CONSTRUCTION INDUSTRY ORGANIZATION,
LABOR RELATIONS AND PRODUCTIVITY

by

Frederick L. Blanchard

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University of Science in Engineering Management
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Submitted to the Department of Civil and Environmental Engineering
and
The Sloan School of Management
in
Partial Fulfillment of the Requirements
for the Degree of
Doctor of Philosophy
at the
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July 16, 1992

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Thesis Supervisor

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Eduardo Kause
Chairman, Departmental Committee on Graduate Studies

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Submitted to the Department of Civil Engineering and
the Sloan School of Management in partial fulfillment of the
requirements for the Degree of Doctor of Philosophy in
Construction Engineering and Management.

ABSTRACT

The definitive works on construction organization have been
credited to Arthur L. Stinchcombe who postulated a theory
based on craft orientation, and Robert G. Eccles whose theory
is based on subcontracting. The author takes issue with the
bases of these theories and provides statistical support for
the contention that they do not correctly describe the basis
for the organization of construction. An alternative theory
is offered and its basis supported with appropriate data.

Various theories have been put forward to link productivity
with motivation, satisfaction and job characteristics. Many
such theories are based on Expectancy, Equity and Job
Characteristic models. The author contends that Expectancy
theories can be utilized to link needs satisfaction to
productivity in the construction industry. Research was
conducted on a number of projects which resulted in the
development of an Equilibrium Model to explain needs
satisfaction and associated productivity. The results of this
research are given and support for the model indicated.

Additional analysis of the research data resulted in
conclusions and recommendations which may help the
construction industry in improving its productivity.

Thesis Supervisor: Fred Moavenzadeh
Director, Center for Construction
Research and Education
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PREFACE

Few occupations are performed under the scrutiny of those who benefit from, but do not participate in its processes. Such is that of the construction craft worker, who displays his labors openly and offers the "sidewalk superintendent" convenient portholes from which to observe a structure taking shape in a cacophony of sound and motion. But what is construction? What do we really know about it other than its accomplishments in the form of houses, hospitals, schools, bridges, plants and the many other types of physical facilities which are its output? Many industries, in particular manufacturing, transportation, finance and services, have been examined in minute detail in an attempt to fathom their inner workings and the causes of their successes and failures. Construction, despite its high visibility, has another side which has remained unknown outside the industry, and unavailable or of little interest to investigators and scholars. Perhaps it is its visibility which makes investigation seem redundant. For whatever reason, construction has escaped extensive critical analysis and diagnosis of what processes are at work, what works, what doesn't, and why.

Construction represents nearly ten percent of America's gross national product. It employs over six million people in more than 20 distinct crafts and even more associated professions. It is a reactive industry. Its major
practitioners do not enter the process until someone else has
determined what is wanted, where, when and usually for how
much. It is often the last to participate when the economy
begins to turn up and the first to contract when the economy
turns down. Despite the economy as a whole, it is extremely
sensitive to interest rates and the availability of capital.

Over the past two decades construction has reaped
increasing criticism for its lack of productivity, its poor
safety record, its labor-management conflicts and its
disinterest in research. Critics point to antiquated
organization structure and lack of innovation as the crux of
its problems. Many of these criticisms lack rigidly
defensible supporting data and analyses but, once leveled,
the same lack of data makes it difficult to refute them.
Entering this fray is fraught with danger, and little positive
is likely to result. Framing the problems from a better
perspective and with an understanding of the industry and its
participants is more likely to produce something positive.

This thesis focuses on contractors directly engaged in the
assembly of the final products of construction. Construction
equipment manufacturers and building material suppliers are
also an important segment but, like other manufacturers and
service organizations, they have been the subject of extensive
research and investigation. Their human relations have also
developed similarly to those of manufacturing.

Why is construction, in particular that segment which
involves contractors, so different from any other industry? Part of the answer lies in the product of construction. Another part is in the personnel who are the craft workers that are the industry's labor force.

Construction produces a unique output, at a specific location, at a specific time. Each house, plant, bridge, renovation or restoration is assembled at a single site from components produced elsewhere. With the exception of some houses and other small buildings, exact duplicates are rarely built and certainly not in close proximity with the original. It is unlikely that the same contractor and the same personnel will construct the building. Once the customers' demands are satisfied, it is rare that they will be back for a similar product for some time, if ever. Reacting to the vagaries of this type of market requires a special type of organization.

Reflecting back over time, it is not difficult to conclude that the demands of this market have not changed. The Pyramids of Egypt, the Parthenon of Athens and the Colosseum of Rome are but a few ancient examples of construction projects which fit the market demand characteristics described above. It does not directly follow that the organization which responded to these projects was the same kind which responds to today's projects. It is possible however, given the competitive environment existing for many centuries, that the efficient organization structure which has survived is not much different from that which built these monuments.
Construction organization has a long history of evolution in comparison to that of manufacturing. No records exist which focus on organizational change in construction. The manufacturing industry has benefited from both records of its development and the fruits of intensive investigation and analyses. The most efficient organizational form in manufacturing is undoubtedly still evolving, because major changes in its environment are still taking place. The demands of construction have changed little, so it is perhaps understandable why its structure is also little changed. But change it has.

As a very mature industry, it is not surprising that change, when it occurs, is slow, subtle and difficult to detect. Changes have been taking place in construction, and organizations are restructuring themselves to respond. These changes are linked to the industry's growth since the start of the Industrial Revolution and the technological advances associated with it.

If the structure of the industry has changed slowly, its basis for compensation has been stagnant. With minor exception, the industry recognizes only two classes of craft worker: the journeyman and the apprentice. This system has its proponents and detractors. Other industries have experimented with many forms of compensation. Academics have put forward many theories about why people work and what rewards are important and why. Construction has been slow to
experiment with innovative compensation schemes, and little is known of construction workers' attitudes.

It is my contention that the increase in demand for construction output, starting with the Industrial Revolution, initiated a shift in the manufacture of building components from the site to the factory. As a consequence, the skill level requirements of most of the construction trades has been reduced. This in turn has reaped the same detrimental consequences as specialization in other industries has, and changes in structure or reward systems have not compensated for it. The craft worker's trade, therefore, has fewer intrinsic rewards and lower productivity is the result. On the other hand, the rigid compensation structure has not adjusted to changing values in the culture -- with the same negative consequences.

Change is not the answer to all structural problems. On the contrary, I contend that the structural form of most construction industry organizations is the most efficient to respond to the environment in which they operate. Major elements of that environment consist of its clients, governmental agencies and labor sources. It is for that reason the first part of this thesis examines the evolution of that structure and the conditions under which it functions. The focus is on the structure which creates the end product.

The historical methods of compensation in the construction industry may be overdue for change. The second part of this
thesis, and the thrust of the research, endeavors to challenge the limited scope and basis of industry compensation and its impact on productivity. In the process, a new model is proposed to explain the interrelationship of motivation and productivity.
I. Thesis Objectives and Outline

The construction industry represents a significant segment of the U.S. gross national product, yet has received a disproportionate share of critical analysis. It is the objective of this thesis to overcome some of this deficiency by providing a cogent analysis of the structure of construction organization and its methods of compensation.

A. Construction Organization

Two major theories have been put forward to explain the organization of construction. One can be called the Craft Orientation Theory, the other, the Subcontracting Theory. Each of these will be examined in detail to identify their underlying weaknesses to provide a satisfactory explanation of construction organization. A new theory is proposed which overcomes the problems of the earlier theories and will be coupled with an explanation of why construction is organized the way it is.

B. Compensation, Motivation and Productivity

Organizational efficiency is a composite of its structure, processes and the actions of its participants. The second part of the thesis presents a compendium of prior research on compensation theory and motivation which impact the productivity of those participants. It suggests a new model to explain motivation and productivity in the construction organization. It is followed by a summary of the research supporting the new model.
II. Theories of Construction Organization

Construction organization theory has benefited from the contributions of Authur L. Stinchcombe (1959), and Robert G. Eccles (1981). It was Stinchcombe who theorized that craft orientation and its attendant socialization explains the lack of a bureaucratic structure in construction. Eccles, on the other hand, considered subcontracting as the structural response to construction market uncertainty. Neither of these explanations recognizes that the organization of construction and the organization of the construction firm are distinctly different and respond to completely separate needs. The result is that data used to support them fall short in critical analysis. A new theory, which stipulates that construction is project oriented, establishes craft orientation as its division of labor, and utilizes subcontracting as a mechanism for obtaining craft inputs, better explains the organization of construction. The project is the basis for construction organization and is distinctly different from that of the construction firm. The project organization is the response to the inherent nature of construction, its unique output, the variability of its assembly and the arbitrary nature of its timing.

A. The Craft Orientation Theory

Stinchcombe (1959) correctly theorizes that the inputs of construction are craft oriented and that craft socialization and human capital substitutes for bureaucratic administration
in construction.¹ The basis of his thesis is that economic instability keeps construction from maintaining a bureaucratic structure. Economic instability is variously identified as volume instability, product mix, geographical distribution and seasonality. He posits that craft socialization substitutes for bureaucratic administration and that subcontracting is a response to seasonal variability.

I contend that craft orientation represents the limit of the standardization of labor and is consistent with the high variability of output requirements. Craft socialization—or training and experience—on the other hand, has enabled craft workers to perform a wide variety of functions with only a modicum of the direct supervision and written instructions which are the foundation of bureaucracy. In addition, subcontracting is purely a mechanism to obtain or insure the availability of craft skills that the project prime contracting agent does not have or does not wish to internalize.

Seasonal variations in construction are both a reality and a myth. They seem a reasonable explanation of why construction workers experience frequent periods of unemployment during winter months and extended periods of rain. This is misleading since colder climates affect only that portion of construction work which is outside. More than half of construction manhours are those spent by craft workers who perform little if no outside work. In addition, a large
volume of construction is conducted in areas which have no seasonal effects, other than exposure of outside construction to rain.

Table 1 represents 1982 Construction Industry census data for single family home builders in the 50 states and the District of Columbia. This series was selected since the industry is essentially devoid of union effects and federal or state mandated contracting and wage regulations. If seasonal factors determined market instability, the hours actually worked by craft workers would reflect it. However, the average hours worked by employees of home builders does not correlate with seasonality. States such as Maine and New Hampshire provide more hours of work than Florida, where construction is unhampered by cold weather or freezing. Similarly, market extent does not correlate with hours of employment. Montana, for example, which has slightly more than 3% of the market of California, also provides more hours of employment. Another explanation of uncertainty or instability would appear necessary.

Stinchcombe utilizes data which suggest the number of clerks in the firm as a measure of bureaucratic administration. He postulates that clerks are unnecessary in

*Seasonality was determined by dividing the U.S. into areas consisting of states in the deep south, the sun belt, the Pacific coast and Hawaii, and those in the Midwest, Atlantic Coast, New England, the Plains states and the Mountain states. It was assumed that the states in the first group would not be affected by cold weather while the latter would be affected.
<table>
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<th>State</th>
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<th>Avg Annual Hours per Worker</th>
<th>Percent Sub Contracts</th>
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<td>41.4</td>
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<tr>
<td>Maine</td>
<td>92</td>
<td>1627.865</td>
<td>20.9</td>
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construction due to the craft socialization of the workers. This socialization substitutes for the formalized instructions which he associates with clerks. Eccles takes issue with this position, citing correctly that instructions as to what is to be done by the craft workers are handed down in contract documents such as drawings and specifications, which are associated with other agents in the construction process. Since the craft worker is trained to read and interpret drawings and specifications and is familiar with the codes which govern the trades, little is left for a formal structure at the project site except for direct supervision, measurement of performance and the management of interfaces between the various crafts.

There are non-craft workers in the contractor's organization which might be confused with the clerks in Stinchcombe's thesis. They are engaged primarily away from the site and associated with commercial, as opposed to clerical-activities of the contractor. In addition to payroll preparation and accounting activities, the predominant indirect activity performed is that of purchasing materials, expediting them and ensuring their delivery when needed on the project site. As a function of total construction receipts, materials represents an average expenditure of over 30%. The percentage of material purchase to the percentage of indirect personnel has a Spearman rank correlation coefficient of .64, indicating a strong relationship between the numbers of
indirect employees in a contractor's organization with the purchasing activity.

Data applicable to the construction firm and supporting hypotheses related to its structure cannot automatically be applied to the structure which undertakes construction. An explanation of the difference between the contracting firm organization and the organization for construction will help remove some of the confusion about structure and how instructions are transmitted and received, which are not completely answered by Stinchcombe's explanation. This will be covered in the new theory.

B. The Subcontracting Theory

Eccles (1981) identifies subcontracting as a mechanism by which craft inputs are obtained, and he further postulates a "Quasifirm" as the structure which interfaces them. Both he and Stinchcombe postulate that craft administration and subcontracting are the responses to instability. He refutes the thesis of Stinchcombe, suggesting craft socialization was confounded with subcontracting, and he posits that market extent and the size and complexity of projects are important explanatory variables for subcontracting. On the contrary, craft orientation and subcontracting are the consequences of increasing stability and standardization in construction.

Subcontracting is a mechanism to obtain additional craft resources for a project not available or internal to the general or prime contractor. It is not, however, correlated
with market extent, as Eccles claims. Using the same data set as in Table 1, the Spearman rank correlation coefficient of total receipts to amount subcontracted was .9778, indicating that the percentage subcontracted is independent of market size. Coincidentally the coefficients for industrial buildings and warehouses and residential construction contractors were .9837 and .9908 respectively.

An appropriate parallel is that of a community fire service. As the town expands, the central station is not

Table 2 Single Family Homes Started and Home Builders

<table>
<thead>
<tr>
<th></th>
<th>1982</th>
<th>1977</th>
<th>1972</th>
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<td>Single Family Units (000)</td>
<td>662</td>
<td>1,451</td>
<td>1,311</td>
</tr>
<tr>
<td>No. of Firms</td>
<td>72,115</td>
<td>100,993</td>
<td>90,207</td>
</tr>
</tbody>
</table>

expanded, but satellite stations are built to better respond to localized needs. Single family home building is typical of this response. Table 2 illustrates the increase in the number of firms in response to the increase in home demand. Industry response to demand is to increase the number of contractors as opposed to expanding the size of individual firms. Table 3 further confirms that the industry as a whole responds to increased volume similarly. The Spearman rank correlation coefficient between the number of firms and total construction receipts is .9318. That this has no impact on the
<table>
<thead>
<tr>
<th>Year</th>
<th>Firms (000)</th>
<th>Total Constr. Workers</th>
<th>Avg. Recpts. Per Firm ($000,000)</th>
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<td>1961</td>
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<tr>
<td>1963</td>
<td>470</td>
<td>58102</td>
<td>6.40</td>
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</tbody>
</table>

The average size of the firm is confirmed by the fact that the Spearman coefficient of firm size to number of firms is -
The construction market is better described as geographical and project oriented. Uncertainty is represented by the size, type and the number of projects undertaken in a given location, as opposed to simply dollar volume.

Eccles further posits that the more complex the project, the greater the amount of subcontracting. I agree to a certain extent, however his explanation that the buildings' functions determine complexity is weak, while the complexity of the building itself offers stronger support for this hypothesis. Additionally, subcontracting has been strongly influenced by unemployment compensation legislation which discourages hiring and firing of craftsmen to suit project requirements. Table 4, developed by the Business Roundtable, illustrates the share, by trade, of various construction projects. Firms would employ those crafts which would ensure their ability to obtain work in their specialty and afford continuity of employment for the worker and contracts for the firm. Given that the prime or general contractor for these projects could internalize or directly hire the dominant crafts and those whose trade was required for nearly the length of the project, the subcontracted percentages agree favorably with those cited by Eccles.

