiliation	8	3

category of support?

The fourth research sub-question attempted to determine the significance of the relationship between management level and the category of support. It is important to note that 30% of High Level corporate affiliated I/A respondents indicated a preference to support general research. A similar percentage (30%) favored Fellowship/ Scholarships. Otherwise no categories were significantly preferred by any particular management level. See Table 10. These preferences for general research support and Fellowship/Scholarship were also the top two categories that were preferred by all levels of management. See Table 11.

It is important to point out that a notable percentage (15.1%) of I/A respondents indicated their preference as unknown.

TABLE 10

I/A MANAGEMENT LEVEL RELATED TO CATEGORIES OF SUPPORT

Management Level	Unrestricted Support	Equipment	General Research	Provide Faculty	Fellowship Scholarship	Minority Engr. Prog.	Placement Center	Uncertain
Hi-Level Corp. Affil.	1	4	11	3	11	3	1	2
Mid-Level Corp. Affil.	1	2	2	2	2	1	0	4
Hi-Level Div. Affil.	0	0	3	1	2	1	0	2
Mid-Level Corp. Affil.	0	3	5	4	5	4	1	5

It is also important to focus on the fact that only 2.3% of I/A respondents indicated a preference for unrestricted support for SEAS.

V. Does the level of office of the corporation donor affect the amount of support?

The fifth research sub-question attempted to determine the extent to which management level relates to the total amount of support provided SEAS I/A organizations. One observation available, after analyzing the data in Table 12, is that the significant number of those consulted (60.7%) were from the high level management category. In relationship to this fact, the largest single management category

TABLE 11

I/A SUPPORT CATEGORY PREFERENCES

Support Category	Preference in %	Frequency of Response
General Research	24.4%	12.2
Fellowship/Scholarship	23.2%	11.6
Uncertain	15.1%	7.5
Adjunct Faculty	11.6%	5.8
Equipment donations	10.4%	5.2
Minority Engineering Program	10.4%	5.2
Unrestricted	2.3%	11.5
Placement Center	2.3%	11.5
Total	100.0%	

TABLE 12

I/A MANAGEMENT LEVEL RELATED TO TOTAL AMOUNT OF SUPPORT

	Total Amount of Support in Dollars							
Management Level	0 - 10,000	10,000 50,000	50,000 100,000	100,000 150,000	150,000 200,000	200,000 250,000	250,000 300,000	300,000 +
Hi-Level Corp. Affil.	9	0	2	2	1	2	0	1
Mid-Level Corp. Affil.	3	1	2	3	0	0	0	0
Hi-Level Div. Affil.	6	2	1	0	1	0	0	0
Mid-Level Div. Affil.	2	3	0	3	0	0	0	0

(High Level corporate affiliation) 52.9% represented I/A organizations that provided support of $10,000. or less.

VI. Is there a relationship between school affiliation and I/A support?

The sixth research sub-question sought to probe the relationship between school affiliation and the I/A representative designation. The data in Table 13 indicates that only 20% of the cases was the I/A representative a UCLA alumnus. The school affiliation was more critical in organizations of 10,000 or less employees where the chief executive officer was a UCLA alumni. In corporations of 10,000 employees or more, the I/A representative was usually not a UCLA alumnus.

VII. Does the amount of the I/A contribution relate to the degree of curricular impact.

TABLE 13

I/A REPRESENTATIVE RELATED TO SCHOOL AFFILIATION

School Affiliation	I/A Representative Yes	I/A Representative No
UCLA Alumnus	8	2
Non-UCLA	20	10

The seventh research sub-question attempted to determine the significance of the relationship between the amount of I/A support and the initiation of school programs. The data in Table 14 indicates that there is a direct relationship between the amount of support and program initiation when the amount contributed exceeded $10,000. It should be noted, that during the period examined by this study, in 52.9% of the cases, I/A support was $10,000. or less. Consequently, well over one half of the I/A contributions provided no program initiation. Further analysis indicated that only 28% of the support received by SEAS from I/A organizations resulted in program initiation.

