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Evaluation of the Massachusetts Manufacturing Partnership: Selected Findings

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Introduction

The purpose of this paper is to share a subset of findings generated through the ongoing program evaluation of the Massachusetts Manufacturing Partnership (MMP), at the Corporation for Business, Work and Learning. MMP is a Manufacturing Extension Program of the National Institute of Standards and Technology (NIST/MEP). The findings described herein were derived through an examination of data related to MMP customers and services, and to the outcomes reported by customers as a result of those services.

This paper is also intended to be responsive to the need for increased knowledge transfer throughout the national network of NIST/MEP centers. To facilitate this program evaluation-based knowledge transfer, a meaningful context will be developed within this paper, allowing others committed to the improvement of manufacturing extension services to assess the applicability of research techniques and findings to manufacturing extension centers across the country.

In order to clarify the conditions leading to reported findings, this paper will include the following:

- an overview of the mission and objectives of MMP;
- documentation of MMP's service delivery model;
- insight into the purpose and approach of MMP's evaluation plan;
- profiles of MMP customer and project characteristics;
- selected findings regarding project development and project results. These findings will be included and expanded upon in the *MMP Year*

Four Evaluation Report, to be published in January 1998.

Mission and Objectives of MMP

The mission of the Massachusetts Manufacturing Partnership (MMP) is to improve the competitiveness of small and medium-size manufacturers (SMEs)¹ in Massachusetts. This purpose is responsive to widespread interest in the maintenance and expansion of the vital, yet declining, manufacturing sector of the Commonwealth's economy. MMP addresses the needs of manufacturers, manufacturing supply chains, local communities and the Commonwealth through its ongoing pursuit of this mission.

The importance of small and medium-size manufacturers to the Commonwealth and its citizens is profound. Manufacturing jobs account for approximately 17% of all non-governmental state employment, and manufacturing output comprises approximately 16% of the total gross state product.² While attention is often focused on the state's largest employers, the Massachusetts economy is also highly dependent on the 81% of its manufacturers that employ fewer than 50 workers.³ MMP's mission to increase the competitiveness and the survival prospects of these SMEs is, therefore, a

vital element in the Commonwealth's overall economic development strategy.

Guiding MMP's pursuit of this mission to improve the competitiveness of SMEs is a set of critical objectives. These include:

- Accelerate the awareness and acceptance by Massachusetts SMEs of world-class manufacturing business and training processes, and practices.
- Provide cost-effective services that yield bottom-line results for SMEs and their workforce, as well as a measurable economic impact.
- Develop, through industry leadership and involvement, a cohesive statewide manufacturing partnership to increase the competitive manufacturing base in the Commonwealth and attract more manufacturing business to the state.

Furthermore, MMP's success in increasing SME competitiveness is believed to rely upon its ability to introduce greater flexibility to the manufacturing process, product, and workforce of companies. In order to effect a higher degree of flexibility and competitiveness among manufacturers, MMP will help SMEs:

- Evaluate, purchase and utilize existing manufacturing and business products and processes that increase quality (*Better*), increase productivity (*Faster*) and decrease costs (*Cheaper*);
- Access education and training for management and workers to increase the benefits of these new manufacturing and business practices; and,
- Pursue new technologies or new products, and develop upgrades for

¹ The National Institute of Standards and Technologies, Manufacturing Extension Partnership (NIST/MEP) defines an SME as a small or medium-size manufacturing establishment with fewer than 500 employees.

² Massachusetts Division of Employment and Training, *Employment and Wages State Summary 1995*.

³ Massachusetts Division of Employment and Training, *Distribution of Establishments and Employment by Size Groups*, March 1996.

current products. And, for contract or service manufacturers, expand and market new technology-based services.

Service Delivery

The MMP service delivery model is designed to maximize service flexibility and the utilization of existing consulting resources within the Commonwealth. Over the past four years, this model has demonstrated the fluidity that is characteristic of young, evolving systems. However, the two predominant modes of service delivery - direct and brokered services - reflect a generally consistent set of characteristics (see Model 1) that may be organized into five phases: initial contact; project development; internal/external resource identification; project management; and, follow up.