Eccles' third hypothesis, that the larger the project the greater the amount of subcontracting, is true only under

"A means test confirmed there is no significant difference."
### Table 4 Labor Share (%) of Projects

<table>
<thead>
<tr>
<th>Craft</th>
<th>Buildings</th>
<th>Light Ind.</th>
<th>Heavy Ind.</th>
<th>Power</th>
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<td>2</td>
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</tr>
<tr>
<td>Carpenter</td>
<td>16</td>
<td>14</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Cement Finisher</td>
<td>7</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Electrician</td>
<td>11</td>
<td>10</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>Equip. Operator</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Insulator</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Instrument</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Ironworker</td>
<td>14</td>
<td>9</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Masons</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Millwright</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Labor/Helper</td>
<td>17</td>
<td>14</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Painter</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Pipefitter</td>
<td>9</td>
<td>14</td>
<td>22</td>
<td>18</td>
</tr>
<tr>
<td>Riggers</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Roofers</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Teamsters</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Welders</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

certain conditions. These conditions relate to constraints imposed by unions, legislation and in some cases practicality. Where these do not exist, such as on some isolated projects as the Alaska Pipeline and in Third World countries with little labor restrictions, there may be no subcontracting at all.

C.A New Theory of Construction Organization

The new theory of construction organization has three premises which enable direct comparison with previous theories. These are:

1. The project is the basis of construction organization structure.

2. Construction crafts constitute the limits of the division of labor within the organization.
3. The construction firm and subcontracting are mechanisms through which the organization for construction is created.

1. Project Orientation

The output of construction has characteristics which determine the rational form of organizational response. These are epitomized by the facts that each output will rarely be duplicated in type, location and time and that these will not be known until the demand is established. The industry terminology for these outputs is a project. Each is unique in the aforementioned characteristics and can run the gamut, from a household plumbing repair to a major oil refinery. A typical example will illustrate the concept of a project and form the basis of organizational response.

Figure 1 illustrates the manning and duration of a typical small custom house which can be constructed in three months. The drawings and specification which control the type, size and details for this particular house will have been prepared by an architect or purchased by the owner from a firm specializing in the preparation of house plans and specifications. The craft workers will have been trained in the fabricating and assembling of the construction materials which are their specialty. They are able to understand and follow the plans for this particular house, having built similar ones containing the common materials of their trade. With the exception of the carpenters and laborers, there is little continuity of employment for the craft worker and work
Figure 1 Home Building Project and Manning

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
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<td></td>
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<tr>
<td>Carpenter</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
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</tr>
<tr>
<td>Electrician</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
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<td></td>
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<tr>
<td>Plumbers</td>
<td>X</td>
<td>X</td>
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<td>X</td>
<td>X</td>
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<td>X</td>
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<td>X</td>
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<tr>
<td>Masons</td>
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</table>

for the firm. This condition demands a very different organizational response.

Craft has been defined by Mintzberg (1979) as work requiring complex and non-rationalized knowledge which is not recorded and is learned by doing. The bases of construction craft orientation are the primary materials used in the building process such as wood, masonry, metal, wiring, piping and paint. The human capital of the individual craft worker is enhanced by the constant repetition of fabricating, assembling or employing the many products which are made of these materials or their substitutes. Although there are further divisions of labor within the trades based on project types, these are still incorporated under the aegis of the basic
trade of carpenter, mason, ironworker, etc. Their training and experience includes the fundamentals of the trade and how the individual trades interface in the building process. Craft workers are then able to work under a process of mutual adjustment with little or no direct supervision.

Figure 2 General Contractor Manning

![Graph of House Building Project](image1)

Figure 3 Subcontractor Manning

![Graph of House Building Project](image2)
Figures 2 and 3 are a breakdown of Figure 1 and illustrate project staffing requirements and provide an explanation for the small size of most construction contracting firms and the extensive subcontracting typical of the industry. Continuous employment of the individual and firm is essential to survival. In the case of the contractor—the carpenters and laborers shown in Figure 2—continuous employment means that another project must have preceded the present one and another will have to follow. Both have the condition that their labor requirements do not overlap. The probability of this occurring is low; therefore the contractor or the craft workers will not limit themselves to home building. They may engage in repair work, renovations or other jobs of short duration to fill in the gaps between projects.

As a contracting firm becomes larger and takes on larger projects which have longer durations, the problem of continuity is exacerbated. There are fewer large projects, their sequencing more unpredictable and the contractor must find work for an increased work force. Survival and growth are therefore dependant on a contractor's ingenuity in obtaining work, juggling the work force between projects and planning projects around their availability. For the individual, it means taking a chance on the market or alignment with contractors who have proven successful at survival. Unionization has been beneficial in these circumstances since the hiring hall provides a clearing house
for contractors seeking extra workers and workers seeking jobs.

Retaining masons, electricians, plumbers and their helpers would be irrational for the general contractor. Their need is intermittent. Securing other work for them during periods their skills are not needed becomes increasingly complicated. Given other alternatives, these craft workers would not elect to become employees of the general contractor with intermittent compensation. The alternative is to work for a contractor who specializes in work requiring the skill. The contractor can offer more continuous employment by engaging in the totality of projects requiring that skill. Specialization in the form of subcontracting is the response to this uncertainty. By making themselves available for all nature of projects within their specialty, plumbers, electricians and other specialty contractors utilize the total volume of construction in a given area as a means to stabilize employment and firm survival.

Figure 4 illustrates the constraints the general contractor has with regard to the carpenters on his payroll and why geography is important in determining contractor size and market. The general contractor, who in most cases is also a craft worker, has geographical limits to the area in which to work or supervise others. The carpenters and laborers needed to execute the project will also have limits in how far they will travel for work. At the extremes of an execution
continuum, the contractor can obtain the project and take the chance of securing the necessary labor in the open market, or secure the labor and take a chance on obtaining the projects to keep it busy. A multitude of possible options exist between these extremes. A contractor, choosing the latter extreme constrains the project market to that area in which the travel limits of the individual workers overlap. In most cases this is sufficient for the small contractor. The limits within these extremes are those the contractor sets for direct involvement in either work execution or direct supervision. Growth beyond this limit requires divestiture of either direct involvement in project execution, delegation of supervisory responsibilities or both. Given the small size of most
contractors, it is at this point which most have apparently chosen to stop.

This example of the small home builder illustrates the problems which magnify with the decision to expand operations. More and/or larger projects must be obtained to cover the additional costs of marketing and administration. The economies of scale must be real, since the larger contractor must still compete with the smaller contractor who does not incur these additional costs. Local standards, building codes and state and local laws favoring local contractors for public construction compound the problems and further discourage expansion of a contractor's market. Subcontracting and the project organization is a rational alternative to facilitate this growth.

A project such as the house requires the assembly of an organization that has various skills. These skills can be provided by firms which utilize the totality of projects in their market to maintain their viability as independent firms. This organization is assembled to satisfy the needs of a specific project and when the project is complete, it is readily disbanded. The project organization, in contrast to the firm organization, is one which retains ultimate flexibility by internalizing only those inputs required for the specific project and for only that time period they are needed. Like the firm which employs only those workers it can keep busy, it is not required to subsidize unneeded resources.
The success of developers of large projects is proof that 100% subcontracting is not only possible but also practical under certain conditions. Large firms such as Bechtel and Fluor Daniel have completed many projects providing only management service and subcontracting all the craft requirements.

The written rules and regulations for governance of the project organization and its administration are incorporated in the drawings, specifications and contracts for each project. Whether these are purely oral contracts between a home owner and a plumber for a furnace repair, or with a major oil company for the building of a refinery, they apply to the organization and administration of that project only. They come into force when the project is initiated and cease to be applicable when the respective project obligations of the parties are discharged.

Recognition that the project organization is separate and independent of the construction firm organization provides a clearer understanding of how construction is actually implemented. It is elements of the firms, or numerous firms performing within subcontracts, which form the basis of the project organization. Firms which have internalized the crafts associated with their area of specialty, and that can undertake projects in their specialty without resorting to subcontracting, still treat each project independently. The primary reasons are economic, contractual and practical. Each project will have a separate client, contract and
specifications, and be executed independently in a different location and time. Craft workers and supervisors assigned to projects will allocate their time by project and must know the different requirements of each project. Organization by projects is pervasive to the extent that in large firms, office personnel working on the same project may be given a separate space to allow them to work together. They may even be sent to work on the project site to improve coordination of the total project organization. This is particularly true when a large volume of material purchasing is involved.

2. Craft Limits of the Division of Labor and Subcontracting

Building trade craft traditions have a long history of evolution based on the skill of fashioning items of utility from the materials used in building. Initially these were wood, stone and masonry. The Industrial Revolution and its supporting technology added steel, wiring and piping. Mastering the skills to fabricate or incorporate them into the many variations called for by a design and specification for a particular use requires years of training and on the job experience. This training and experience eliminates the need to reduce the process to writing which would be irrational given the infinite variety of output requirements. Where it has been possible to standardize the fabrication and assembly process, the parts affected are now made off site and become another material input. In most cases, the incorporation of
this input has become the task of the trade which originally made it on site. The same holds for substitute materials.

Formalization of building craft tradition into an organized structure first surfaced in ancient Greece, when skilled workers formed themselves into free societies called Collegia (Briggs, 1925). The present form of craft structure, however, originates from the Guild movement of Europe in the Middle Ages (Kramer, 1927). It should not be confused with the trade union movement which was the outgrowth of the Guild system abuses. The Guilds are more closely related to the specialty contractor trade associations which today attempt to accomplish the same monopoly in the trades as did their predecessors. That they have allies both in the building trades unions and the individual craft worker attests to the fact that their goals, though different, are fostered by common objectives. These are to preserve the distinction of their trade and to control the entry and qualifications of its practitioners. The result has been to establish informal standards for qualification of craft workers and a differentiation in their compensation.

The resultant trade distinction and the evolution of trade contractors creates a condition of mutual dependence. Since a general contractor uses only intermittently the trade skills necessary to accomplish most projects, they are discouraged from internalizing them. His specialty may be in the crafts which are engaged over much of the project's duration, or it
may be only in the management of the project. The specialty contractor has not the skill to undertake projects outside the specialty. The general contractor therefore relies on the specialty contractor to supply the needed skills, and the specialty contractor depends on the general contractor for participation in larger projects. This helps perpetuate the craft distinction.

The open shop construction contractor share of the market (>70%) far exceeds that of the unionized sector and has blurred the craft distinctions somewhat through the encouragement of multi-skilling. More than 50% of the respondents to the research questionnaire developed for this thesis indicated a capacity to perform more than one skill, and the percentage was only slightly less for those claiming union membership. Craft identification is still strong; more than 60% considered themselves craft workers first, as opposed to an employee of a firm.

Experience and continued application of attained skills ensures that the craft worker remains low on the learning curve. Employment of multiple skills reduces the application of an individual skill, thereby reducing its efficiency. The contractor employing multi-skilled individuals must balance the benefits gained against the costs. The reduction of skill requirements through off site fabrication and substitution reduces that cost. At the same time, the individual possessing multiple skills can command a portion of these
savings.

Craft compensation has benefited from some of these innovations but is still mired in its traditional simplicity. Financial and other rewards for effort must respond to a plethora of individual differences, not the least of which are skill, experience and productivity. The research has shown that the reward recipients are far more responsive to these differences than either their employers or craft leadership. Compensation is much too complex to succumb to simple expedients.

D. Summary

Arthur L. Stinchcombe introduced craft orientation as a determinant of construction organization. Robert G. Eccles suggested subcontracting as a superior determinant. Both were partially right, but confused the organization of the firm with the organization of construction. They are mutually exclusive, and the actual organization is better explained by its project orientation. Their major contribution may have been to focus attention on an industry which has long escaped critical analysis.

Structural change has taken place in many other industries as a result of international competition. Construction, on the other hand has retained its basic form despite structural adjustments in its complementary disciplines in design and engineering. In addition it has absorbed the higher costs of environmental and social requirements. The result has been
a plethora of claims that the industry has lost productivity and is unresponsive to change.

Productivity in construction is a function of the efficient interfacing of many factors and many players. Although the unit of analysis of its operating structure is the project, the firm and its suppliers and agents provide important and critical inputs. Materials must flow in the quantities required at the time they are needed. The design of the project must be complete and flaw-less so it can be executed without having to correct work already accomplished. Management must assemble and integrate the structure to create the necessary chemistry to produce synergy.

The debate on productivity was joined in earnest by the 1983 report of the Business Round Table.7 Both business and labor have produced numerous studies as to the negative influences on productivity by actions or policies of the other.77 At the core of these arguments is the fact that construction has remained a heavily labor-intensive industry. The project organization may have the flexibility to respond to interruptions in material flow, errors in design and inept supervision, but its resultant productivity is still very much dependent on the individual craft worker's effort.

The construction firm, particularly those associated with

design and engineering have responded effectively to technological advances. Computer aided design and the implementation of project management on a more scientific basis have transformed the formal inputs of construction. Who could fault the material control requirements and implementation of "just in time" inventory control of buildings erected in city centers, where materials and equipment cannot be left on the street overnight. The most overlooked variable in the productivity equation however, is labor.

The industry, despite attempts at mechanization, is still labor intensive. It possesses a unique capability to measure the effects of labor input, even if it has not been universally employed. Unfortunately, the measurement system has remained only that. Without analysis, the factors affecting productivity and how various stimuli can be utilized to institute positive change remain unknown. The consequence is that the organization structure, which is responsive, efficient and has been refined and honed over time, is not able to utilize its full potential. It is this deficiency that the research is intended to overcome.

The research sought to determine the motivational basis for craft labor productivity and to find a model which might enable the organization to maximize craft labor output. The results are unfortunately not robust due to the limited number of samples. The data however, indicate that the model
developed is directionally correct and suggestive of further investigation. The model is based on motivation and compensation theory and suggests the interrelationships of motivation and compensation which effect productivity. A review of the theoretical bases precedes the discussion of the research and its conclusions. The new model is offered as an organizational tool. It may improve the efficiency of the project organization by providing a greater understanding of what motivates craft workers to perform, and what stimuli might improve their productivity.
References


III. Compensation, Motivation, and Productivity

Whether organizations adapt, are selected out or changed as a result of executive choice, it is in response to their environment. It has been contended that the major environmental factors affecting construction organization have not changed, and consequently, the structure of the industry has not changed. Is the reason the construction industry is under attack because its organization is antiquated, unresponsive and suffering from declining productivity? These are subjective arguments and with sufficient cannon fodder to debate from either side. One august body reported,

"On the basis of a review of the literature and its own analysis, the committee found that it is difficult to show conclusively that construction productivity has actually decreased in recent years or, if it has decreased, to show the magnitude of the decrease. However, most evidence suggests that even if construction productivity has not actually decreased, it probably has not increased very much either" (BRB, 1986).¹

Such a conclusion seems reasonable, given the diametrically opposed viewpoints which various factions and their supporters use to identify the causes and favor specific remedies. Allen (1985)², Stokes' (1981)³ and Cremeans (1981)⁴ describe productivity as declining. On the other hand, Dacy (1965)⁵, Gordon (1968)⁶, and Shriver and Bowlby (1985)⁷ refute that view.