The second major research question examined by this study was: What are the faculty concerns with regard to the impact of increased UCLA/SEAS Industrial Associates contributions on the content and development of the SEAS curriculum? The general categories of opinions cited by faculty respondents were:

1. Increased pressure for more applied laboratory experience. The major concern discussed by 15.5% of the SEAS faculty was the anticipation of more pressure to make SEAS laboratories more concurrent with I/A applications of technology. This, as was pointed out by faculty with this concern, would require a redefinition of the school's mission and a recapitalization of the current lab facilities. Many faculty members interviewed (12%) pointed out that the curriculum expectations of I/As are beyond the resources of the school. Changes in courses and programs would require alterations in lab

TABLE 14

TOTAL AMOUNT I/A SUPPORT RELATED TO PROGRAM INITIATION

Amount of Support in Dollars	Contribution Initiated Program	Contribution Did Not Initiate Program
0 - 10,000	0	20
10,000 - 50,000	2	2
50,000 - 100,000	1	1
100,000 - 150,000	2	0
150,000 - 200,000	1	0
200,000 - 250,000	1	0
250,000 - 300,000	1	0
300,000 +	1	0

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experience, computer access and additional facilities. Each of these requirements are currently financially out of reach for SEAS. Those SEAS faculty interviewed also felt that, if the curriculum changes were to be made according to industry expectations, those changes would need to be resourced by I/A organizations. To illustrate these concerns, SEAS faculty members pointed out, "The curriculum might evolve towards a more applied orientation. Additional updated labs are almost cost prohibitive without industry support. But what's the price?"

2. Expectations by I/A organizations for course additions and program changes that exceed capacity of SEAS resources. SEAS faculty were concerned (12%) that course additions and program changes require resources and often faculty expertise that might not exist. If school resources are defined by its mission, the SEAS, which is more general in its orientation, would not have resources to make application oriented changes unless that mission was altered. One SEAS interviewee indicated, "It seems that our resources are bound to our research and graduate education focus. New information is certain to cause instructional and program content to be altered. The question is the capacity of the school to make the transition."

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3. Acceleration of course changes and program restructuring. The rate of curricular change expected by I/A organizations was another area of accentuated concern by 11.5% of the SEAS faculty. They indicated that the two institutional systems operated ate different rates and with different encumbrances. It was specified that the rate of change in the school and university would involve a complicated network of discussions sanctions. Normally, this is a slow process. On the other hand, I/A organizations have less encumbrances and operate at a faster pace. This incongruence is expected to be a serious area of difficulty. One SEAS faculty member was certain to point out, "Curriculum development is a process that requires complex validation. It could be a 'sore' point in our relationship with I/As."

4. Expectation of I/A organizations for course additions and program changes that are not concurrent with the expertise of the school. Faculty expertise and research interests often do not always intersect with the rapidly changing nee of I/A organizations. Consequently, some changes expected by I/As might require the addition of faculty. The faculty members (10.3%) with this concern felt that in these cases, I/A organizations would be called upon to supply properly credentialed adjunct faculty. This would be necessary because engineering faculty members are not easily

obtained. The discussion in in the background section provides additional insight into the issue of the engineering faculty shortage. As one faculty member expressed it, "If care is not taken to protect academic autonomy, the courses and programs offered might be out of phase with the mission of the school and the expertise of the faculty."

5. Enhanced capacity to offer more technically advanced laboratory experience. If I/A organizations were to significantly increase support, 10.2% of the faculty members interviewed felt that the additional resources would increase the capacity of SEAS to update its laboratory facilities. In fact, several faculty respondents indicated I/As could update, outfit and maintain entire labs in specific areas of mutual interest. One SEAS respondent said, "More I/A support, if directed at the application aspects of our program, would be a plus."

6. Program alterations that will require more courses in the major. A major concern of 10% of the SEAS faculty is maintaining the balance of technical and non-technical courses. The university has specific non-technical requirements, the school has major and non-major requirements and the students have major electives. In this mix of courses, it is difficult to

delete courses, if, in doing so, it interferes with the ability of students to acquire a comprehensive university education. Consequently, program changes requiring additional courses in the major would be difficult to accomplish, given these constraints. One faculty member felt that, "Students will end up taking more discipline specific courses and less fundamental courses in all engineering disciplines."

7. Closer approximations of applied industry experiences in SEAS labs resulting from technology transfer. Technology transfer is expected by 9.5% of the SEAS faculty to be a result of additional or increased interaction between SEAS and I/A organizations. This technology transfer would have the effect of making SEAS lab experiences more closely approximate those of I/As. As was mentioned earlier, the expectation would be, that, additional I/A resources would facilitate these changes. One interviewee felt, "Additional information and interaction will allow better articulation for more updated course and lab content."