Phase 1: Initial Contact

MMP conducts outreach to potential customers through a variety of means. Initial contact with an SME may be the result of direct sales by the project manager; participation in an event sponsored by MMP or an MMP partner; or a referral from another company or organization. Following the initial contact, an MMP project manager arranges to meet with key company staff in order to learn about the company and to assess whether it could benefit from MMP services.

Phase 2: Needs Assessment and Project Development

The first meeting between MMP and the company provides an opportunity for the project manager to gather basic descriptive data regarding the company, including its products and processes, business performance and

goals. This discussion may form the basis for an informal needs assessment by the project manager. A plant tour is usually conducted which allows the project manager to observe the company's manufacturing layout and equipment utilization.

As a result of this meeting, the project manager and the company may immediately begin to discuss technical assistance project (TAP⁴) opportunities in response to identified company needs. Another possible outcome is an agreement to have a follow-up meeting to conduct a formal needs assessment to clarify company performance and needs. This follow up meeting may lead to a TAP or, alternatively, the company may decide not to take advantage of MMP services.

Phase 3: Resource Identification

When a company decides to contract for a TAP the project manager's role shifts from assessment and development to resource identification. The project manager identifies the most suitable internal MMP or external consulting resources available and presents the findings to the company. External, or "outside," resources may include private consultants, college or university faculty, or staff of other organizations. In most cases, the company entertains a proposal from each resource and selects from among them, with the input of the project manager. In some instances, MMP may serve as the technical resource to the project, if suitable skills are available within the organization.

⁴ Technical Assistance Projects (TAPs) are MMP activities that involve >8 hours of project manager time and for which a formal contract for services has been agreed to.

The use of outside resources for project implementation is a key element of MMP's service delivery strategy. This strategy allows MMP to offer a wide range of services to a large number of SMEs, because project development is not limited by MMP's internal expertise and because a project manager can manage several TAPs in the time it takes to implement one.

Phase 4: Project Management and Implementation

Once the project is defined and a resource is selected, the project is formalized through the TAP contracting process. A statement of work, financial arrangements and timetables for completion of milestones are agreed upon in this contract. Contract development is a critical aspect of the project manager's job. MMP has documented through case studies that some of its most successful projects began with a project manager's insistence that a statement of work be revised until it fully met the company's needs.

With the contract finalized, the company and outside resource begin the project. In this stage, the project manager is responsible for oversight and ensures the requirements of the contract are met. When the TAP is completed, the project manager reviews all work and, if satisfied that all contractual obligations have been met, closes the project.

Phase 5: Follow Up

The project manager will, in most cases, follow up with the company after the project is completed. This is both to ensure that the company remains satisfied with MMP's services and, when appropriate, to allow the project manager

to assume an ongoing role in the company's improvement strategy. In some cases, the first project will lead to a second, which may or may not require different expertise and, therefore, a different resource. In this case, the cycle of project development will repeat itself.

Direct v. Brokered Services

Earlier in this section, it was mentioned that MMP's service delivery model is dynamic and evolving. There is no more significant trend in service delivery than the recent shift toward the provision of direct services, utilizing internal MMP resources. Through September 30, 1996, over 95% of all MMP technical assistance projects were delivered using a brokered service strategy. But since that time, 25% of all completed projects have utilized internal resources. This reflects an increased emphasis within MMP on retention of project revenues and the implications of this trend will be studied extensively in the *MMP Year Four Evaluation Report*, scheduled to be published early in 1998.

The MMP Evaluation Plan

MMP has, since its inception, made a strong commitment to program evaluation and data driven program management. Dating back to the earliest stages of center development, MMP collaborated with the Donahue Institute, University of Massachusetts in the design and implementation of a comprehensive evaluation plan. The plan, which has evolved with MMP over the past three years, is designed to achieve certain specific objectives. These objectives defined the plan's original design and continue to guide its ongoing implementation. On a fundamental level, the purpose of the MMP evaluation plan is to support:

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- Internal (MMP) management decision making;
 - Program monitoring and reporting; and,
 - NIST/MEP and other external research and evaluation efforts.