As might be expected, labor leadership and its supporters blame management, and management and its supporters blame labor, for the apparent decline in productivity. Robert Georgine (1980), president of the Building Trades Department
of the AFL-CIO, cites management's unfeeling attitude and remoteness.\textsuperscript{8} The Business Roundtable went to great lengths in its Construction Industry Cost Effectiveness Project report to codify the practices of labor which promote inefficiency (BRT, 1983).\textsuperscript{9} Bourdon and Levitt (1980),\textsuperscript{10} Freeman and Medoff (1984),\textsuperscript{11} Clark (1980)\textsuperscript{12} and Mandelstamm (1965)\textsuperscript{13} promote the view that unionism increases productivity. Northrup (1986),\textsuperscript{14} on the other hand, lauds the merits of the open shop. Most recently, Allen (1984,1987) has elaborated directly on the efficacy of union versus non-union construction labor.\textsuperscript{15} \textsuperscript{16} The survey questionnaire, which forms the basis for the test of the thesis hypotheses, contained a question regarding responsibility for lower productivity in construction. Nearly 80\% of the craft respondents indicated the responsibility was that of both labor and management. What promotes this apparent confusion?

In defense of their respective views, nearly all researchers have decried the lack of appropriate data and the underlying assumptions in the use of what is available. E. Quinn Mills (1979) said it most appropriately:

"Labor productivity is said to be low and the industry is generally held to be costly and technologically stagnant...are these statistics accurate or are they misleading? Measuring productivity requires the raising of at least three basic questions. One is, are the statistics accurate; two, do the statistics measure what they claim to measure and, three, what interpretation is appropriately given to the behavior of those statistics?"\textsuperscript{17}

The lack of data is compounded by the fact that construction rarely produces more than one of any single output and if so,
changes are usually introduced in the second output to confound comparability. At the core of any assumptions about the variables in the production functions used to describe construction, or any other industry, are the interactions of the individual variables. Construction, unlike many other industries with output and input continuity, offers little or no opportunity to control the variables in order to examine the effects of one under study. This does not mean that attempts to determine productivity in construction should cease.

A. Compensation

Having said that the organizational structure of the construction industry has not changed, it is not surprising then that its compensation structure has not changed either. However, its processes have changed as have the craft and the craft worker himself. It would seem appropriate that these latter changes should have resulted in changes in both the organizational and compensation structure. An examination of this apparent contradiction may provide some answers as to the cause of complaints of low productivity and clues about what might be done to improve it.

Two factors predominate in trying to analyze the critical influences on craft labor productivity and their ultimate impact. One is the continuing substitution of factory made components for those fabricated on site by the craft workers—a process which has come to be called de-skilling. The other
is the traditional distinction within the craft of only journeymen or apprentices. Both factors affect attitudes toward the work and the intrinsic and extrinsic rewards to be gained from it. In short, change as a consequence of substitution and lack of change in traditional distinctions, has affected the gross total of monetary and psychological compensation.

Compensation is important because it is the measure used to determine the worth of one's contribution to society, the value of human capital and the effort expended in its acquisition. It is a multi-dimensioned measure including: a comparison of one's own compensation with that of another; adequacy for effort expended and skill possessed; and its potential to fulfill the aspirations of the individual. Compensation in this context includes intrinsic and extrinsic factors, monetary pay and those salient features of work such as supervision, working conditions, promotional opportunities, training and the satisfaction gained from the work itself.

Many terms have been used to describe equity and inequity. Distributive justice was used by G. C. Homans (1950) to describe the relationship:  

\[
\frac{A's \text{ rewards less } A's \text{ costs}}{A's \text{ investments}} = \frac{B's \text{ rewards less } B's \text{ costs}}{B's \text{ investments}}
\]

J. S. Adams (1962) points out the weakness in this equality in that A's perception of rewards, costs and investment are not necessarily identical to B's perception of A's situation. Moreover, he contends, though two persons might agree on what
their investments are, they may disagree what weight should be given each investment. Adams describes inequity in terms of input and outcomes. Inputs include such variables as age, sex, seniority, effort and experience. Outcomes include such variables as promotion, salary increases, company cars, larger office, formal recognition of accomplishment and perquisites. Both suggest the characteristics of relevance and recognition as perceived by the individual. Jacques (1961) theorized that there are shared social norms of equitable payment, and that the totality of these "constitutes a pattern of equitable differential payment for differentials in level of work carried". Skinner (1957) has demonstrated that through the process of socialization and utilization of the "verbal community", individuals learn what is appropriate reciprocation and who should assess the marginal utility of a variety of outcomes to others.

The Festinger equality equation supported by Adams (1962) is one in which the ratios of inputs to outputs is equal. That is:

$$\frac{O_p}{I_p} = \frac{O_a}{I_a}$$

where $O = O_i$, $I = I_i$ and $p$ and $a$ are subscripts denoting Person and Other respectively. She opined that inequity in this relationship can be altered by changing inputs and outcomes as well as by cognitively distorting the inputs and outputs. Several experiments were conducted to demonstrate these possibilities. It was L. Festinger (1980), in
propounding his theory of "cognitive dissonance", who postulated "if an individual simultaneously holds two cognitions that are psychologically inconsistent, he will experience discomfort. Consequently, he will strive to reduce the inconsistency (dissonance) by changing one or both cognitions to make them more consonant or by adding a third cognition which will render the original cognitions less inconsistent with one another".²⁵ In terms of pay, the theory postulates that a man cannot both be satisfied and dissatisfied with his pay at the same time and he will find a way to be either satisfied, or dissatisfied, but not both.

Another comparison is that made by Patchen who postulated that workers make comparisons like the following:

<table>
<thead>
<tr>
<th>My Pay compared with His(Their) Pay</th>
<th>My position on dimensions related to pay compared with His(Their) position on dimensions related to pay</th>
</tr>
</thead>
</table>

Cognitive dissonance occurs when there is an inequity in the proportions (Patchen, 1961).²⁶ The motivation is to maintain consonance which, if dominated by achievement motivation, may in this circumstance be tolerated.

A critical element in comparative evaluation is the availability of pay information (Lupton, 1963).²⁷ This is not difficult for the factory employee whose pay is an element of bargaining within a plant or even an industry, such as steel or autos. Outside these confines, it becomes impossible. Even if some knowledge can be obtained, it would be incomplete as to the actual pay, including fringe benefits, or in
comparing the job content. In the construction industry, these present no problem to the worker. There are only two pay scales, that for journeymen and that for apprentices. Although there will always be differences between individuals in the level of skill and performance, there is a generally acknowledged standard connoted by the terms journeyman and apprentice. *Engineering News Record (ENR)*, the leading publication of the industry, regularly publishes union craft wage and fringe benefit rates for major cities throughout the country. It also often publishes similar rates for open shop, or non-union, craft workers. It is the comparison between closed and open shop rates which is the focus of some of the industry's current disputes.

Craft unions have succeeded, over time, to achieve a high level of wages for their members. On a pure hourly basis, they are some of the highest paid workers in any industry. In the past decade however, they have seen their bargaining power eroded by the incursion of a growing open shop movement. *ENR* has estimated that by 1989, 70% of all construction was being performed by non-union firms. Unions argue that open shop construction does not have the quality of union construction, that safety is compromised and that contractors exploit labor which is not as well trained. On the other hand, non-union contractors accuse the unions of monopoly power and restrictive practices which result in higher pay for work requiring lesser skill. While the union and non-
union contractors are verbalizing their battle in any forum available, what is the impact on the working members of the industry?

Craftsmanship has been identified (Wright, 1951) as a fully idealized model of work gratification involving six major features. There is an inner relation between the craft worker and his work. There is a psychological tie between the product and its producer. The workman is free to plan and modify his work. The craft worker's work is a means of developing his skill as well as himself as a person. The craft worker expresses himself at the same time he creates value, and because work is the mainspring of his existence, he does not separate it from his leisure. This is a grandiloquent definition of craftsmanship, but its implication is at the heart of the current dispute.

The de-skilling of craft labor is not a new phenomenon, if not always called by that name. William Haber (1930) said, "For a majority of the building trades unions, the monopoly of skill is slowly becoming of less significance. The threat of the helper and the 'greenhand' is a much greater menace than in the past. The decreased skill generally required of the modern building worker places a new interpretation on the question of apprentice training". This impression was echoed much later by P.D. Anthony (1977) who opined "work, the production of artifacts, the construction of man's work, is said to have declined. Craft work has certainly declined but
the man-made environment has not been noticeably reduced. Work, the making of things was believed to be a satisfying activity when it made satisfying things. But, if meaninglessness is a characteristic of alienation and work creates an increasingly meaningless world, then work begins to seem more alienating than labour which retains, however tenuously, some purpose."\(^{30}\)

Standardization, made practical by the increasing volume of construction and new materials, has resulted in more and more field fabrication being performed off site in factories and even the elimination of some crafts. The existence of structural steel fabricators, window and door companies, prefabricated panel manufacturers, plastic extruders and cabinet making firms are only a few of those manufacturing enterprises which have eliminated the need to fabricate many products formerly fabricated on site by the craft worker. The only portion of the skill remaining is the knowledge of how and when the product fits into the finished building. Trades such as that of the lather have disappeared altogether, and those of the ornamental ironworker, stone mason and copper roofer are on the verge of it.

Many scholars have documented the unintended and unfortunate consequences of work simplification. They have shown that simple and non-challenging jobs lead to high employee dissatisfaction, increased absenteeism and turnover, and to management difficulties (Hackman, 1971).\(^{31}\) C. Argyris
(1957) argued persuasively "that the structural features of the average work task embodied values which contradict those cherished in the American Dream-autonomy, resourcefulness, responsibility, and refusal to defer to power-holders simply because they hold power". Others (Thomas, 1988) have said, "In traditional firms at least, less attention may be paid to the human and organizational implications of technological change than ever before". Most of these studies were performed in the factory environment and did not involve construction workers. As a result of these studies many firms began implementing work enrichment programs, quality circles and job enlargement. The objective of these programs was to reduce the negative effects resulting from workers' increased control over and involvement in their jobs and to create a team approach with its attendant cooperative spirit. The construction crew, usually a foreman and several co-workers have always enjoyed the benefits of what these programs intended for factory workers. Is it possible that these consequences are also being experienced in the construction industry and for the same reason.

Worker attitudes on compensation in the manufacturing and service sectors have been extensively investigated by many researchers. The construction industry has not had much attention in this area, but the broad basis of some of the results may be extrapolated to construction craft workers. Five propositions based on the expectancy theory of
motivation, first postulated by Lewin (1938)\textsuperscript{34} and applied to the work setting by Vroom (1964),\textsuperscript{35} have been used by Hackman and Lawler (1971) to conceptualize the interaction between job characteristics and individual differences represented in many attitudinal surveys. These are:

1. A person will engage in a certain behavior to the extent of the belief that a valued outcome will result.

2. Outcomes are valued to the extent they satisfy physiological or psychological needs or lead to other outcomes which do.

3. If organizational and individual goals are properly integrated, a person will tend to work toward those goals.

4. A person may experience higher order need satisfaction on a continuing basis without diminishing the desire to satisfy these needs.

5. Persons who desire, or are capable of, higher order needs satisfaction will most likely attain them when they receive recognition for work they consider meaningful.\textsuperscript{36}

Designing a job, or redesigning an existing one, so that it will force people to work to their optimum capacity, will have intrinsic and extrinsic rewards. Examining the current situation and trends in the construction industry may be useful in determining why, its participants should be concerned and why its detractors arguments may be justified. The examination will focus on the compensation system prevalent in the industry and its ramifications on motivation.
within the framework of expectancy theory.

Intrinsic Rewards

1. Autonomy
2. Meaningfulness
3. Feedback

Autonomy is the dimension which relates to personal responsibility for the work. In a sense, it is the psychological ownership of the thing produced and the satisfaction derived from its production through personal effort. This is closely correlated with meaningfulness, in that what is produced must constitute a useful whole or a perceived significant part of the whole. The latter enables the individual to consider ownership in the team context. Meaningfulness may be self-explanatory, but it must be remembered that it is not meaningfulness in the eyes of the supervisor or manager, but as perceived by the worker. Feedback may come from the work itself or from co-workers and supervisors. It is that characteristic which tells the worker how he is doing.

The process of construction is ever-changing. Over time, tools have been introduced which obviate much of the physical effort required in construction. The process has become more complex as a consequence of the enormous variety of products required and the materials utilized. This has resulted in the development of new crafts, the elimination of others and the increase of specialization within the crafts. Substitution
of capital for labor in the form of purchased factory-made components has reduced the contribution of site labor to the finished product. Time and cost pressures have reduced the character of much of construction's product.

One of the benefits of physical activity is the feeling of exhilaration in its performance and the pleasure experienced in the exhaustion resulting from its perceived usefulness. If such an outcome is desirable in the mind of the construction worker, it has now been almost removed with the advent of the automatic nailer, electric screwdriver and similar effort saving tools. It should be noted that these are described as effort-saving, not necessarily labor-saving tools. There can be no doubt that the former description is true, but there is not much evidence of the latter. If physical activity is perceived as a desirable outcome and it is reduced, there can only be a reduction in labor input as a consequence.

Increased specialization, as has been seen in the manufacturing industry, produces many unexpected and undesirable outcomes. It has minimized the worker's identity with the final product and much of the autonomy required in its production. This is highly correlated with substitution of factory components, in that rigid adherence to craft jurisdictions has inhibited the ability to expand jobs to compensate for increased specialization. Where training and experience are limited, closer supervision and more direction
are needed, which reduces worker autonomy.

With the exception of very long projects and relatively small organizations, the construction worker has little opportunity to form meaningful relationships with supervision or achieve any identity with the firm. This tends to minimize the feedback the worker might receive. If this is compounded by the elimination of rewards from the work itself as a consequence of specialization, the worker may be left totally without motivation.

Unions grew from the alienation of journeymen with the masters and from their disillusion with the benevolent societies which were formed in a few leading towns of colonial America. Guilds, in the European sense, never took hold because workers were too widely dispersed (Foner, 1947). The earliest objectives of these unions, as were the objectives of the Guilds was to reduce work hours. These later expanded to include the regulation of the trade through control of entry, and the rates of pay (Sorges, 1977). As a consequence, worker loyalties are to the union and fellow craft workers and only secondarily to the employer, if at all. In the absence of a union and with the temporary nature of the work resulting in a soon-forgotten variety of employers, loyalties, if any, are to the trade and fellow tradesmen. Given the historically adversarial and often combative nature of the worker-employer relationship in the industry, it is not difficult to conclude that meaningful relations between worker
and management would be difficult to develop and lead to positive feedback in the motivational sense.

**Extrinsic Rewards**

1. Employment security
2. Equitable pay
3. Opportunities for promotion and personal growth

Employment security in the construction industry has a different connotation than in manufacturing. For the factory worker, it means the continuity of employment with a single employer. To the construction worker, it means the ability to continue to be employed in his craft, irrespective of employer. When a project ends, so does the job, and if there is not another one which follows, irrespective of employer, unemployment is the expected consequence. This, and the seasonal nature of construction in many areas, accounts for the high hourly pay of construction craft workers, while the average annual pay is less than in manufacturing. Small- and medium-sized firms, recognizing the benefits to be gained from continuity in employment, keep their operations within the limits they can reasonably sustain and are able to retain the same craft workers, often for many years. This is tantamount to employment security, but is by no means guaranteed. From the workers perspective, benefits of this continuity is a reasonably steady income and a higher sense of security than those of his counterparts. The firm gains from the loyalties and relationships which can be developed, the feedback it can
provide, and the predictability of performance it can obtain from an employee it knows and who knows its systems and procedures.