8. Inequitable influence over research directions that would limit creative basic research. A concern that is less prominent, but no less important, is the concern related to inhibiting creative research because of the tendency of I/As to support specific mutual interests,

rather than providing unrestricted research support. Several SEAS faculty (8.2%) emphasized that I/A organizations could inequitably affect the research of SEAS if their resources become prominent in the mix of SEAS research support. With regard to this concern, it was stated that, "We might experience more influence over research directions that might choke off investigation in many areas of technical importance."

9. Expectation for project completions that are incompatible with certain goals of graduate education. Graduate education involves intense give and take between graduate student and advisor. This exchange is not confined to a specific time frame. It was pointed out by 7.3% of the faculty respondents that I/A sponsored research projects often have specific completion dates. Thus I/A projects could often be out of phase with the process of an individual graduate student's progress. Anticipating this problem, SEAS faculty members were uncertain about seeking I/A research support unless it would be unrestricted. In support of this concern, one SEAS faculty member pointed out, "If there is more collaborative research, the graduate student experience might be expected to fit unacceptable constraints."

10. Expectation for curriculum changes that are out of phase with the current mission of the school. Several

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SEAS faculty members (1.5%) felt that the mission of providing a general engineering education is not congruent with the specific curriculum concerns of I/A organizations. The desired course additions and program changes might impose limitations on the SEAS unified curriculum that would be unacceptable to these faculty members. With regard to this concern, it was said, that, "The academic traditions of SEAS would need to be restated if industry generated change was to be adopted with little scrutiny."

These concerns and quotes certainly indicate faculty do expect curriculum change resulting from increased I/A support. In order to further analyze the second major research question the following research sub-questions were posed to investigate relationships between certain variables critical to this study. See Table 15.

I. Is there any difference in the opinions of faculty regarding curriculum impact resulting from the expansion of the I/A program between faculty involved in I/A supported research and those not receiving I/A support?

The first research sub-question attempted to determine whether there is a relationship between expected curriculum impact resulting from expansion of the I/A Program and I/A research support to faculty. The data related to this relationship is presented in two tables. Table 16 depicts the

TABLE 15

SEAS FACULTY CATEGORIES OF CURRICULUM CONCERN

Categories of Curriculum Concern	Frequency of Response in %	Frequency of Response
Additional applied experience	15.5%	7.1
I/A curriculum expectation beyond school's capacity	12.0%	5.2
Accelerated rate of change	15.5%	7.7
I/A curriculum expectations incongruent with current faculty expertise	10.3%	5.1
Increased capacity for technically advanced labs	10.2%	4.6
Program changes requiring more major courses	10.0%	4.6
Closer approximation of industry lab experience.	9.5%	4.3
Inequitable influence over SEAS research faculty	8.2%	3.7
Graduate program incompatibility	7.3%	3.2
I/A curriculum expectations out of phase with SEAS mission	1.5%	0.7
Total	100.0%	

expected curriculum impact related to I/A support. Table 17 presents the relationship between faculty opinion regarding expansion of the I/A Program and I/A research support. Table 16 indicates that all faculty expect curriculum impact. I/A support was not a critical factor in faculty expectation. Table 17 relates to the difference between those supported and those not supported regarding expansion of school support through the I/As. The data in Table 17 indicates that 100% of those supported by I/As favored expansion. It also points out that 44% of the SEAS faculty respondents were undecided on I/A expansion.

TABLE 16

EXPECTATION OF CURRICULUM IMPACT RELATED TO AMOUNT OF I/A RESEARCH SUPPORT RECEIVED

I/A Research Support	Curriculum Impact Yes	Curriculum Impact No
Receive Support	7	0
Receive no support	31	0

II. Is faculty rank a factor regarding faculty opinion about the curricular impact of increased corporate giving through the I/A Program?