Evaluation Methodology

Underlying the MMP evaluation plan is a conceptual model that illustrates the relationship between MMP customers, the technical assistance services they receive and the outcomes of those services (see Model 2). The MMP evaluation plan is designed to document and clarify elements contained in this conceptual model. Through this process, the purpose and objectives of the evaluation plan can be realized, and many of the program management and policy concerns of MMP, its investors and the nationwide NIST/MEP network may be addressed.

This evaluation logic model articulates the complex chain of events leading from MMP technical assistance services to business and economic outcomes. It relies on the assumption that services prescribed by MMP project managers and subsequently implemented by outside or internal MMP resources, lead to changes that affect the manufacturing performance of companies. These changes result in longer-term business impacts which, in turn, result in changes in the larger state and national economies. It is also assumed that the specific characteristics of the company, the project and the current economy may influence the effectiveness of actions and changes throughout the course of these events.

Profile of MMP Customers

MMP serves the Commonwealth and its citizens through the provision of technical assistance projects to SMEs. This section briefly describes two principle attributes (company industry and company size as indicated by number of employees) of the companies served by MMP since initiation of services in August 1994. For the purpose of this study, service is defined as, and limited to, a completed TAP (project). All company data were collected through the MMP “Customer Profile” form, except where otherwise indicated. As of August 31, 1997, MMP had completed 1,074 projects with 650 different companies.

Key Industry Sectors

Among the companies served by MMP are representatives of 32 different two-digit standard industrial classification (SIC) codes, including all of the manufacturing SICs (numbers 20-39). This wide coverage of industries reflects MMP’s strategy and ability to serve the broadest possible range of manufacturers. However, MMP has also pursued a policy that focuses resources on four two-digit SIC Codes that it considers particularly critical constituencies. These four SICs account for 49.5% of all companies served by MMP. In the Massachusetts economy, these SICs comprise \$9.89B (55%) of the \$18.12B in total manufacturing payroll.⁵ These SICs include:

- Fabricated metal products (SIC 34)
- Industrial and commercial machinery (SIC 35)
- Electronics (SIC 36)

⁵ Massachusetts Division of Employment and Training, Employment and Wages State Summary 1995

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- Measuring and analyzing instruments (SIC 38)

Companies from five other SICs (see light shading in Table 1 below) represent an additional 28% of all companies served through MMP projects. These companies also account for 18% (\$3.14B) of all manufacturing employment wages in the Commonwealth.⁶

Company Size (Employment)

Among Massachusetts's manufacturers, approximately 81 percent employ 50 or fewer employees and less than one percent employ 500 or more.⁷ This means that almost all of the Commonwealth's manufacturers are MMP service-eligible by company size criteria and, further, that the vast majority of these manufacturers are very small companies (<50 FTE). Figure 1 displays the distribution of MMP customers, by size of company workforce.

This chart reveals that 55% of companies served by MMP projects employ 50 or fewer employees and 74% employ 100 or fewer. While the distribution of companies receiving services is not proportional to the overall population of manufacturers in the Commonwealth, it nonetheless demonstrates an emphasis on small and very small manufacturers. MMP has engaged in considerable discussion regarding the most effective strategies that may be employed in order to maintain and enhance its focus on very small manufacturers.

⁶ Ibid.

⁷ Massachusetts Division of Employment and Training, Distribution of Establishments and Employment by Size Groups, March 1996

Profile of MMP Technical Assistance Projects

MMP strives to improve the competitiveness of SMEs by helping them evaluate, purchase and utilize products and processes that will increase product quality (*better*), increase productivity (*faster*) and decrease costs (*cheaper*). This section provides a brief review of two critical project characteristics including: project type, a chief indicator of the substance of a project; and, project cost, an indicator of the level of effort expended on the project. Further, it briefly examines the relationship between these two characteristics. This review encompasses the 1,074 projects completed by MMP as of August 31, 1997.

Project Types

NIST/MEP has defined thirteen distinct project types (and "other") that, while sufficiently specific to be meaningful categorizations, may contain a range of projects with diverse characteristics. MMP does not utilize the "other" type category and includes an additional type, "technical training" in its internal tracking. Project type is the foundation for this examination of project characteristics, as it reflects the essence of the project activity. All project characteristics reported in this section rely on data collected through MMP's "TAP Contract" form.