Each worker possesses a skill and contributes both a mental and physical effort for which he receives a monetary reward. Previously cited research has demonstrated that this input is affected by the worker's perception of whether this exchange is equitable. The perception relates both to how the worker sees the exchange as it relates to the value he places on the effort and how it compares with the outcomes of others.

It is difficult to imagine that there is not a distinction between individuals in their skill, education, motivation and attitude which affects their work. Adams and others have provided adequate evidence of the operation of equity theory. Vroom (1964) and subsequent researchers have demonstrated the validity of expectancy theory, which postulates that effort is related to the valence of expected rewards.36 It was J. R. Hicks (1964) in explaining marginal productivity who said,

"If laborers in a given trade are not of equal efficiency, then strictly speaking, they have no marginal product. We cannot tell what would be the difference to the product if one man were removed from employment; for it all depends on which man is removed".40

For the marginal theory to work (be in equilibrium), each man must be treated as a separate factor of production. Manufacturing tries to obviate this treatment by creating narrow job descriptions and setting performance criteria for each job. The consequences of this were already described.
The impact on construction craft workers has been alluded to in the adjustment of input needed to operate automated tools.

The tradition of journeyman and apprentice first codified in the guilds has been perpetuated by the craft union. It is espoused in the constitutions of nearly all craft unions that not only perceive of themselves as a brotherhood for its preservation, but also embody the term Brotherhood in their name. Many union contracts contain prohibitions against piece work to further the contention that there is no difference among workers' skills or performance. The only way a union worker can increase his pay is by working overtime. One could surmise that if the outcome is to be equal, as proposed by Festinger in his equality equation, that inputs would adjust to that of the least productive worker. Companies in the industry try to negate this possibility by selecting out the best workers for future jobs where possible.

Some efforts have already been made to recognize the distinctions among individuals, their skill and performance. In the unionized sphere, with its rigid pay structure, employers reward better performing and more skillful workers with some continuity of employment. In some cases, bonuses have been paid based on profits. The more aggressive approaches have come in the non-unionized sector, albeit sporadic and inconsistent. Smaller contractors provide some continuity of employment as a reward and pay bonuses based on profitability of the business. The most aggressive, but least
common, provide continuity of employment, bonuses or profit sharing based on output, and increase wages based on acquisition of additional skills through in-house training.

Every worker has a level of capacity, the physiological and mental skill to carry higher or lower levels of work. These are the determinates of the quality and quantity of work. One could support Jaques' (1961) conclusion that "higher production rates can only be achieved over short bursts or they will be accompanied by fatigue or slow-up. The importance of external conditions, so-called incentives, is to facilitate the expression of normal pace, concentration and capacity in work, and to prevent interference with their expression". This is a logical perception. It would help to explain why many incentive plans ultimately fail and why overtime, and its attendant higher rate of pay, fails to produce the desired results when employed over long periods of time. Expanding his logic, any program to motivate workers to produce consistently up to their capacity must contain elements of extrinsic and intrinsic compensation that the worker, not management, wants and values. Conversely, perceived inadequacies result in the worker not performing up to capacity. Finding perceived inadequacies may provide the key to higher productivity.

The journeyman/apprentice tradition and the rigid adherence and defense of craft jurisdiction have prevented expansion of the human capital and opportunities for the craft worker. The
aspirations of many are limited to the level of foreman and, for the few, the opportunity to go into business for themselves. A foreman in most crafts makes about a dollar more an hour than the journeyman and may be last to be laid off. This would hardly be enough to attract entrants to the trade and retain those in it. Jurisdiction over the work is fiercely protected by the craft union. As the amount of work and the skill required to perform it has decreased, the craft worker is prevented from acquiring the skills of other trades to substitute for the loss or to expand his capability and hence his opportunity. Non-unionized firms are free of these jurisdictional pressures and allow, or in some cases encourage, their workers to attain additional skills. In some of the larger firms, the development of an internal labor market has resulted in a hierarchy of jobs which can be achieved by the craft worker, depending upon the skills attained and the level of performance. Some amalgamation has occurred in the trade union movement but it has stagnated in the past decades. It is not too difficult to imagine a single building trade union which would provide the benefits of unionism now enjoyed by workers and employers. Unfortunately, few union leaders have the vision to grasp the possibilities and the power to bring it off.

B. Motivation

It was Victor H. Vroom (1964) who hypothesized that performance is a function of ability and motivation. To prove
this relationship there must be objective measures for the variables and a frame of reference. As will be explained later, the construction industry utilizes a productivity measure against which to measure output performance. In short, individual tasks are assigned an execution time—that is, the time required of an individual of average intelligence and skill, working at a normal pace to execute the task. Theoretically, the standard of productivity is taken as the average time from past performance records divided by the actual time observed. If the observed time is less, the productivity will be >1.00 and if more, <1.00. Note that nothing has been said about motivation.

The only alternatives of performance are average, above average or below average. As cited earlier, above average performance can be sustained only for short periods of time, constrained by the natural fatigue accompanying excessive physical or mental activity. Below average performance may be infinitely sustainable. But what is average performance, and is it an individual or collective measure?

Capability is the human capital possessed by the individual enabling the performance of the task assigned. Motivation is the critical variable in determining how the individual uses that capability. The performance measure used in the construction industry is the time required by a craft worker of average skill to perform a specified task, exerting a sustainable effort during a normal work day. The benchmark
performance is the average time required divided by the time actually taken. A mark above 1.0 indicates better than average performance, 1.0 average performance and below 1.0 lower that average performance.

The standard way to estimate construction durations is to equate the scope of work of the project to activities or tasks, whose average time of execution has been established through the development of historical records. Establishing the average time required by each craft to perform all of the tasks necessary to complete the project enables the contractor to determine the labor cost estimate for the project. If the contractor obtains the contract, he must ensure that all of the tasks can be accomplished within or less than the time estimated. To accomplish this, the contractor must motivate the craft workers to perform at or above average levels.

C. Theories and Hypotheses

Worker motivation is by no means a new subject. Motivation, more accurately demotivation, has been addressed since the time of Adam Smith. In 1776, Smith (reported in Lewis, 1963) stated that "It [division of labor] corrupts even the activity of his body, and renders him incapable of exerting his strength and vigour and perseverance, in any other employment than that to which he has been bred". It was not until the experiments of the late 1920s at the Western Electric Hawthorne plant however, that the worker began to be recognized as a more complex component in the production
process, rather than the automaton perceived by Frederick W. Taylor in his theories of scientific management. These experiments resulted in an entirely new field of study and a plethora of theories attempting to explain the phenomena observed.

Motivation is a psychological stimulus. It is an individual condition, yet influenced in its manifestation by one's environment, values and objectives. Therein lie the difficulties in observing and measuring the forces influencing it and explaining its outcome. The framework utilized to overcome these difficulties has concentrated first on understanding the individual and then in the context of the group, which constitutes the usual working environment. It would appear from the research undertaken that the concentration is not on explaining motivation itself, but to determine the factors which stimulate it and to measure the outcome as a consequences of increasing or decreasing them.

The genesis of much of the work in the area of motivation took seed in the ideas of Carl R. Rogers. It was Rogers who departed from the psychoanalytic tradition and took issue with orthodox Freudians, particularly on the question of unconscious motivation (Luft, 1970). Abraham Maslow, who

***It is assumed the reader is familiar with the now famous Hawthorne studies. One of the earliest and most comprehensive statements on these studies is contained in Elton Mayo's *The Human Problems of an Industrial Civilization*, The McMillan Co., New York, 1933. A short, but comprehensive, summary is contained in Fatigue of Workers by George C Homans, Reinhold, 1941, pp.56-65.
picked up on Rogers' idea that the individual is basically guided by inner needs for growth, health and self-actualization. This led to the hierarchy of needs upon which much of the work motivation theory is based. Figure 5 shows the hierarchy as conceptualized by Maslow (1954).** His theory was that man was motivated to satisfy basic needs in an ascending order from the physiological (food, shelter) to the satisfaction of his ultimate potential in self-actualization. In the context of the work environment, one cannot exclude the latent motivations of physical and security needs; however, the stress is on the social, esteem and self-actualization needs.

Maslow's theories were intuitively appealing, but presented overwhelming difficulties in developing methodologies which could provide a basis for any substantive proofs. A major
effort to overcome these problems concentrated on the result of needs as opposed to their motivation. This effort was led by Frederick Herzberg, B. Mausner and B. Snyderman, who in 1959 published their "Motivation to Work", which put forward the "two factor" theory. This introduced the concept that needs could be explained in two contexts and the inference that motivational effects could be interpreted from the satisfaction of needs.

The dual factor theory postulates that man has two sets of needs: his needs as an animal to avoid pain and his need as a human to grow psychologically. The interview findings which led to the theory suggested that job satisfaction consisted of two independent dimensions, each with its own continua. The first was related to job satisfaction and identified by job "satisfiers". The second to job dissatisfaction, or job "dissatifiers". The satisfiers are related to factors inherent to the work and rewards which flow directly from it. The strongest can be associated with the upper end of the Maslow hierarchy. Dissatisfiers can be associated with extrinsic factors such as the environment in which the work is done, such as company policy, supervision, pay and promotional opportunity. The second hypothesis of the theory postulates that satisfiers are effective in influencing motivation and hence are called motivators, whereas, dissatisfiers are not and can be classified as hygiene factors.
Since its introduction, the two factor theory has been subjected to considerable study, and several variations have resulted in both support and criticism of the theory. House and Wrigdor (1967) summarized some of the early criticisms. They cite Henry Vroom in suggesting the theory is methodologically bound. He argues that the storytelling critical-incident method accounts for the associations found by Hertzberg, and that other methods are required to adequately test the theory. The necessity of interpretation of the data and coding by the rater should have been obviated by having the coding determined by the rating system and the data itself. Inconsistency with previous evidence is supported by the work of Brayfield and Crockett (1955) whose review of the literature up to 1955 concluded that one's position in a network of relationships need not imply strong motivation.

In the 10 years following its appearance, no fewer than five separate versions of the theory had been developed through the design of various researches (King, 1970). In their review of these versions, Hulin and Waters (1971) concluded that three of the versions were distinct and separate variations and two had not been adequately tested and may reflect only method variance. Their conclusion was that the data supporting the testing of the three theories met the criteria of assessment of satisfaction and dissatisfaction on different scales, that a wide range of individual job factors
was considered and that the analyses were adequate. The results were that fewer than 50% of the predictions of the three versions were supported and that no individual version made more than 50% correct predictions. They stated that "we again arrive at the oft-stated conclusion: The two factor theories receive no support when tested using data generated by methods other than the critical incident or S-coded techniques". 49

Unlike Maslow’s theory, Hertzberg’s dual factor theory has provoked considerable empirical research, some supportive, some not. In spite of its supporters and detractors, it has resulted in numerous offshoots which have either sought to improve on the theory or obviate its shortcomings. One major variation was in the direction of the relationship between job dimensions and job satisfaction, represented in the work of J. Richard Hackman and Greg R. Oldham (1975). Their work and that of others stimulated the interest in the area of job enrichment which was evidenced in the Volvo plant experience in Sweden and most recently employed in General Motors' Saturn auto plant.

Since the first formal recognition of job satisfaction investigation by A. W. Kornhauser (1930), 50 the area continues to interest researchers. An exhaustive study by W. W. Ronan (1970), however showed that "little relationship was found between satisfaction and behaviors". He concluded that "where such a relationship was found, the link appeared to be direct
supervision .... and that behavioral measures load on more than one factor, the interrelationships are extremely complex."

A significant result of all the research in this area was the focus on task attributes or job characteristics as determinants of satisfaction. Turner and Lawrence (1965) summed it up succinctly from the results of their own researches:

"The very strong relationship between workers' perception of task attributes and their expressed job satisfaction suggests that how workers perceive their task may predict their ultimate satisfaction with the job more accurately than how the job attributes are systematically scored by someone else." 51

An early effort was the development of the Survey of Work Values (SWV), which attempted to provide an index of an individual's attitude toward work as opposed to feelings about a specific job (Wollach, 1971). 52 It was linked to principal aspects of the Protestant Work Ethic as described by Weber in 1958. Three dimensions were selected which represented intrinsic aspects: pride in work, job involvement and activity preference. Two represented extrinsic aspects: attitude towards earnings and social status of the job. Two were of mixed character: upward striving and responsibility to work. They concluded that the six values were discriminably different from one another and represent the constructs they were intended to measure, that the internal consistency of the subscales was relatively high and, that the scores have
discriminated meaningfully among occupational groups and correlated substantially with background variables associated with other measures of work values.

A second approach, which drew much more interest, was in the area of identifying job characteristics which might lead to more meaningful measures of satisfaction and enable the design of better jobs. The Job Characteristics Survey (JCS) of Hackman and Lawler (1971) was the most important of these efforts and received the greatest critical attention of other researchers. It was based on the needs satisfaction theories of Maslow already discussed, but leans heavily on the expectancy theories of Kurt Lewin (1938) and V. H. Vroom, about which more will be said.

The problem with job satisfaction studies was in relating them to performance behavior. It was V. H. Vroom (1964), building on the initial work of K. Lewin who postulated how the two may be linked. He examined five properties of work roles in an attempt to specify some of the determinants of the preference between working and not working:

1. They provide financial remuneration.
2. They require expenditure of energy.
3. They involve the production of goods and services.
4. They permit or require social interaction.
5. They affect the social status of the worker.

One of his important premises was that since "work provides many sources of satisfaction which are not economic in nature,
Situational Variables: Present:
- Communicate Probability that j will be followed by j
- Communicate desirability of j
- Objective Probability that
- Degree of motive arousal, e.g., length of food deprivation

Situational variables: Past
- Proportion of trials or which I has been followed by j
- Frequency with which j has been contingently associated with established rewarding or punishing outcome

Inferrred Variables
- Valence of outcome j
- Expectancy that act i will be followed by outcome j

Behavioral Variables
- Verbal report of attractiveness of j
- Verbal report of probability that i will be followed by j
- Amount or rate of consummation of outcome j
- Choice or rejection of act i
- Change in probability of act i when i is followed by j
- Content of fantasy
- Decision time; degree of difference between valence of outcomes
the deprivations of unemployment cannot be eliminated by employment insurance or more abundant programs of relief". This was based on the many studies of the unemployed during the depression of the 1930s. He discarded the assumption of much of the earlier work that differences in job satisfaction are the exclusive results of differences in work roles. Acknowledging that individuals vary greatly in their motives, values and abilities, and that such differences have an important bearing on the optimal characteristics of their work role, he sought to examine the complex interactions of both situational and personality variables. The model developed from this work is shown in Figure 6. Simply stated, motivation to perform a given act or task is the product of preference for a desired outcome and the expectation that such performance will result in its achievement. The model expands on "needs" theory by incorporating desirable as well as necessary outcomes of effort. Missing still are the answers to job choice and the measure of performance resulting from motivation. This spawned the next phase of need/satisfaction models, those relating to characteristics of the job itself which determine satisfaction.

The most often copied job characteristic scales are those introduced by Turner and Lawrence (1965).\(^\text{56}\) They described the dimensions in the following way:

Variety--The degree to which a job requires employees to perform a wide range of operations in their work and/or the
degree to which employees must use a variety of equipment and procedures in their work.

Autonomy--The extent to which employees have a major say in scheduling their work, selecting the equipment they will use, and deciding on procedures to be followed.

Task Identity--The extent to which employees do an entire or whole piece of work and can clearly identify the result of their efforts.

Feedback--The degree to which employees receive information as they are working which reveals how well they are performing.

Dealing with Others--The degree to which a job requires employees to deal with other people to complete the work.