The second research sub-question attempted to ascertain whether faculty rank was a factor in faculty opinion regarding curriculum impact. An analysis of the data in Table 18, points out that rank is not a critical factor in relationship to expected curriculum impact resulting from expanding I/A support. It should be pointed out that 97% of the faculty responded that they expect the curriculum to be impacted positively. However, the previously cited quotes seem to indicate that positiveness is relative. Given the choices contained on the interview instrument involving this issue, faculty tended to be optimistic. It should be noted at this point, that the rank of SEAS faculty is not representatively distributed. Table 19 demonstrates this lack of representativeness.

TABLE 17

FACULTY OPINION CONCERNING EXPANDING I/A SUPPORT RELATED TO I/A RESEARCH SUPPORT RECEIVED

I/A Research Support	Expand Support througn I/A	Non-expansion	Uncertain
Receive Support	8	0	0
Receive no I/A Support	23	0	11

TABLE 18

EXPECTED CURRICULUM IMPACT RELATED TO FACULTY RANK

Rank	Curriculum Impact Positive	Curriculum Impact Negative	No Curriculum Impact
Assist. Prof.	6	0	0
Assoc. Prof.	5	0	0
Professor	27	1	0

III. What evidence does faculty cite as possible negative curricular effects of increased corporate giving through the I/A Program?

The third research sub-question provided no opportunity for meaningful statistical analysis based on the faculty responses to the question. Most felt that the negative or positive effects or expanding the role of the I/As were yet to be determined. The SEAS faculty concern for curriculum impact has been previously discussed in this chapter.

Discussion of Other Related Findings

The analysis of the data was enhanced by a brief consideration of two non-curriculum issues that involves a comparison of I/A and faculty preferences regarding program structure and general support categories.

The data in Table 20 indicates that 68% of the I/A respondents favor a centralized program whereas, only 9.5% of faculty favored a centralized program. The majority of faculty (57%) prefer a combination program. Ninety percent of the faculty felt that the program structure must allow for significant department involvement, either in the form of decentralized or a combination program.

The second significant preference comparison relates to general support categories. The chart depicts the preference by general support categories.

TABLE 19

FACULTY POPULATION DISTRIBUTION IN PERCENTAGES
BY RANK AND DEPARTMENT (a)

Department	Professor	Associate Professor	Assistant Professor
Chemical Engr.	7	1	2
Computer Science	19	6	3
Electrical/Electronic	16	1	3
Engineering Systems	10	2	0
Materials Science & Engr.	10	2	0
Mechanics & Structures	33	6	3
Systems Science	10	1	2
(a) Totals	105 (76.6%)	19 (13.8%)	13 (.09%)

n = 137

The data in Table 21 reveals an incongruence between preference of faculty versus I/As. In the category of unrestricted support, 100% of the faculty prefer unrestricted support. However, only the other end of the continuum, the faculty indicated 0% for restricted support, whereas, 92.5% of I/A respondents prefer some sort of restricted support.

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TABLE 20

COMPARISON OF I/A AND FACULTY PREFERENCE
I/A PROGRAM STRUCTURE

Interviewees	Centralized School-wide Program	Decentralized Dept. Based Program	Some type of Combination
I/A Frequency of Response	30	8	6
Faculty Frequency of Preference Response	4	14	24

CONCLUSIONS AND IMPLICATIONS

In an environment of limited resources, fiscal stringency and increasing demands to maintain pace with the technological advances, SEAS is confronted with the challenge of increasing its resources while maintaining its fiduciary responsibility to develop new knowledge and educate competent engineers. This challenge is intensified by the acceleration of technical change as well as the limited funding options available. The most

TABLE 21

COMPARISON OF I/A AND FACULTY PREFERENCE
FOR GENERAL SUPPORT CATEGORY

Interviewee Group	Unrestricted	Restricted	Combination
I/A Frequency of Response	4	37	3
Faculty Frequency of Response	44	0	0

viable sources of additional funding are the corporations that require engineering knowledge and talent. As a result, it is critical that SEAS structure its I/A Program to provide opportunities for I/As to discuss their significant concerns.

Out of the findings of this study, it is clear the I/As have curriculum concerns. Consequently, those concerns need to be thoroughly examined. The importance of this task is directly related to the SEAS objective of increasing corporate support through the expansion of its I/A Program. It is acknowledged by scholars of corporate philanthropy that, as the gift size increases so does the donors desire to maintain a close proactive relationship with the recipient.(89) SEAS should expect to encounter this phenomenon as I/A support increases. In fact, the critical importance of the engineering curriculum to maintaining the technical competence of I/A organizations requires that SEAS expect to encounter interaction and interpenetration. I/A expectations, regarding their curricular concerns, indicate that they are certainly oriented towards promoting various changes in the SEAS curriculum. Since the curriculum concerns of I/As and the manner and purpose of their implementation are not congruent with those of SEAS faculty and administration, no significant increase in I/A support would be likely to occur unless these concerns are addressed by SEAS faculty.