Figure 2 displays the distribution of MMP projects, by project type. Three types of projects predominate, representing 59% of the MMP project portfolio: quality/inspection/ISO- E (26%); human resources- M (19%); and, process improvement- K (14%). Market development-I (10%), EDI/ communications/ LAN- B (7%), plant layout- K (5%) and business systems/

management- C (5%) are other commonly conducted project types.

Project Cost

Cost is an essential project characteristic that can be used as a rudimentary measure of project intensity. It also has obvious implications for a center's strategy with respect to the generation of project-based revenues. Due to the limitations of data collected by MMP, the most accurate representation of project cost that can be applied to the 1,074 projects reviewed in this section is the sum of money identified in the contract for services between MMP, a company and any outside consulting resource.

Any money that is transferred as a result of the contract agreement, including both direct payments and any MMP project subsidy⁸, is factored into this calculation of cost. This cost formula does not include any other labor costs that may have been incurred by the customer (i.e. staff time, line shutdown), outside resource or MMP during the development and implementation of the project.

As Figure 3 displays, MMP has pursued a strategy to offer low cost services to SMEs. Of the 1,054 projects reviewed by this analysis, 48% cost less than \$2,500 and 75% cost less than \$10,001. Data show that very expensive projects (>\$20,000) are not a major segment of the project portfolio. It should be noted, however, that MMP does not include project-related capital investments as part of project cost. Company business investments that result from projects are discussed in greater detail in the section *Evaluation*

Findings: Company Investment Behavior.

Relationship Between Cost and Type

Table 2, below, provides detail relating to the mean cost of different project types. This detail is further clarified by the line plot analysis in Figure 4. The error bars in Figure 4 show the expected cost values associated with different types of projects. Wherever these error bars fail to overlap, there is a statistically significant difference in the mean cost of the project types being compared, within one standard error.

Based upon this data, it can be inferred that MMP project cost is, to a limited extent, a function of project type. Of projects with 50 or more observations, human service (M) and market development (I) projects are particularly inexpensive. Whereas, quality/ inspection/ISO (E), process improvement (K) and new product design or development (L) are relatively expensive.

An limitation of this finding is that MMP's mean project costs may also reflect an unstated approach-to-service strategy. That is, MMP conducts a relatively large number of human resource projects in seminar formats, which keeps costs very low. If MMP emphasized larger scale, on-site human resource projects, then cost data may show different results. For this reason, this finding may not be broadly applicable to other NIST/MEP centers. However, within the context of MMP's historical project profile, project type does appear to influence project cost.

⁸ MMP no longer provides cash subsidies to customers as of February 9, 1997.

Findings: Project Development

▪ Understanding of Company Needs

One of the presumed benefits to companies of working with MMP is the objectivity and manufacturing experience of the MMP project manager. In the eyes of many customers, these attributes make MMP a credible source for manufacturing or business needs assessments. While it is assumed that project managers conduct an informal needs assessment for all projects, in some cases, formal assessments⁹ may be conducted to more systematically clarify priorities for company improvement. As of August 31, 1997, MMP had conducted 386¹⁰ formal assessments.

MMP collects data relative to the company's perception of the project manager's assessment of their needs. The question "how would you rate the project manager's understanding of your particular problems or needs?" is asked as part of a customer feedback survey administered immediately after project completion. Answers are given on a five point scale with "1" meaning "poor" and "5" indicating "excellent." As of August 31, 1997, 260 customer feedback surveys were completed for MMP projects.

Data show that clients have reacted very positively when asked to assess the project manager's understanding of company needs. Table 3 details the mean score on this question for all project types. The mean for all

projects is 4.4 of 5 possible points and no project type has a mean score of less than four. This would seem to indicate that MMP is providing services that are appropriate to the needs of SMEs.

▪ MMP Influence on Company Actions

It is reasonable to follow this discussion of the assessment of company needs with some consideration of the extent to which MMP has influenced the business actions of companies. This information is also collected through MMP's customer feedback survey. The question "Would you have undertaken this project or made any of the resulting changes without the assistance of MMP?" is intended to address this specific point of interest.

As shown in Figure 5, a majority (61%) of survey respondents indicated "yes" the company would have undertaken the project or pursued similar actions without the assistance of MMP. As many as 39% may not have pursued these actions with services. It is reasonable to conclude that the business actions of companies that indicated "no" or "maybe" in response to this question were probably influenced by MMP. What remains unexamined is whether the companies that would have made changes without MMP assistance were influenced by the program.