Friendship Opportunities--The degree to which a job allows employees to talk with one another on the job and to establish informal relationships with other employees at work.

Hackman and Lawler (1971) developed five propositions which conceptualized the interaction between job characteristics and individual differences represented in many attitudinal surveys. These are:

1. A person will engage in a certain behavior to the extent of the belief that a valued outcome will result.

2. Outcomes are valued to the extent they satisfy physiological or psychological needs or lead to other outcomes which do.

3. If organizational and individual goals are properly
integrated, a person will tend to work toward those goals.

4. A person may experience higher order need satisfaction on a continuing basis without diminishing the desire to satisfy those needs.

5. Persons who desire, or are capable of, higher order needs satisfaction will most likely attain them when recognition is attendant to work considered meaningful.

Hackman and Lawler's independent variables were a measure of the strength of desire for the satisfaction of "higher order needs" and the description of jobs on four core dimensions (variety, autonomy, task identity, and feedback). On the basis of their survey, they conclude that when jobs are high on the four core dimensions, "employees who are desirous of higher order need satisfaction tend to have high motivation, have high job satisfaction, be absent from work infrequently and be rated by supervisors as doing high quality work". They condensed the Turner and Lawrence dimensions into two groups, the first of which they labeled "core dimensions" which incorporated all but the latter two, opining that those were not centrally related to job satisfaction. They developed a Motivating Potential Score which measures whether (a) the job is high on at least one or more of the three job dimensions that lead to experienced meaningfulness, (b) the job is high on autonomy, and (c) the job is high on feedback. Their formulation is as follows:

It was Oldham (1976) who later introduced the moderating
effects of interpersonal variables.\textsuperscript{56}

Another measurement system was the Job Characteristic Inventory (JCI) developed by Sims, Szilagyi and Keller (1976).\textsuperscript{59} They classified previous attempts at measuring job characteristics as divided into two categories: objective and perceptual measurement techniques. Their objective was to avoid the difficulties of the perceptual method, wherein error may arise in the measurement by characteristics which are attributes of the individual rather than of the job. They agreed with Hackman and Lawler who posited that it is not the objective characteristic of the job but how the individual perceives his job that is the important determinant of job's influence on the individual's satisfaction. Their attempt was to develop a perceptual measurement technique which has the power to discriminate between different jobs. This power, they say, is necessary if the technique is to be regarded as valid for deriving useful conclusions about the relationship of job characteristics to the individual's satisfaction.

Brief and Aldag (1975) replicated the Hackman, Lawler work in 1975 and found significant, positive correlations between job dimensions and employee reactions.\textsuperscript{60} Although they
confirmed that higher order needs strength moderated the job characteristics/employee reactions relationship, they found the role of higher order needs strength more complex.

The thrust of much of this work was the effort at job redesign and job enrichment, provoked by the decline of productivity, high rates of turnover and absenteeism in many production facilities where highly repetitive, unchallenging work seemed the cause of these problems. Emphasis was on trying to determine what work motivated employees and what factors characterized motivating work. Hackman (1976) later expanded his work to create a model that specifies the conditions under which individuals will become internally

Figure 8 The Job Characteristics Model of Work Motivation

[Diagram of the Job Characteristics Model of Work Motivation]

EMPLOYEE GROWTH NEED STRENGTH
motivated to perform effectively on their jobs. This model is shown in Figure 8. This work made use of the Job Diagnostic Survey developed as a means to redesign jobs to improve employee motivation and productivity (Hackman, 1975). With the exception of absenteeism and turnover, personal and work outcomes are highly subjective and difficult to correlate directly with output.

Job satisfaction and job characteristic research was employed in a variety of settings, and conditions in the past two decades in an attempt to enrich jobs. These attempts have produced a variety of results. Goal setting was employed by Unstot, Bell and Mitchell (1976) in a managerial setting. They found that job enrichment had a substantial impact on job satisfaction but little effect on productivity. Goal setting had less impact on satisfaction but a major impact on productivity. It was also found that significant differences occur between job characteristics and employee satisfaction across technologies (Rousseau, 1977). Studies of federal employees found that job enrichment caused significant increases in job satisfaction, involvement and internal motivation, and led to significant decreases in absenteeism and turnover. It had little impact, however, on performance (Orpen, 1979).

Most subsequent research has not questioned the underlying basis of the Turner and Lawrence framework but has suggested variations in an attempt to develop a more universally
replicable format. Dunham, Aldag and Brief (1977) subjected the task attribute measures -- variety, autonomy, required interaction, optional interaction, knowledge and skill required, and responsibility -- to factor analysis and suggested that a priori dimensionality cannot be considered to exist unless specifically documented for the specific sample. 66 This confirmed an earlier conclusion of Pierce and Dunham (1976) that the underlying dimensionality of perceived task design is still unknown. 67 The JDI discussed earlier was an attempt to overcome this deficiency, and Pierce and Dunham (1978) subsequently performed the same factor analysis of its underlying dimensionality. 68 They concluded that the JDI was superior to the JDS in internal consistency and empirical dimensionality and that the utility of these instruments in job design research has been clearly demonstrated. Correlation analyses performed by Green, et. al. (1979) revealed that the format used in collecting the data may be partially responsible for the different factor structures found for various types of workers and that simplification may be needed. 69 Kopelman (1979), however, concluded through causal-correlational analysis of pertinent data for the entire Porter and Lawler model that the pattern of relative correlations was highly supportive. 70

Arnold and House (1980) identified three basic issues arising from the job characteristics model of motivation: "the validity of the Motivating Potential Score (MPS) formula based
on the hypothesis that all three psychological states are necessary for internal motivation to exist, the validity of the hypothesized two-stage moderating effect of growth need strength (GNS), and the effects of valences of the psychological states upon personal and work outcomes". 71 Their analysis produced no support for the formulation, some support for the GNS moderating effects on the job dimension/psychological states relationship, but no support for its moderating effect on the psychological states/outcomes relationship. They did find evidence of interaction and valences of psychological states in influencing internal motivation.

Some of the deficiencies in the results obtained in using the various instruments to test perception might have been caused by the fact that employees at different levels in the organization have different perceptions of their job. This may be that higher level employees have a "different general view of the company, the industry, or of the meaning work...or that they have a specific relationship to the job in question, i.e., they are directly responsible for it or for the person performing it", as suggested by Pokorney, Gilmore and Beehr (1980). 72 It has also been suggested that tasks and employee responses to them be examined in the organizational contexts in which they occur (Roberts, 1981). 73

It has been suggested that the assumptions concerning task dimensionality are severely restrictive and are compounded by
the usage of a particular combinatory model (Aldag, 1981). More objective measurement strategies could possibly lead to overcoming the inconsistencies in previous findings. One method has been put forward by Schwab and Cummings (1976) in which task characteristics are measured in terms of three dimensions of task stimulation: (a) magnitude of stimulation provided by the task, (b) variation of stimulation, and (c) number of sensory modalities affected by the task. This approach is not conceptually bound to the Turner and Lawrence model but is linked to both expectancy and activation theory.

Many attempts have been made at identifying moderating factors to add to the core factors in the original Hackman and Lawler model in order to achieve consistency and replicability of results. Growth need strength has already been identified as one and was further confirmed by Griffin (1982). The effects of the organization as a moderator has been identified by Dunham (1977). He suggested that theoretical models of task design should include consideration of non-task environmental characteristics. Welch and LaVan (1981) investigated commitment to the organization as an important behavioral dimension related to measure of job satisfaction. Feedback has been considered in most models, and some research has found that positive feedback served as an independent predictor of performance (Pavett, 1983). Demographic factors have also been found to influence job satisfaction (Lee, 1988). Job satisfaction, for example, was shown to increase
with age; younger employees were less satisfied with the intrinsic character of the work, and older employees were more satisfied with the extrinsic characteristics. Kemp and Cook (1983) examined job longevity and growth need strength as joint moderators and found that job longevity was not a significant moderator and that growth need strength moderates the job complexity/job satisfaction relationship only for employees with short job tenure. Self esteem has been found not to moderate the job complexity/job performance, or satisfaction relationships (Tharenou, 1984).

The most significant negative critiques of the job characteristics/satisfaction models developed to date attack the structural deficiencies of the models. Salancik and Pfeffer (1977) contend that the models are "frequently formulated so as to be almost impossible to refute, and the research testing them has been beset with consistency and priming artifacts". They contend that need models "may have persisted because of their perceptual biases, their consistency with other theories of rational choice behavior, and because of what they seem to imply about human behavior". They suggest that most need-satisfaction models assert hypotheses about needs as if they were established truths, then move on to the problems of the interrelationship of needs, jobs, and attitudes. They contend that because needs are related to attitudes through the experience of the individual on the job, the theories must define jobs in terms
of characteristics that could then be related to need satisfaction. Both are open to serious question and alternate interpretation. They conclude that because researchers have seldom attempted to disprove the model, it must be seriously reexamined and does not warrant the unquestioning acceptance it has attained. A further claim is that "while need-satisfaction models posit rationality and the possibility of individual action, they do not give humans credit for much adaptability in the pursuit of satisfaction".

Katz and Van Maanen (1977) describe the structural deficiencies as conceptual. Work satisfaction, they claim, is treated for the most part as if it were unidimensional and somehow amenable to measurement and representation by a single number. They conclude that either the satisfaction formulation is too general, without practical implication, or the calculus is too specific, misleading in a diverse work situation. In their study they attempted to move away from traditional conceptualizations by demonstrating empirically the situationally dependent nature of the concept. They demonstrated this by denoting clearly the linkages attaching satisfaction attitudes to workaday realities. They posit that work satisfaction is interwoven with job, interaction and policy threads which make up the loci. Furthermore, they argue that "satisfaction is a function of situational surroundings accompanying the doing of work rather than a function of the psychological predispositions or demographic
characteristics of the doer."

D.A New Model of Satisfaction and Productivity: The Equilibrium Model

The simplicity of Maslow's (1954) needs hierarchy theory belies the difficulties in designing a proof. Attempts by Hackman and Oldham (1975) to link satisfaction and behavior and Turner and Lawrence (1965) to define job attributes leading to work motivation have had mixed results. Vroom (1964), building on the Lewin (1938) model, linked situational and personality variables but failed to equate them to measurable output. Hackman and Lawler (1971) defined characteristics of jobs but again failed to link them adequately to performance. What is needed is a simple model which builds on the best attributes of the former work and provides a direct link to measurable output.

The needs hierarchy embodies the motives for work and the desire for self-expression. They are not mutually exclusive; indeed they exist in concert, to a greater or lesser degree. In its simplicity, the hierarchy depicts the reasons people work, suggesting the characteristics of the jobs people want to do and what will motivate them to perform at their highest mental and physical capacity. Unlocking these interrelationships and quantifying them have proven difficult, yet a new model may provide this key.

The Equilibrium Model of Satisfaction and Productivity is based on the concept that people have a maximum sustainable
level of performance and will perform to that level in proportion to how they perceive the satisfaction of their needs in the employment relationship. The former is in keeping with Jacques' contention that output is regulated by physical and mental capacity and that above normal performance can only be sustained for short periods. The latter conforms in large degree to the expectancy framework of Vroom(1964) and the comparative framework models of Homans(1950), Adams(1962) and Festinger(1980). The model hypothesizes that needs are expressed and satisfied in job selection and performance by four characteristics:

1. Pay--monetary or other direct compensation
2. Task--gratification or stimulation afforded by the work itself
3. Variety--diversity of the work or its environment
4. Autonomy--choice, risk, and control.

In the research associated with the construction of this model, the attributes used to represent these characteristics are similar to those employed by Hackman, Lawler and others in development of Motivational Potential Scores and Job Characteristics Inventories. The relationship of these characteristics, however, is significantly different.

The model postulates that occupational choice, job selection, satisfaction and ultimately productivity is a counter-balance of needs, as shown in Figure 9(a). The first set is provided by the work itself and the employer and are
represented by Pay, Task and Variety. The second set is more related to self-actualization. It is the manifestation of the need of independence, self expression, and it is also and expression of choice — the degree of risk one is willing to take and one’s ability to control his own destiny. This is the Autonomy need. These are in balance when the Pay, Task, and Variety attributes of the work match the expectations of Autonomy, as shown in Figure 9(a). If this balance exists, individuals will produce at a level commensurate with their mental and physical capabilities. Autonomy needs in this context are exemplified by the expectations of the investment in human capital, risk tolerance and ego satisfaction. The characteristics of Pay, Task and Variety are in a sense subsumed in autonomy and expressed only to the extent they are lacking in the bargain. Some authors have referred to this as higher order need strength.

As in Figure 9(a), a balance is achieved when needs are satisfied to the extent the individual perceives a reasonable bargain and will produce an average output. If, as in Figure 9(b), expectations of Pay, Task, or Variety are not met, imbalance occurs. The bargain is perceived as unfair, and output will be reduced to restore what is then considered a fair bargain. The employer would measure this as a drop in average productivity. If, as in Figure 9(c), expectations of Pay, Task, or Variety are subsumed, imbalance also occurs. The autonomy need is more than satisfied and would be
accompanied by a higher than average output. The employer would measure this as an increase in productivity.

Occupational choice is not always voluntary, and job characteristics within that choice may or may not be those which were anticipated. Therefore, responses regarding those choices will reflect underlying as well as transient motivations. The former are representative of the basic expectations of the individual in the choice of occupation and the latter, what is acceptable in the short term. In any work environment one could then find individuals who were well-
satisfied, in that the work meets most of their expectations, and those who were dissatisfied.

On a rating scale of 1 to 5, the equilibrium concept is illustrated by the possibilities shown in Table 5. Given a normally distributed population and the probability that needs at either extreme would be satisfied half the time, an employers experience would appear as shown in Figure 10. Points \( x \) and \( y \) represent the means of the normally distributed population. Points \( x', x'', y', y'' \) are the standard deviations of the normal population. The perpendicular axis and arrows indicate the direction of higher or lower than normal productivity.

The construction industry is somewhat unique in how it measures productivity, in that the measurement is nearly totally related to individual and collective human output and virtually devoid of capital measures. There is always some bias in the measure due to the influence of supervision, the quality of design and the availability of materials. These
Factors will influence the effect of human effort either positively or negatively. Therefore, the construction industry's productivity measure will, for the most part, reflect the direct response by craft workers to the needs satisfied by the work itself, its variety and its compensation.

Each occupation will attract entrants with a variety of needs. Construction, for example, tends to attract individuals with high autonomy needs. Manufacturing and production might attract those with high pay needs. Therefore, the expected average experience would reflect a skewed distribution and appear as in Figure 11.

Actual experience will reflect worker responses to the
work, its variety and in particular the compensation system prevalent in the industry and the distribution pattern of needs of the measured workers. That experience would be another line, parallel to the average (P=1.00), and indicate whether the experience was above or below average.

The model is dynamic in that actual experience will vary as needs vary and as employers alter the pattern of compensation and even the work itself. If measurements are consistently taken of labor productivity, the consequences of these changes can be directly measured. According to needs theory, needs themselves will change over time as they are satisfied and the individual moves further up the hierarchy. If the work or the employer do not change almost in lock step,
actual productivity may still be measured as $P(\text{actual})=1.00$, since it reflects cumulative experience, but the line may be falling further to the negative. This may explain why observers of the construction industry fault its loss of productivity, while its practitioners claim the opposite. The following chapter offers support of the theory and additional insight into the argument of productivity decline.

E. Summary

The focus of motivational research seems to rest on the answers to three critical questions:

1. What makes people want to work?
2. What is it about the job which creates satisfaction or dissatisfaction?
3. What is it about the job, the individual, or the environment which motivates performance?