Although I/A representatives and SEAS faculty and administration have different views concerning curriculum content and development, technical change is expected by both groups to affect the SEAS curriculum. Changes in technology are expected to require SEAS to respond through the re-orientation of courses, programs and research projects. However, a framework for I/A and SEAs collaboration on curriculum change is not clearly defined. Currently, each system is oriented toward divergentfinality, with regard to the goals, objectives and structure of the I/A SEAS relationship.

The major challenges to both systems are to identify their mutual interests, focus on areas in need of reconciliation and provide the opportunity for reconciliation to occur. One focus of mutual interests where this could occur would be in the development of more applied oriented labs supported and equipped by I/As, particularly since both I/As and faculty identify this as a mutual goal. If this does not happen, it is unlikely that I/A support will sufficiently increase to meet the resource deficiencies anticipated by SEAS. One I/A interviewee indicated that, "We are certainly missing a golden opportunity to meet the needs of all concerned."

Implications for SEAS Faculty and Administration

In order for SEAS to invest the same dollar value in its current students as it did in 1973, the school would need an additional 11 million dollars.(90) If SEAS expects to bridge this massive resource gap by expanding its I/A program, it is essential that SEAS attempt to reconcile the two institutional systems toward equifinality. This effort would involve apprising the SEAS faculty regarding the merits of this expansion and the importance of their participation in its planning and implementation. Faculty involvement is quite important and cannot be overlooked. Also involved in the objective of reconciliation, is the examination of the relevant concerns of the SEAS faculty. Except of the 1978 Faculty Retreat, the opinions regarding expanding the I/A Program have not yet been carefully examined. This must occur before strategies for the expansion of the I/A Program can be effectively developed.

The dissimilarity of I/A and SEAS faculty opinion, regarding I/A Program structure, the rate and manner of curriculum change and gift category preferences, must be addressed if the goal of increased I/A support is to be achieved. The I/A representatives favor a structured and centralized I/A Program. However, the SEAS faculty prefer a decentralized I/A Program that affords more departmental input. The challenge is for SEAS to develop a program structure that can optimally accommodate these divergent interests.

Curriculum change is expected by both groups. However, SEAS faculty certainly do not expect to implement change at the pace expected by the I/A representatives. I/A representatives expressed expectations for immediate adjustments in curriculum content. These differences require systematic analysis if curriculum adjustment is to occur in a manner supportive of the objective of increasing I/A support. The importance of I/A concern for input into SEAS curriculum content and development, is revealed by the findings of this study. In order to provide for this input, SEAS must define and structure an appropriate process and framework. This researcher recommends that SEAS should develop an I/A advisory group for program analysis, development and implementation. The I/As consider themselves as a valuable curriculum data source. They also consider their curriculum concerns as essential to the success of their organizations. It was pointed out in the Lockheed Plan that, "Lockheed involvement in engineering curriculum development is critical to the continued technical viability of the Lockheed Corporation."(91)

I/As prefer restricted contributions that afford 'quid pro quo'. SEAS faculty and administration favor support that affords more prerogatives for use. Without seeking to confront these differences, it is likely that the increased I/A support expected by SEAS, would not be forthcoming. SEAS must consider the self interest nature of corporate philanthropy. The strategies developed to increase I/A support also must reflect a consideration of I/A support category preferences if they are to be successful. SEAS must persuade I/A organizations to invest in SEAS without expecting a direct return on investment. The previously discusses results indicate that this task will be formidable.

The findings of this study also indicate that the I/A liaison is appointed more often by role in the I/A organization

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than by school affiliation. Most I/A representatives are not UCLA or SEAS alumni. Consequently, the sensitivities of UCLA alumni will not be a significant factor in the expansion of I/A support. In light of this fact, the donor liaison role becomes critical to maximization of corporate support to SEAS. However, the role has not been well defined an communicated by SEAS to its I/As. It is important for SEAS to correct this deficiency so that I/A organizations can appoint individuals who can be effective in this role.