Figure 6 shows further detail regarding the responses of those companies that would have undertaken the project without MMP assistance. In particular, it shows that 43% of those companies would have pursued the project in the same time frame. However, for no less than 34% and as many as 57% of these companies, MMP did influence actions, causing or

⁹ Examples of formal assessments commonly used by NIST/MEP centers include Performance Benchmarking, QuickView, and SITE.

¹⁰ Data source: Massachusetts Manufacturing Partnership Monthly Report, August 1997.

enabling them to undertake changes sooner than they otherwise would have. For those companies that reported no MMP influence on actions, the likely appeal of working with MMP would include cost sharing, technical support, resource location, contract management or overall cost effectiveness.

Findings: Project Results

Ultimately, MMP's performance is viewed in light of project results. Concerned interests want to know whether MMP is positively influencing the business behavior and competitiveness of SMEs. For this reason, a variety of results-focused data are routinely collected for MMP through two basic tools: a customer feedback survey and a follow-up impact survey. MMP contracts with a third-party consultant, the Donahue Institute, University of Massachusetts, to conduct these telephone-based surveys. As of August 31, 1997, 260 customer feedback surveys and 384 Eight Month Follow-up Impact Surveys had been administered. All companies with surveyable projects are contacted and overall response rates for these surveys are 78% and 75% respectively.

Specific business or manufacturing changes that result from MMP projects are summarized by six categories: sales; cost savings; intermediate manufacturing outcomes; employment; investments; and, "other".

- **Did the project lead to change within the company?**

Eight Month Follow-up Impact Survey data, collected approximately eight months after a project is completed, indicate that 80% of surveyed projects resulted in changes within the company

by the time of survey (Figure 7). An additional 11% of companies had not yet implemented changes as a result of the project, but expected to in the future, while 9% of companies did not intend to take action as a result of the project. A review of data suggests that neither project type nor cost is a reliable determinant of whether changes will be implemented.

- **Did reported changes lead to business impacts?**

While changes may have been implemented, this does not necessarily mean the company experienced a business impact, as captured by MMP's Eight Month Follow-up Impact Survey. Analysis reveals that 81% of projects that led to changes resulted in some impact on company sales, cost savings, intermediate manufacturing outcomes, employment, investments or "other".

Frequency of Impact by Project Type

The frequencies of projects with "some reported impact" are listed in Table 4, by selected project type (those with 12 or more observations)¹¹. Data indicate that the substance (type) of a project may be an indicator of the likelihood that a project will lead to a business or manufacturing impact. As Figure 8 demonstrates, these findings are statistically significant within one standard error. Specifically, it can be inferred that customers with projects that are quality/inspection/ISO, plant layout, process improvements, or product or design development most frequently experience a business impact as a result

¹¹ The activity-type profile of projects contained in the survey sample is very similar to the profile of all completed projects, as reported in the section *Profile of MMP Technical Assistance Projects*.

of MMP services. Companies that engage in EDI/communications/ LAN, business systems/management, human resource or market development projects appear less likely to report impacts as a result of an MMP project.

Frequency of Impact by Project Cost

Data in Table 5 suggest that project cost is also a factor in the frequency of reported project impact¹². Specifically, projects that cost less than or equal to \$2,500 are less likely to result in a project impact than are projects of higher cost. Furthermore, the likelihood of project impact increases as costs rise, up to the \$5,000-\$10,000 level. Above this cost level, the frequency of impact shows little variation. These findings, depicted in Figure 9, are significant within one standard error.

Frequency of Impact by Company Size

Data in Table 6 indicate that the size of the company that engages in a project may also influence the frequency of project impact¹³. Figure 10 illustrates that companies that employ one to ten employees appear less likely to experience project impacts than larger companies. This finding is statistically significant to one standard error.

Frequency of Impact by Industry

Data in Table 7 indicate that the industry classification of the company

that engages in a project may also influence the frequency of project impact¹⁴. The most prominent aspect of Figure 11 is the very high likelihood of impact associated with SIC 38, “Measuring and analyzing instruments.” Also noteworthy is the less frequent impact associated with SIC 34, “Fabricated metal products,” and SIC 35, “Industrial and Commercial Machinery.” Again, the error bars associated with these observations reflect significance within one standard error.