Needs theory, expectancy theory, activation theory and job characteristics models seem to answer parts of these questions, but certainly not all. One of the more serious shortcomings has been the lack of connection between satisfaction, motivation and performance. Definitive measures of performance have been few and far between. Supervisor rating systems are subjective and can be biased by such factors as the "halo effect". In one study where employee productivity was measured by unit output (Griffen, 1982), the comparison was on a before and after basis for each employee as opposed to a norm or comparison with other employees. The
lack of a common output across employees accounted for the limitation.

Most of the needs-satisfaction research has been conducted in office, or factory settings, with little, if any, relating to craft workers. The entire construction industry has for the most part been ignored yet represents an ideal environment for the type of research being conducted. Certain characteristics of the industry offer the opportunity to negate some of the arguments confounding the development of an appropriate model.

The construction craft worker is essentially an individual entrepreneur. The nature of the work results in regular turnover, disruption of or discouragement of social relationships and association with a single employer. As such, the influence of these factors as moderators is either eliminated or minimized. The salary and promotional structure of the building trades results in a similar situation with regard to growth need strength. The apprentice-journeyman phase is essentially all that is open to the craft worker. Growth opportunity if there is any or if it is desired is outside the performance of the craft. The choice to become a craft worker almost acknowledges that the only option for promotion or income growth, beyond market adjustments, is for the craft worker to go into business for himself.

The most inviting opportunity presented by the construction industry is that of direct measurement of productivity. The
nature of the trades and the methodology of the industry results in definitive, repeatable, measurable tasks. Despite the fact that economists have not been able to come to grips with the productivity of the industry, the productivity of the single craft worker and small groups of craft workers on individuals jobs is well-known, and is being constantly measured and employed. Much of the work which can be economically mass-produced is being performed off site. The remaining work, which is still considerable, is labor intensive yet standardized. Examples can be seen in the commercially available estimating manuals which develop the material and labor requirements for various tasks and building components. This means of measuring eliminates consideration of the productivity of capital or the effects of substitution which bias much of the measures of productivity. The availability of an effective productivity measure enables the application of the expectancy model of Vroom and the simplicity of the core dimensions of the Hackman and Oldham model. It enables answering all three of the critical questions and results in a model which satisfies the concerns of structural deficiency. Support for this theory is given in the next chapter.
References


56. op. cit., Turner and Lawrence

57. op. cit. Hackman and Lawler, p. 262-263.


80. Raymond Lee, Elizabeth R. Wilbur, Age, Education, Job Tenure, Salary, Job Characteristics, and Job Satisfaction: A


IV. Research Data Acquisition, Results and Analysis

A. Questionnaire Design and Administration

Individuals enter the building trades with a variety of expectations. If these could be determined, it may be possible to develop the relationships between behavior, in the form of performance, and the satisfaction of those expectations. Experience with the industry prompted the selection of five reasons why individuals enter the building trades. These can be associated with four core dimensions (pay, task, variety, autonomy) in the following manner:

Reason for Becoming a Craft Worker  Core Dimension

1. To earn high wages.  Pay
2. To create things with my hands.  Task
3. To work on a variety of jobs in different places.  Variety
4. To learn a skill which I can use anywhere.  Autonomy
5. Because my father or close relative was a craft worker.  Autonomy

In the event these reasons were not all inclusive, the test questionnaire allowed for a write-in of a sixth reason. Of the 323 responses to the test questionnaire, only five elected to add a sixth reason. All but one of these was directly related to the other five. That indicated a preference to

*****A copy of the questionnaire is included in the Appendix.
work outdoors, which is closely related to reasons 2 and 3. Reason five was included to ascertain the influence of relatives in selection, which would moderate the autonomy dimension. This reason was rated by 77% of respondents as least, or not very, important.

Questions were asked concerning the specific trade of the individual, the work the respondent was doing, conditions in the industry as a whole and the conditions under which the craft worker labored. These were rated on a five-point Likert scale. Attitudes and preferences were rated on a positive-negative, or choice of specified alternatives scale. Demographic data was collected in standard formats. In addition to questions related to needs, a variety of questions were asked with the specific objective of determining respondent attitudes toward skill requirements and changes in those requirements.

B. Sampling

Randomly selected individuals working on 23 separate projects completed the questionnaire, whose coded responses were used to test the theory and several hypotheses. Five of the projects offered incentive compensation on the basis of improvements in the average time required to perform various tasks; the remainder offered no comparable incentive. Of these five projects, two conditioned the award of incentives on continuation of employment and absenteeism in order to reduce turnover and absenteeism. The objective was to
determine the validity of the model dimensions, incentive, and productivity which was available on 19 of the projects. The projects surveyed are classified as heavy industrial with a SIC code of 16. This segment of the industry includes 6% of all construction establishments, 20% of all construction employees and 22% of all construction receipts. The 23 projects were not randomly selected from the number of projects being executed by the individual contractors, but were those where project managers were willing to cooperate in the study and management did not consider questions of a sensitive nature with respect to their union relations. The projects yielded a total of 323 acceptable responses for coding and analysis. Productivity measures were available for 19 projects. Productivity was measured on a composite basis, not by individual respondent. Therefore, the productivity sample size was 19. Comparisons of the distribution of age, sex and education with the employed population and with the construction industry are given in Table 6.

Abstract data shown in the table, except for sex and education, is not reported specifically for the construction trades. The sex distribution of the sample is for data taken mostly in 1991 and is three years more recent. The proliferation of affirmative action plans and the fact that samples were taken from projects undertaken by larger contractors more exposed to Equal Opportunity Commission scrutiny may account for the higher representation of women
Table 6 Sample Versus Statistical Abstract Data

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<th>Sex</th>
<th>Statistical Abstract</th>
<th>Samples</th>
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<td>95%</td>
</tr>
<tr>
<td>Female</td>
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<td>5</td>
</tr>
<tr>
<td>Education</td>
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<td></td>
</tr>
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<td>27</td>
</tr>
<tr>
<td>H.S. Grad.</td>
<td>52</td>
<td>43</td>
</tr>
<tr>
<td>1-3 yr. Coll.</td>
<td>19</td>
<td>26</td>
</tr>
<tr>
<td>4 yr. Coll. &amp; +</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
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<td>50-59</td>
<td>7</td>
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</tr>
</tbody>
</table>

in the samples. The continuing downturn in the economy has resulted in the release of many individuals with higher educational attainment and may account for the higher educational distribution of the sample. Fewer older workers may remain in construction due to the physical demands of the work.

The effects of bias in the samples cannot be accurately measured. This bias arises due to the nature of the business of the sources of the data. These contractors specialize in large projects in the process, refinery and chemical industries with a higher utilization rate of the specialty trades such as pipefitters, electricians and to a lesser extent on the more common trades of carpenter, mason and ironworker. Geographic distribution of the samples varied from the middle-Atlantic, mid-South, deep South and Southwestern states. Open shop projects provided 68% of the
responses, unionized and merit shop projects 15% and 17% respectively. Merit shop are those projects where the employer is not bound to hire union craft workers, but pays a prevailing wage, usually based on the union rates in the area. Prevailing wages are mandated on Federally funded and most State funded projects. The projects were all privately financed, and merit shop arrangements employed only where the owners voluntarily elected to employ prevailing wage provisions to enable competition between unionized and non-unionized contractors. Union members represented 15.4% of the responses. This compares with 21.1% union members of the total construction labor force as reported for 1988 by the Department of Labor.

Because construction managers and construction workers have an inordinate fear of intervention by outsiders, obtaining this data was extremely difficult and time consuming. Although the firms from which the data was collected had numerous other projects, permission to administer the questionnaire was only obtained from 23. In most cases, management solicited the approval of the resident Project Manager, who had the final say. In one attempt, the senior vice president of the firm determined the questions too sensitive and hence no projects were offered. Those project managers who did participate were for the most part enthusiastic, and many requested copies of the results.

C.Core Dimensions

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1. Autonomy

The construction industry promotes independence, in fact relies on it, as a means to satisfy the organizational needs for a flexible and impermanent work force. The craft worker exemplifies this in that craft skill is independent of employer, requires a minimum of direction and offers its practitioner a maximum control over the skill purveyed, for whom, and how it is expressed. More than 77% indicated that acquiring a skill they can use anywhere was very important or most important in their choice to become craft workers. This expression of autonomy was further reflected in other responses regarding direction and supervision. Autonomy was correlated neither with age nor education. Respondents who indicated union membership, where the union serves somewhat as an internal labor market, had only moderately higher yet insignificant correlation.

There are three main elements of any task: what to do, when to do it and how to do it. A full 92% of respondents would have the foreman tell them what to do and when, then allow them to go about doing the assigned task. Only 32% would want the responsibility to decide the tasks they perform on the job. Given the opportunity to choose their tasks or be assigned to a variety of tasks, eight out of ten opted for assignment. An equal number chose to perform an interesting task they were assigned, rather than a repetitive task they chose themselves. This is not to say that the craft workers
surveyed accept task assignments without question. Nearly 70% indicated they would get more satisfaction from the job if they were asked what to do and when. And 95% prefer to set their own targets for the quality and quantity of the work they produce. These responses support the contention that the human capital accumulated in skill and experience is highly valued, and the assumption that the craft worker has to be told how to do the job is strongly resisted.

The desire for autonomy extends beyond that of the tasks at hand and further confirmed the strength of the independence factor. Sixty-eight percent of respondents expressed the preference to negotiate their own pay rather than have it negotiated by a representative of their trade. This declined to 56% for respondents indicating union membership. The fact this can be accomplished to some extent in the open shop segment of the market populated by the smaller contractors may be one reason for the decline in union membership.

It may seem reasonable that the ability to perform more than one trade increases human capital and evidences a greater expression of autonomy. There was, however, no difference in the rankings of autonomy between respondents indicating a multiple trade capability and those with only one trade.

The factor of independence manifests itself in attitudes toward compensation. Eighty-four percent indicated that a person who possesses greater skill should get more pay. In regard to obtaining skill, 86% indicated that a craft worker
who invests his own time to become more skillful should be paid more than one who does not. This declined to only 83% for those indicating union membership. Fifty-seven percent indicated that a craft worker who does more work should be paid higher. As the job nears an end, 89% prefer that layoffs be based on the quality and quantity of work produced rather than seniority. Seventy-one percent indicated that these factors were important in their employment opportunities.

Previous findings on Pay were tested for sensitivity in respect to age, education, training and union membership. With the exception of the 60 and over age group, which was evenly divided, 75% or more indicated their pay should be determined by the skill they have, not by what they are actually asked to do on the job. It was only moderately correlated with education, increasing with the level of education. Union membership did not influence opinion, with 58% of union members supporting pay based on skill versus 57% of those who are not union members. This is still significant given that union contracts recognize only two pay levels, that of journeyman and apprentice, and contain other prohibitions regarding pay differentiation.

2. Pay

The attraction of pay in the building trades is not lost on young people who opt to enter the labor market as opposed to those who pursue further education before selecting a vocation. Entry level pay for apprentices is generally 40%
of the journeyman rate, which for carpenters is reached after a four-year apprenticeship. Union carpenters in the Boston area for example are currently paid nearly $30 per hour. The apprentice entry rate would be approximately $14 per hour, given that the benefits portion of the wage is not affected by the 40% multiplier. This is well in excess of the average hourly rate for entry level jobs in all but the mining industry. Open shop rates are lower than union wage rates, but still relatively attractive in comparison with other industries. Comparing union craft workers and non-union craft workers, the difference in the mean value of pay as a reason for entry is significant (3.8 to 4.2). This difference may be due to the fact that union wages are well-known and less variable and are therefore less significant a factor in choice decisions.

Craft workers perform many necessary supplementary tasks not directly related to their craft skill. This is confirmed later, under the Task section, by many who concede a portion of their work can be performed by lesser skilled individuals. Acknowledging this fact, 25% considered that they are being overpaid for the work they perform. This opinion was not equally shared between union (14%) and non-union (27%) craft workers. It is possible that because of the pay disparity between union and non-union craft workers that the non-union workers are assigned more such tasks.

The need of autonomy also influences attitudes toward how
pay should be determined. All age groups feel that their pay should be based on the skill they possess, not what other people earn. When tested against union membership, 86% of non-unionized craft workers held this position, compared with only 62% of union members. This is understandable given the traditions of brotherhood in the craft unions.

The temporary nature of construction, with attendant numbers of employers has an impact on the benefit segment of the craft worker's wage. Unionized workers are somewhat insulated from the frequency of different employers through union contractual provisions which provide uniform benefits through the trade union rather than the employer. The response to whether benefits are more important than the hourly rate was evenly divided. It was highly correlated with age, benefits increasing in importance as the age of workers increased. Sixty percent of union members versus only 41% of non-union members considered benefits are more important than the hourly rate. It is possible that because of the already high level of direct compensation that union members consider benefits more attainable in negotiations under current economic conditions. Fringe benefits have only recently become a part of the wage package of open shop contractors, brought on by the competition for skills. Non-union workers may consider closing the disparity in direct compensation between themselves and their union counterparts of greater importance.
A second question addressed the preference of steady work and lower pay versus higher pay and unsteady work, with benefits held constant. Seventy-three percent of all respondents opted for the higher pay. Younger craft workers were less likely to opt for the higher pay than older ones. Being a member of a union made no difference in the choice.

Pay in this context should not be confused with compensation in the theoretical sense. Compensation in that context includes all forms of reward and benefits, not just wages.

3. Task

The trades have changed over time as more and more prefabricated materials are being incorporated into the finished building. The expression of craftsmanship as an art form can now only be practiced in custom construction which is rapidly vanishing due to its high cost. Satisfaction in craftsmanship must now be experienced in the ability to adapt semi-finished goods for the most part into something of utility which may be aesthetically pleasing, such as a new home, an office building, or complex, like a power plant or refinery. It is still a predominantly manual task, and the satisfaction of creation by manual effort is omnipresent. Ninety percent ranked making things with their own hands as important in their decision to become craft workers, and 95% indicated they achieved satisfaction in building things with their own hands. Pride in exhibiting their craft is reflected
in the fact that 94% indicated they would feel badly if an inspector finds their work not up to standard.

De-skilling has been mentioned in other parts of this thesis, and there would be wide support for the position that the carpenter of today performs far different tasks than the carpenter of the colonial era. That this constitutes de-skilling may be a misnomer; new and substitute materials in construction have required the learning of new skills to keep pace with the economic and technological realities of changed demands. Re-skilling may be a more proper term for this change and it is reflected in the attitudes of today's craft workers in their task.

Eighty-three percent of respondents disagreed that their trade has been simplified by tools and technology, and 83% indicated that changes in the industry requires them to continually learn new skills. Twenty-percent did, however, indicate that their trade required less skill than before. This is further evident in that 76% indicated that one-quarter or more of their work could be performed by those with lesser skill. Surprisingly, those with less than a high school diploma and college graduates did not fully support this majority. It could be that those with lesser education feel taxed to their abilities on their assigned tasks and college graduates are assigned to more complicated tasks. This opinion was not sensitive to age groupings or union membership.
Standardization over time has increased the number of components which are now made off site as compared with being fabricated on site. That this has affected the skills of the craft worker is reflected in the response to whether it has decreased the skill levels required to perform the craft. The age of respondents was compared with the degree to which they considered this transfer has affected skill levels. The Spearman rank correlation coefficient between increasing age and decreasing skill levels was 0.94.