The information obtained from the SEAS Development Office Reports, indicated, that contributions by I/As in excess of their annual I/A membership assessment were very limited. What, in fact, needs to occur, is for SEAS to more accurately educate I/A representatives regarding the present and future resource problems facing SEAS. The results of this study point out that I/A representatives were not well informed concerning the resource challenges confronting SEAS. I/A representatives and organizations need to be more aware of how to effectively invest in SEAS for mutual benefit. The need for this education is essential if the objective of increased I/A contributions is to be achieved. In addition to educating the I/As, it is equally important for SEAS to systematically study the giving patterns of its I/As. This information would provide data for SEAS to set its contribution targets, as well as establish the most effective strategies to meet those targets.

It is clear, from the findings of this study, that the communication between SEAS and its I/As was generally obfuscated, circuitous and infrequent. It lacked effective follow-up on the part of both systems. This type of communication must radically change if SEAS is to reach its future I/A contributions objectives. The major challenge to SEAS is to define and structure the SEAS I/A relationship for more effective and focused interaction and interpenetration. The definition and structuring of that relationship must allow the needs of both institutional systems to be recognized, understood and satisfied. Establishing an appropriate framework for productive interaction and interpenetration of both systems is quite important to the content and development of the SEAS curriculum. SEAS teaching and research must encounter industrial experience if it is to be a bridge between basic engineering principles and the practical challenges in industry.

One possible component of the framework would be to establish a Dean's I/A Advisory Council. This group should consist of high level executives from I/A organizations who can make decisions regarding the involvement of their organizations with SEAS. Another possible component of the framework would be a Departmental Forum. This would be an open meeting that would allow Department chairs to discuss matters of mutual concern with I/A representatives. The framework ought to also include an I/A advisory group for the SEAS administration, faculty and students.

The development of this framework for effective involvement should be formally incorporated into the SEAS self study processes. This would provide normative evaluation of the framework and its results, so that the framework could be altered according to relevant changes in the two systems. The primary responsibility for the development and implementation of this framework belongs to SEAS. If the I/A SEAS relationship is to be optimally effective, the process of developing this framework must commence promptly.

Implications for Industrial Associate Organizations

The results of this study indicated that, I/A organizations must more clearly define the nature and purpose of their relationship with SEAS. Once the overall mission is established, I/A organizations must be certain that the individuals assigned to implement this I/A relationship with SEAS understand the mission clearly. Also, I/A representatives must be given a specific role to play by I/A organizations.

I/A organizations must seek to be more informed concerning the resource needs of SEAS. The results of this research clearly indicated that the resources provided by I/As was not adequate to assist SEAS in bridging its resource gap. This is due, in part, to a lack of comprehensive knowledge concerning the resource needs of SEAS. I/A organizations must become more well informed if they are to more effectively provide support to SEAS.

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In most cases, the findings of this study, indicated a lack of systematic organization of university corporate support programs by I/As. This resulted in contributions in restricted categories that often did not meet the needs identified as the most crucial by the School of Engineering faculty. It is important that I/A efforts be directed by adequate information of SEAS' critical needs which must be provided by the Development Office. This would allow the opportunity for I/A contributions to be guided toward the most crucial SEAS resource needs.

The data analysis suggests that interpenetration is an expectation that I/As have regarding the I/A SEAS relationship. Consequently, it is quite important for I/A organizations to understand the institutional systems of the University of California, UCLA and SEAS. This knowledge would provide I/As with more insight into the effects of their involvement with SEAS, UCLA and the University of California. It will also give them a better comprehension of the pace of major change in these institutional systems. Currently, I/A expectations, with regard to curricular change, do not reflect accurate knowledge of these systems. If I/As are to meet SEAS expectations, they must completely understand the relevant institutional systems.

Technology is a social phenomenon in our social system. I/As must be certain to understand this fact more fully. The effect of more insight into the phenomenon of technology would be a much needed infusion of altruism into the 'quid pro quo' nature of I/A philanthropy. If 'quid pro quo' remains the single motivating factor in I/A contributions, SEAS will certainly discover a major obstacle in its path. It is likely that this obstacle will diminish the opportunity for SEAS to reach its contribution objectives.

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