Summary

Data show that project characteristics such as substance type and contract cost may influence the likelihood of project impact being realized by MMP customers. However, attributes of the customer, including industry and number of employees, also appear to influence the likelihood of impact. This understood, what remains to be known is which of these factors is *most* responsible for project results. Unfortunately, MMP results data sets are still relatively small and therefore attempts to conduct this type of analysis have shown inconclusive results.

▪ **What types of impacts are attributed to projects?**

Knowing whether impact occurred as a result of a project is only the first step in understanding the results of MMP services and their effects on SMEs. A logical next step is to determine the types of impacts that are likely to occur

¹² The cost profile of projects contained in the survey sample is similar to the profile of all completed projects as reported in the section *Profile of MMP Technical Assistance Projects*. However, projects costing <\$2,500 are slightly under-represented and projects costing between \$5,001 and \$20,000 are slightly over-represented.

¹³ The employment levels of companies engaging in projects contained in the survey sample is very similar to the profile of all completed projects as reported in the section *Profile of MMP Customers*.

¹⁴ The SIC Code profile of companies engaging in projects contained in the survey sample is similar to the profile of all completed projects as reported in the section *Profile of MMP Customers*. The one noticeable exception is that SIC Code 38 is slightly over-represented.

as a result of projects with different attributes. In the examination of this question, project substance (type) is assumed to be the primary determinant of the kinds of changes a company is likely to experience as a result of the project. Specific business or manufacturing changes that result from MMP projects are summarized by six categories: sales; manufacturing efficiencies; cost savings; employment; investments; and, "other."

Data pertaining to these impact areas are captured through the Eight Month Follow-up Impact Survey, which requests both qualitative and quantitative data. In this survey protocol, the respondent is first asked whether a change in sales occurred. If the response is "yes," they are asked whether sales have "increased" or "decreased," and finally, they are asked what the dollar value of the change in sales has been, to date. Respondents are far more likely to offer qualitative data than quantitative. The following analyses rely upon those qualitative responses.

Frequency of Change in Sales

Revenue generation is a primary consideration for many small and medium sized manufacturers. Data contained in Figure 12 demonstrate the frequency of reported impact on company sales resulting from MMP projects. From this figure, it is clear that certain types of projects are more likely than other types to generate new sales. In particular, plant layout (F), market development (I), and new product design/development (L) appear most likely to result in this type of impact.

A particularly interesting aspect of this finding is that previous analyses indicated that market development projects had a relatively low likelihood

of any impact. Two other project types that showed a relatively low frequency of any project impact, business systems/development (C) and human resources (M), demonstrate a very low frequency of impact on sales. So, for a company with revenue generation needs, market development projects may be more helpful than frequency of impact statistics may suggest.

Frequency of Manufacturing Efficiencies

In some cases, companies have issues pertaining to manufacturing production that require immediate resolution. Areas of concern may include: production lead time; set-up time; material handling; scrap rate, re-work rate, quality and overall production output. As shown in Figure 13, certain types of project services provided by MMP appear very likely to affect change on one or more of these measures of manufacturing efficiency. In particular, quality/inspection/ISO (E), plant layout (F), process improvement (K) and new product design/development (L) appear likely to result in these types of intermediate manufacturing outcomes.

Frequency of Manufacturing Cost Savings

Positive intermediate manufacturing efficiencies should, ultimately, begin to show bottom line results to companies, in terms of cost savings in labor or materials, as a percent of sales. It should be noted that other, non-manufacturing, business changes may result in cost savings as well. Figure 14 describes the frequency of reported cost savings and significant differences are in evidence among the various project types. Two clusters are apparent. EDI/communications/LAN (B), market development (I) and human resources

(M) projects are least likely to result in cost savings for the company, while the other identified project types demonstrate a higher frequency of these types of impacts.