4. Variety

The sequential nature of construction ensures that tasks performed today will be different tomorrow. When that portion of the job in which the trade is employed is over, the next job may be different in the type of structure and certainly in a different location. Jobs can be both short or long in duration and large and small in the numbers employed. These characteristics of construction ensure that the job will neither become routine nor repetitious. That these features of the industry are desirable to some is attested by the fact that 76% prefer jobs which last six months or less and that nearly 47% prefer jobs on which there are 100 or fewer workers. Some 23%, however, find themselves doing the same thing on every job, indicating they may have been victims of specialization. This same group expressed an above average preference for being able to decide what to do and to have input in the task selection process. Doing the same thing was
highest among those under 20 and those over 60, reflecting the possibility that younger workers were limited by experience and older workers may be relegated to tasks requiring less physical effort, thereby limiting task options.

When given the choice between variety and pay characteristics, pay is not always preferred. More than 53% would prefer a seasonal construction job with occasional unemployment over a steady factory job. When given the same choice but at less annual pay, only 40% opted for the seasonal building trade. It is possible that unemployment compensation may be implied in conditioning the response to the first question and not the second. Given the choice between a long job or different jobs of the same overall duration and the same pay, only 30% elected the different jobs. This appears to be at odds with the preference for jobs between three and six months duration until it is realized that a long job means something different to workers who may have a dozen or more employers during any given year.

D. Population Means Differences

Sample data was tested for significant differences in the means of the independent variables in accordance with the methods of hypothesis testing. Comparisons were made of results by age groups, educational attainment, the presence of incentive compensation or not, and between the union status of the respondents or projects.

Jobs paying incentives had a significantly lower mean age
than projects not paying incentives. This may be explained by the fact that these projects attract younger workers and discourage older workers since the work is physically demanding and incentive projects expect higher levels of output.

Younger workers considered the Task itself of greater importance in occupational choice than older workers. This may have also been true of older workers when they first became craft workers. As workers get older, in particular when responding to why they entered the trade years ago, the reasons for entering the trade and staying in the trade may blur or values change. Non-union members ranked Pay significantly higher than union members. The model would suggest that this indicates an imbalance which would tend to lower productivity. It is possible that those entering the unionized sector are already conditioned to the high pay before entry and certainly afterwards; therefore, Pay needs are subsumed, suggesting and increase in productivity. Additionally, pay in the union sector is negotiated by others for as much as three years in advance and is not variable beyond the rates negotiated for journeymen and apprentices. Pay in the non-union sector is variable and often dependent on skill and production. The ability to earn more in this sector may be more important to those who choose to enter it and may be reflected in Autonomy. Unionized craft workers employed in the non-unionized sector also have a fall-back if
the economy picks up because they can reenter that sector and obtain higher wages and benefits. They also have retirement and health care benefits, provided they continue dues payments to their union.

The mean age of union craft workers in the samples were higher than that of non-unionized workers and showed slightly more experience for their age. It is possible that unionized workers entered the trades at an earlier age. The age difference may also be explained by the decline in new union members accounting for the maturing of this population. Controlling for both age and experience had no impact on the difference in attitude toward pay. Incentive compensation, in the framework of expectancy theory, provides the motivation to produce more effort. It affects both Pay and Autonomy. The former would be obvious, and the latter on the basis that individual effort and performance will be rewarded.

E. The Equilibrium Model

Productivity in the construction industry and on the projects sampled refers to the estimated hours needed to perform a variety of tasks versus the actual hours used. It is based on a historical average experience on past similar work. A productivity of 1.00 would indicate that the hours used were equal to the hours estimated. A figure above 1.00 would indicate fewer hours were actually used and vice versa. The measure is a collective one in that individual productivity itself is not measured, but rather productivity
relating to crews of craft workers.

The respondents indicated on a five-point Likert scale the importance of the core factors in their choice to become craft workers. The choices were related to Pay, Task, Variety and Autonomy. The ratings were least important, not very important, important, more important, and most important, which forced a ranking but allowed for two or more choices to be the same. Unfortunately this tended to skew the results, particularly with the limited number of samples. When future projects are sampled, restrictions will be placed on the responses to ensure a forced ranking of the choices. The productivity measure for each project was a composite of the sample craft workers since individual productivity was not measured. Therefore the sample size is only 19.

Construction, having evolved from the crafts, seems to attract those with high autonomy needs. The work itself enables the expression of independence, has wide variety, task identity and high hourly pay rates in comparison with those of manufacturing. Only the responses to the Variety dimension were not narrowly distributed, as might have been expected from the scaling. Minimums and maximums ranged from 1 to 5 and 2 to 5 on every project. It was not correlated with age, or experience and only moderately correlated with education.

The results of a regression using productivity as the dependent variable and Pay, Task, Variety and Autonomy as independent variables is shown in Table 7. As predicted by
the model, the negative coefficients of Pay, Task and Variety

Table 7 Regression on Pay, Task, Variety and Autonomy

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>Number of obs = 19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>.2406</td>
<td>4</td>
<td>.0601</td>
<td>F(4, 14) = 3.54</td>
</tr>
<tr>
<td>Residual</td>
<td>.2378</td>
<td>14</td>
<td>.0169</td>
<td>Prob &gt; F = 0.0339</td>
</tr>
<tr>
<td>Total</td>
<td>.4784</td>
<td>18</td>
<td>.0265</td>
<td>Adj R-square = 0.3608</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>product</th>
<th>Coef. Std.Err. t P&gt;</th>
<th>t</th>
<th></th>
<th>95% Conf. Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>pay</td>
<td>-.1702 .0927 -1.835 0.088 -.369 .0287</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>task</td>
<td>-.2801 .1192 -2.351 0.034 -.535 -.0245</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>variety</td>
<td>-.0439 .1071 -0.410 0.688 -.273 .1858</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>autonomy</td>
<td>.4018 .1205 3.334 0.004 .143 .6603</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>constant</td>
<td>1.2157 .5566 2.184 0.046 .022 2.4097</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Productivity = 1.22 + 0.4(autonomy) - 0.28(task) - 0.17(pay) - 0.04(variety)

indicate that expression of these characteristics suggest they have not been subsumed in that of Autonomy and that their presence reduces productivity. Therefore, it is the reduction of Pay, Task and Variety needs which will result in increased productivity. This may be accomplished by increased pay, task identification and variety. If the method chosen also increases the sense of autonomy, such as with incentive compensation or task selection, productivity will be further increased.

An F statistic of 3.54 (with 4 and 14 degrees of freedom) indicates the hypothesis that all coefficients except the intercept are zero can be rejected. The probability of obtaining a higher F (Prob. >F=.0339) is low. T-tests on Pay (t=-1.835 and P>|t|= .088), Task (t=2.351 and P>|t|= .034 and Autonomy (t=3.334 and P>|t|= .005) allows rejection of the
hypothesis that their coefficients are 0. It is not possible to reject this hypothesis for Variety (t=-.410 and P>|t|= .688). This is further confirmed by specific F-tests on the hypothesis that the coefficients are 0. The results are given in Table 8.

Table 8 F-tests and Correlations

<table>
<thead>
<tr>
<th></th>
<th>product</th>
<th>pay</th>
<th>task</th>
<th>variety</th>
<th>autonomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>product</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pay</td>
<td>-0.2248</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>task</td>
<td>-0.2729</td>
<td>0.2176</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>variety</td>
<td>-0.1183</td>
<td>-0.1123</td>
<td>0.3088</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>autonomy</td>
<td>0.3495</td>
<td>0.3434</td>
<td>0.4919</td>
<td>0.1166</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

\[ \text{pay} = 0.0 \; F(1,14) = 3.37 \; \text{Prob} \; > \; F = 0.0878 \]
\[ \text{task} = 0.0 \; F(1,14) = 5.53 \; \text{Prob} \; > \; F = 0.0339 \]
\[ \text{variety} = 0.0 \; F(1,14) = 0.17 \; \text{Prob} \; > \; F = 0.6879 \]
\[ \text{autonomy} = 0.0 \; F(1,14) = 11.12 \; \text{Prob} \; > \; F = 0.0049 \]

A significant outlier was identified and dropped. In addition, the F-test on Variety indicated the model would not be affected by its exclusion, and the regression was re-run. The results are shown in Table 9. The coefficient of determination, R\(^2\), has increased significantly despite the elimination of one of the variables. In addition, F has increased to 6.77 (with 3 and 14 degrees of freedom), and the probability of a higher F reduced to .0047. T-test statistics confirm that, as with the previous regression, that the coefficients are not 0. Further confirmation by F-test is given in Table 10. As expected, the coefficients of Pay and Task are negative. According to the model, the theoretical maximum productivity would occur at a point of
Table 9 Regression with Outlier Removed

<table>
<thead>
<tr>
<th>Source:</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>Number of obs = 18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>F(3,14) = 6.77</td>
</tr>
<tr>
<td>Model:</td>
<td>2830</td>
<td>3</td>
<td>.094 3</td>
<td>Prob &gt; F = 0.0047</td>
</tr>
<tr>
<td>Residual:</td>
<td>1951</td>
<td>14</td>
<td>.0139</td>
<td>R-square = 0.5919</td>
</tr>
<tr>
<td>Total:</td>
<td>4782</td>
<td>17</td>
<td>.0282</td>
<td>Adj R-square = 0.5044</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Root MSE = .11808</td>
</tr>
</tbody>
</table>

| Product: | Coef. | Std.Err. | t   | P > |t| | 95% Conf. Interval |
|----------|-------|----------|-----|-----|-----------------|
| Pay      | -.1711| .0826    | -2.071| 0.057| -.3484| .0061 |
| Task     | -.3492| .1071    | -3.261| 0.006| -.5790| -.1195 |
| Autonomy | .4868 | .1189    | 4.091| 0.001| .2316| .7420 |
| Constant | .9700 | .4523    | 2.145| 0.050| -.0001| 1.9401 |

Productivity = .97 + .49(Autonomy) - .35(Task) - .17(Pay)

Table 10 F-tests and Correlations Associated with Revised Model

<table>
<thead>
<tr>
<th></th>
<th>Product</th>
<th>Pay</th>
<th>Task</th>
<th>Autonomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product:</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pay</td>
<td>-0.2242</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task</td>
<td>-0.2757</td>
<td>0.2222</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>Autonomy</td>
<td>0.3736</td>
<td>0.3470</td>
<td>0.5455</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

Pay = 0.0  F(1,14) = 4.29  Prob > F = 0.0574
Task = 0.0  F(1,14) = 10.63  Prob > F = 0.0057
Autonomy = 0.0  F(1,14) = 16.74  Prob > F = 0.0011

maximum Autonomy, and the needs of Pay, Task and Variety are subsumed. Therefore measured productivity would be represented by Autonomy minus the perceived unfilled needs of Pay, Task, or Variety.

The significance of this regression is important for the industry in that it presents a simple means of projecting productivity from a minimum of input information. The problem
of accuracy, however, is still present. The confidence interval of the coefficients is too broad to provide the narrow range of accuracy which would be useful. Many more samples will be necessary to reduce the confidence intervals.

**F.Mean Tests**

Various t-tests were performed on the means of the data. Those which are significant are given in Table 11. The most

**Table 11 T-tests of Selected Means of Project Data**

| Hypothesis                                      | Obs. of x | Obs. of y | t    | d.f. | Pr>|W |
|------------------------------------------------|-----------|-----------|------|------|-----|
| Productivity is not affected by profitsharing   | 13        | 5         | -1.72| 5    | 0.15|
| Autonomy needs are not influenced by union membership | 15        | 3         | 5.58 | 17   | 0.00|
| Autonomy needs are similar for individuals on projects with or without profitsharing | 13        | 5         | -2.07| 9    | 0.07|
| Productivity is not affected by the unionization of projects | 15        | 3         | 2.20 | 11   | 0.05|

notable test is that of the hypothesis that the Autonomy need of craft workers on unionized projects is the same as that on non-unionized projects. The test indicates this hypothesis can be rejected within a confidence interval of 99.9%. The positive sign indicates higher mean Autonomy on non-unionized projects. Data from only three unionized projects was obtained, accounting for the lower degrees of freedom.
However, the total of all individual responses was tested, since many union members are employed on non-unionized jobs. The results of the same hypothesis related to union membership, as opposed to the project being unionized, was 2.83 with 59 degrees of freedom and a Pr>|t|=.0064. The significance lies in that the model would project that individuals higher in autonomy tend to be more productive.

Confirmation of this significance is illustrated by the results of the hypothesis that the productivity of unionized projects is the same as that of non-unionized projects. This is also given in Table 11. It can be seen that this hypothesis can be rejected at the 90% level with the sign indicating the higher productivity mean on non-unionized projects.

The number of unionized projects sampled was small and the results should not be used to conclude that unionized projects or unionized labor are less productive. It should also be noted that the base of 1.00 for unionized projects and that of non-unionized projects may be different. Although the base established on non-unionized projects may include non-union members, the conduct of the work as regards the assignment of tasks is considerably different, leading to the conclusion that the task hour measurements may be different. The union membership t-test, however, compares the means from similar bases and therefore would not be influenced by this difference. The significant conclusion which can be drawn
from the model is that incentives which satisfy the autonomy need and which produces results on the non-unionized projects would have the same effect on unionized projects.

Several of the non-unionized projects employed profit sharing as an incentive to increase productivity. The results in Table 11 conclude that the hypothesis that Autonomy on projects employing profit sharing was the same as that not employing this incentive can be rejected at the 90% level. The sign indicates that the mean of Autonomy is lower on projects not employing profit sharing. That this would lead to higher productivity could not be demonstrated conclusively. The direction, however, indicates the results one would expect of this stimulus and warrants further study. One of these projects was dropped as an outlier in the second regression. This and another project, which also had a productivity below 1.00, conditioned the payment of the incentive to remaining on the job. Incentives were employed on these projects to relieve conditions of high turnover and absenteeism. It is possible that this condition reduced satisfaction of the Autonomy need, thereby resulting in lower productivity.

Conclusions as to the efficacy of the model cannot be drawn from these tests since the data is limited. The trend of the data in support of the model, however, suggests that it possesses the intuitive simplicity of the Maslow Hierarchy, and it is supportive of the work of Expectancy theorists.
V. Conclusions and Recommendations

A. Organization

Technology has resulted in the addition of many new crafts and the discipline of engineering to the construction industry. Legislation, regulation and codes have constrained the environment in which construction is executed. Examined in the perspective of its fundamental form, that of a project, the critical elements which influence organizational response, construction has not changed. Construction requires the spontaneous assembly of resources to fulfill a single need and its corresponding disassembly once the need is filled. These needs are individually uncertain but collectively predictable. The construction firm responds with its resources to the variety of projects which create a demand for them, and survives because the multiplicity of projects enable it to level its response capability. As in nature, unregulated environments condition survival of the firm on those who are the fittest. That is, those who can provide what is wanted at the lowest cost.

Labor monopoly power and political reaction to perceived social inequity and self-preservation have adulterated the environment of free markets, resulting in higher cost to the owners of construction. Prevailing wage laws, building codes, minority enterprise and preferential contracting are but a few of the means by which this has occurred. Under such arrangements firms are encouraged which would have otherwise
never survived, and overall costs of construction have risen. In addition, the regulatory maze has dwarfed actual construction in the cost and timing of its execution. The benefits anticipated have never been substantiated and are in themselves questionable. The consequences, on the other hand, are that capital expenditures for construction have been reevaluated, and the cost of a home for the average individual is unaffordable.

This condition has begun to be corrected, if only in a small way. Building code standardization in many areas means that contractors are no longer constrained by geography because of uncertainty about standards. Restrictive legislation which benefits only special interest groups should be repealed. Efforts in this area have been made, but for the most part unsuccessfully because of the strength of those special interests. The large-scale effort which is needed to rehabilitate the infrastructure may provide a basis for identifying the disparity in costs of special interest legislation. An informed electorate is needed to apply pressure to rectify this condition.

Although this thesis has focused on the productivity of craft labor, the influence of organizational factors cannot be overemphasized. Unmeasured impacts of material coordination, design quality and particularly supervision significantly impact labor's ability to be productive. The firm is responsible to the project structure to insure these
inputs affect productivity positively.

B. Unions

Though union power to organize has waned, the power of construction unions in the political arena remains formidable. The research indicates that the policies construction union leadership supports do not reflect the attitudes of the union membership. More than 80% of the respondents indicated that both labor and management were responsible for low productivity in the industry. And most consider that extra effort and more skill should enable them to earn more than less skilled co-workers. Moreover, like their non-union counterparts, they would like to have a say in the tasks they perform. Rigid craft orientation and restrictive jurisdictional rules inhibit the practice or development of multiple skills. Nearly all grant that at least 25% of their work could be done by workers of lesser skill.

Craft orientation is, however, deeply entrenched, not only in the building trade unions but also in the makeup of contractor specialization. Envisioning an amalgamation of all of the building trade unions may be farfetched, but it would maintain the strengths of the union movement while providing craft workers the opportunity to fill needs they express. A universal craft union with individuals identified by specialty would preserve the benefits unions afford and the worker the freedom to expand. Specialties will still exist and survive because market forces would still favor the economy of
performance by one trained and experienced in the skills required.

C. Open Shop Construction

The open shop contractor has enjoyed a rapid expansion in market share as the strength of unionized contractors and the unions have waned. It is an example of market forces at work on a level playing field. Union claims that quality and safety suffer are questionable: imagine telling an experienced non-union carpenter that he was less skillful and exposed to more unsafe conditions because he did not have a union card. The open shop contractor has greater flexibility in work assignment and compensation. The craft worker in the open shop can earn more based on skill level and effort. The worker also is free of union control in obtaining work, which certainly caters to the expressed individuality and independence of the craft worker.

The missing ingredient in most open shop construction firms is transferrable benefits. This is one area the craft unions have an advantage: as an internal labor market, unions obtain benefits for their members that are transferrable regardless who their employer is. Some open-shop contractors are endeavoring to create an internal labor market, and one has succeeded quite well. There are, however, risks. If the effort leads to the need for continuous employment, the firm's flexibility is endangered. If the craft worker perceives a loss of independence in order to obtain benefits, the theory
would predict a loss of autonomy and resultant lower productivity. If however, a majority of open shop contractors, through their association, could offer transferrable benefits, both they and the craft worker would benefit.

D. Core Dimensions

Construction work inherently caters to people with high needs for task identity, variety and autonomy. Many researchers, including myself, have argued many of the trades have been de-skilled, however, the results of the survey on this issue were inconclusive due to the limited sample size. It is reasonable to expect that a younger worker, trained in today’s requirements, would discern little change in the craft. In any event, it would be reasonable that a craft worker expecting to create something would get less satisfaction from assembling things created by others. The result, according to the theory, would be lower productivity. Further research in this area is needed.

The most often elected choice in the survey was the desire to be consulted about work assignments. It would follow that a worker with high autonomy needs believes he has something to offer and desires to be in control. If this is not satisfied, the result would be lower productivity. Recently, the president of Bechtel Construction discussed the high level of productivity of the disparate force (36 different nationalities) brought together to put out the oil fires in
Kuwait. He explained that if he could bottle up whatever it was that generated the enthusiasm, innovation and results, he would be a millionaire. I suggested to him that what he experienced was the chemistry which exists when people feel their contribution is wanted and when the leader helps optimize their contribution. Success, innovation and productivity prevail whenever this chemistry is present.

Pay in the construction industry has been predicated on the simple distinctions of apprentice and journeyman, as perpetuated first by the Guilds and later the trade unions. The survey demonstrates these distinctions no longer satisfy the needs of a more autonomous craft worker. Incentive compensation, at least in the open shop market, has demonstrated that productivity can be increased by satisfying this need. The same contractor from whom much of the data was obtained is now employing incentives on its union projects, and productivity has increased. The message is clear: incentives -- like safety-- pay; they don't cost. The projects surveyed which utilized incentives did not cost any more to construct than they would have otherwise. The savings incurred were shared with the workers and the remainder became additional profit. This contractor has, however, shifted the P=1.00 line by reducing its historical manhours by 10%, which still left an opportunity for labor to earn incentive compensation. It is still too early, however, to judge the impact of this shift.
E. The Equilibrium Model

The search for a measurable connection between satisfaction, motivation and output has been an elusive one. Job inventories, diagnostic surveys and expectancy models present persuasive logic but little in providing direct measurement of satisfaction and productivity. The Equilibrium Model provides, at least for the construction industry, an apparently effective measurement mechanism. More data is needed, however, before the variances can be reduced and more definitive conclusions drawn.

It is the contention of some authors, Argyris(1957) and Alderfer(1972), that need strength changes.\textsuperscript{12} Salancik(1977) points out that "the perspective underlying need-satisfaction models assumes that the needs themselves are fixed characteristics of individuals".\textsuperscript{3} I would agree with those who perceive need strength and satisfaction as a dynamic measure, and the model accommodates this perception. It is accomplished by the redefinition of $P=1.00$ over time based on experience. If mechanisms are introduced to increase productivity, new workers will expect them as normal, and ultimately the old line shifts to accommodate the new norm. If no mechanisms are introduced in the industry, changes in workers' needs satisfaction would occur as a result of mechanisms introduced in other industries. This would result in worker migration, lower productivity or both. Construction craft jurisdictions have maintained a rigidity no longer as
clear, and a compensation system cast in stone. These conditions support those outside the industry who perceive it as having productivity deteriorate while those in it perceive it as unchanged or growing. The dynamic of the theory would indicate that change must be continually introduced as needs change. Therefore it might be concluded that, since construction compensation has not changed over time, that productivity in the industry has declined, even if the industry did not measure the change. That change made a positive difference where it was introduced should demonstrate its need.

The Equilibrium Model may have application in industries other than construction. Productivity in many industries is measured by output per manhour, which in most cases measures capital as well as human productivity change. Industries have routinely measured human output and time and motion studies have a long history. Such industries would seem an appropriate laboratory for testing the theory and may not experience the same reluctance of management and labor as that of construction.

F. Future of the Industry

Like the image of a curved mirror in a fun house, construction has a false impression of itself. It is concerned with only the future, not the past, and it refuses to look at itself for fear of what it might find. Its workers do not want their progeny to enter the trades and resent the
intrusion of outsiders on their domain. Its buyers seem reluctant to engage it, and instead achieve their objectives by other means. Even the infrastructure, which is in need of replacement and repair, cannot seem to generate enthusiasm to invest in it. Much of this is outside the control of the industry itself. The fragmentation and internal conflict of segments of the industry do not foster collective action. The ability of all contractors to pass on legislatively mandated costs discourages action to eliminate or reduce them.

The capital base of America is declining and is need of investment only to remain stationary. Capital investment in plant and facilities will occur only if the construction industry brings its costs, quality and productivity under control. The industry’s reluctance to examine itself has been noted, but it must occur if construction is to ascertain its ills and correct them.

It is not surprising, given the response by craft workers regarding their offspring, that the average age of craft workers is increasing and their numbers declining. Being one of the few high-paying careers which requires no more than a high school diploma, it would seem a natural for those who do not aspire to, or who cannot afford a college education. Nevertheless, construction is not attracting these people, and the industry is doing little to encourage them; indeed, the competitive nature of construction discourages contractors from hiring the inexperienced. It may take another effort
similar to the Depression era's Civilian Conservation Corps to overcome these conditions. Given the needs of the infrastructure and the high level of unemployed youth, it would seem a natural match if the reluctance of special interests could be overcome.

G. Further Research

The construction industry pales in comparison to other industries in regard to the objective analysis of its structure, and the relations between the firm and its workers. As a significant contributor to gross national product and in view of the criticisms of it, this is an oversight which must be corrected. Suspicion of the intentions of outsiders must be overcome and practitioners in the industry encouraged to participate in research, and suggest and lead in areas of investigation.

The questionnaire designed for this research had two flaws which can be overcome in future work. The questions asked provoked suspicion and caused concern with regard to sensitivities in union and firm relationships. In retrospect, those questions which provoked this response could have been eliminated in favor of increasing the volume of data collected without significantly reducing its content. Additionally, the distinction between occupational choice and their current task must be more clearly determined.

The results of this work suggests a relationship between Pay, Task, Variety and Autonomy which must be more clearly
defined. The design of future research should explore these relationships.


APPENDIX: Research Questionnaire

Section 1

The following are several reasons for becoming a building trades craft worker. Please check each one as to their importance to you in your decision to become a craft worker.

<table>
<thead>
<tr>
<th>Importance</th>
<th>Least</th>
<th>Not Very</th>
<th>Important</th>
<th>Very</th>
<th>Most</th>
</tr>
</thead>
</table>

1.1 To earn high wages.

1.2 To create things with my hands.

1.3 To work on a variety of jobs in different places.

1.4 To learn a skill which I can use anywhere.

1.5 Because my father or close relative was a craft worker.
Section 2
The following statements concern your trade, the jobs on which you work, or the construction industry in general. Please indicate by a check after each whether you strongly agree, agree, disagree, strongly disagree, or have no opinion regarding the statement.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>No Opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1. I think of myself as a member of a trade first rather than as an employee of the company for which I am working.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2. I would take less in hourly pay if my benefits stayed the same and the work were more steady.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3. New materials and methods of construction have made the building trades a more desirable profession.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4. I get a lot of personal satisfaction at work building things with my own hands.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5. Insurance, health, retirement and other benefits are more important to me than the hourly rate.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6. The foreman’s job is to tell me what needs doing, when, providing the materials, and then letting me do it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.7. I prefer working on a variety of construction jobs with occasional unemployment than on a steady job in a factory or office.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.8. Building components made off site have reduced the skill levels I need to do my job.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.9. My pay should be determined by the skills I have, not what anyone else earns.

2.10. Power tools, like automatic nailers and screwdrivers are designed to increase production rather than reduce physical effort.

2.11. My trade has been so simplified by tools and technology that almost anyone can do it.

2.12. I feel I'm overpaid for some of the work I'm asked to do.


2.15. Training for my trade includes skills no longer required on the job.

2.16. My pay is based on what I can do, not on what I'm actually assigned to do on the job.

2.17. Jobs require less of my skill than they used to.

2.18. A craft worker who does more work should get more pay.

2.19 I want the responsibility of deciding the tasks I perform on the job.
Section 3
The following section requests you to make a choice between two alternatives. Assume there is nothing to prevent you from selecting either one. Check the one you prefer.

3.1. Start a small contracting business for myself. _____ or Work for others. _____

3.2. Be assigned to work on a variety of jobs. _____ or Wait for a chance to pick my own jobs. _____

3.3. Earn steady pay on jobs which I'm assigned. _____ or Earn unsteady pay on jobs I choose myself. _____

3.4. Determine myself the quantity and quality the job requires. _____ or Have the foreman or superintendent tell me what is expected of me. _____

3.5. Use a variety of my skills for the regular wage. _____ or Get overtime pay, but at work requiring only one of my skills. _____

3.6. Learn new skills on my own time which might let me earn more pay, or provide more job security. _____ or Earn a regular wage on the jobs which are available. _____

3.7. Do an interesting task someone tells me to do. _____ or Do a repetitive task, but one I decided to do myself. _____

3.8. Work at a steady job in an office or factory. _____ or Work at a seasonal building trade for a less annual pay. _____

3.9. Take a single job where you can be employed for the next two years. _____ or Take several different jobs which together will keep you employed for the next two years. _____

3.10. Work at the same pace as others on the job. _____ or Work to the level of my capability. _____

3.11. Negotiate my own pay directly with my employers. _____ or Have my pay negotiated with employers by an elected representative of my craft. _____

3.12. Perform a wide variety of tasks all of which I can do but am not an expert at. _____ or Perform a few tasks I know and do very well. _____

3.13. Earn a steady wage on a long job. _____ or Earn an irregular wage on a lot of short jobs. _____
Section 4
The following section requests a response on various aspects of your work and your trade. Please check the one which most accurately reflects your opinion.
4.1. New materials and building methods have increased ____, decreased ____ the skills required of the craft worker.

4.2. The craft worker's job requires the performance of a great variety of tasks. In your opinion, how many of those tasks could be performed by lesser skilled workers.
None ____ A Quarter ____ Half ____ Three quarters ____ All ____

4.3. I find myself doing the same thing on every job.
Agree __ Disagree __

4.4. I prefer to decide what is to be done and how much to do rather than be told by the foreman.
Agree __ Disagree __

4.5. I would get more satisfaction from the job if I was asked about what to do and when.
Agree __ Disagree __

4.6. For the same pay would you rather assemble something complicated from parts made by others ____ or, create something simple, but useful, with your own hands ____.

4.7. A craft worker who invests his time to learn new skills should be paid more than one who doesn't.
Agree __ Disagree __

4.8. I like to set a target for myself in quality or quantity on the job and then meet or beat it.
Agree __ Disagree __

4.9. I feel badly when an Inspector finds the work I've done not up to standard.
Yes ___ No ___

4.10. Doing more work or doing a better quality job doesn't seem to make any difference to my employment opportunities.
Agree __ Disagree __

4.11. As a job nears completion, layoffs should be based on how much I did and how well I did it, and not seniority.
Agree __ Disagree __

4.12. What length of job do you prefer? ____ Under 3 months ____ 6 months to 1 yr. ____ 3 to 6 months ____ Over 1 year
4.13. What size job do you prefer?
Small—Less than 20 craft workers
Medium—20 to 100 craft workers
Large—Over 100 craft workers

4.14. Lower productivity in construction is the fault of management____, labor____, both management and labor____.

The following is an open ended question. Please respond with yes or no and a brief statement why.
4.15. If I had children, I'd want them to enter the building trades.
Yes____ No____ Why__?
Section 5
Please complete the following information but do not sign your name or, otherwise identify yourself.

5.1. Sex: Male ____ Female ____

5.2. Age (check one):
   ____ under 20 ____ 30-39 ____ 50-59
   ____ 20-29 ____ 40-49 ____ 60-over

5.3. Education (check only the highest level achieved):
   ____ Grade School
   ____ Some Vocational or High School
   ____ Vocational or High School Degree
   ____ Some Business, Technical School, or Community College
   ____ Business or Technical School Degree
   ____ College Degree
   ____ Master's or Higher Degree

5.4. Trade (Check only your primary trade, the one you learned first)
   ____ Bricklayer ____ Ironworker ____ Operator ____ Plumber
   ____ Carpenter ____ Laborer ____ Painter ____ Electrician
   ____ Mason ____ Pipefitter ____ Insulator ____ Sheet Metal
   ____ Instruments

5.5. Are you qualified by license, trade test, apprentice program completion or employer certification in more than one trade?
   Yes ____ No ____

5.6. How did you learn your trade? You can check more than one.
   ____ Trade or Vocational School
   ____ Union Sponsored Apprentice Program
   ____ Employer Sponsored Apprentice Program
   ____ On the job
   ____ Government Training Program

5.7. Are you currently a member of a construction trade union?
   Yes ____ No ____

5.8. How long have you practiced your primary trade?
   ____ 0-5 years ____ 5-10 years ____ 10-20 years ____ over 20 years