Frequency of Change in Employment

In many instances, MMP projects may result in the retention of jobs that would otherwise have been eliminated. In other cases, MMP customer employment changes may occur based on the needs of the company, whether those needs are to reduce or augment existing staffing levels. Figure 15 displays data related to the frequency with which some change in employment is reported as a result of a project, by project type. Data indicate that new product design/development (L) projects are most likely to result in an employment impact, while business systems/management (C) and human resources (M) projects are least likely result in changed employment.

Frequency of Business Investments

One of MMP's objectives is to "help SMEs evaluate, purchase and utilize... manufacturing and business products that increase quality, increase productivity and decrease costs." This would indicate, based upon MMP's assessment of company needs and subsequent evaluation of existing technologies or methods that may address those needs, that many companies will make some investment as a result of MMP services. While these investments may be considered costs to the company, they also represent a modernization of the company's equipment, process or management approach that may improve the company's long term competitiveness.

MMP tracks "capital investments in plant and equipment"; "investment to support process improvement (i.e. software, material flow charts)"; investment in product enhancement or new product development (i.e. new material, R&D)"; and, "investment in training." As figure 16 shows, certain types of projects are more likely to result in at least one of these investments than are others, with new product design/development (L) projects standing out in this regard. Market development (I) and human resources (M) projects demonstrate the lowest frequency of reported impact on company investment.

Frequency of "Other" Impacts

Companies frequently report impacts that do not correspond to a specific question on MMP's impact survey. "Other" impacts reported by MMP customers include: improved morale; greater awareness of new practices and processes; better corporate image; increased work skills; increased flexibility; and increased capacity for change. In some instances, respondents said that these impacts were the greatest benefit of the project.

The project types that appear most likely to result in some impact on a measure not included on MMP's impact survey are (see Figure 17) EDI/communications/LAN (B), quality/inspection/ ISO (E) and process improvements (K). Business systems/management (C) projects, on the other hand, appear least likely to result in "other" impact.

- **What is the magnitude of reported project impacts?**

There is an understandable interest among program managers, program stakeholders and the larger research community in assessing the magnitude of impacts experienced by companies and the larger economy as a result of MMP services. In particular, it would be helpful to know which types of projects result in the greatest and most positive outcomes.

Unfortunately, MMP's follow-up project impact data set contains too few observations to support this type of analysis. This limitation is exacerbated by two factors: (1) the low frequency of reported impacts that are quantified (44%) and (2) the enormous range of values amongst those quantified responses. Because conclusions that might be drawn from such an analysis of MMP data could be misleading, they are not pursued in this report.

This said, MMP does utilize an alternative, qualitative measure of the magnitude of project impact. The mission of MMP is to improve the overall competitiveness of small and medium size manufacturers. In order to measure the effectiveness of its services upon companies, MMP asks each company to indicate "to what extent did this project improve your competitiveness?" This question is asked on the customer feedback survey and responses may be influenced by the subjective perceptions of the respondent. Response options are on a five-point scale corresponding to the values listed below:

- no change 1 point
- slight improvement 2 points
- moderate improvement 3 points
- substantial improvement 4 points

- very substantial improvement 5 points

Responses and other detail for this question are shown below in Table 8. All project types with more than 10 responses to this question were included in this analysis, as well as new project development (L), for which there are only five observations. This project type was included for consistency with previous analyses.

The overall mean score for improvement of competitiveness across all project types was 2.5, which would place the mean response between a "slight" improvement and a "moderate" one. As Figure 18 illustrates, respondents tend to rate the results of environmental (D), plant layout (F) and market development (I) projects upon company competitiveness lower than other project types. Among those types that showed higher ratings of improved competitiveness, quality/inspection/ISO project outcomes stand out. These projects have a higher customer rating of improved competitiveness than all other types and this result is based upon the largest number (75) of responses associated with any project type.

Figure 19 offers another perspective on responses to this question, showing the distribution of responses. It shows that 71% of MMP projects result in some improvement of company competitiveness. Additionally, 34% of companies report that projects led to "substantial" or "very substantial" improvements in competitiveness. However, a substantial portion of respondents (29%) indicated that the project resulted in no change in competitiveness.

Conclusions

The preceding analyses provide new insight into the development and results of MMP projects. This section offers a summation of key learning points resulting from those analyses.

▪ Companies Needs are Understood

Data indicate that MMP project managers demonstrate a clear understanding of company needs during the project development process. In fact, mean scores of project manager “understanding of needs,” by project type, range from 4.0 to 4.8, on a balanced scale of 1 to 5, with 1 indicating “poor” and five indicating “excellent.” This finding suggests that MMP is functioning effectively in its role as an objective resource, listening to and helping to clarify the needs of SMEs. Any concern that any particular type of project is being forced on customers may be dispelled by these findings.

▪ MMP Influences Company Actions

Data show that as many as 29% of MMP customers may not have undertaken the changes resulting from services without MMP assistance. Furthermore, in the absence of MMP services, at least 34% of those companies that planned to make the changes without MMP would have delayed implementation of those changes for some period of time.

At the same time, it is also clear that many companies (61%) already have clear ideas about how to improve their business and that MMP helps them implement these ideas. Apparently, some

companies work with MMP to help identify appropriate solutions to business issues, but a sizeable number of companies work with MMP for other reasons, such as to acquire outside perspective on problems, to make use of consultant resource identification services or for MMP project and contract management expertise.

▪ MMP Projects Lead to Change

Survey data indicate that no less than 80% of MMP projects resulted in business changes within the companies that conducted those projects. Companies also report that an additional 9% of projects that did not result in change by the time of MMP’s Eight Month Follow-up Impact Survey may still lead to some change. Among the explanations provided by companies that report they will not make changes as a result of MMP services, personnel changes, lack of time or financial resources, or a decision to change business strategy were the most common reasons for failure to implement changes.

▪ Companies Report Impacts for a Vast Majority of Projects

Of those MMP projects that resulted in some change within the company, 81% were reported to result in an impact on one or more of the following measures: sales, manufacturing efficiency, cost savings, employment levels, investments or “other.” Four distinct analyses were performed in order to clarify the variables that may influence the likelihood of reported project impact: company SIC; company size (FTE); project cost; and, project type (substance).

Data are inconclusive as to whether any one particular project or customer attribute is uniquely important as a determinant of project effectiveness. However, data showed that each of the aforementioned characteristics might have some influence upon results.

Impact and Company SIC

Companies from seven different two-digit SIC codes were analyzed for possible correlation between industry and the likelihood of reported project impact. Among these industries, those companies from SIC 38, “measuring and analyzing instruments,” demonstrated a significantly higher frequency of reported impacts (within one standard error) than companies from other sectors. It is possible that other characteristics of either the companies or the projects conducted with this sector may have influenced this result, but data sample sizes are insufficient to say this definitively.

Impact and Company Size (FTE)

MMP provides services to companies with workforces ranging from a handful to 500 employees. However, MMP’s client portfolio generally reflects the Commonwealth’s distribution of manufacturers and is largely comprised of companies with 50 employees or fewer (55%). Data indicate that companies with between 11 and 250 employees (76% of all customers) have similar frequencies of reported impact as a result of services, with means running from 74% to 88%. Companies with a workforce of one to ten employees demonstrated a significantly lower likelihood of impact (67%) than did companies of other sizes (within one standard error).

Impact and Project Cost

The services provided to SMEs by MMP tend to be very low in cost, as 75% of projects cost \$10,000 or less. Of particular note, 48% of all MMP projects cost \$2,500 or less, with a substantial number of these being human resource and market development projects. Interestingly, the frequency (66%) of impact attributed to an MMP project is lowest for this large subset of very low cost projects.

Frequency of reported impact for projects that cost between \$2,501 and \$5,000 climbs slightly to 81% and projects of \$5,001 or more demonstrate very high frequency of reported impact, ranging between 90% and 100%. The differences in mean impact scores associated with these three broad cost levels are significant within one standard error.

Impact and Project Type

MMP services may be most clearly defined by the “substance type” that is associated with them. Among the fourteen identified project types listed by MMP, eight have sufficient survey data to allow analysis. Data show two distinct groups within these types with respect to the likelihood of reported impact. Quality/inspection/ISO (94%), plant layout (93%), product or design development (92%) and process improvement (87%) projects show significantly higher mean frequencies (within one standard error) of reported impact than do projects in a second grouping. In this second grouping that includes business systems/mgmt., EDI/communications/LAN, market development and human resources projects, mean frequency of impact ranges from 69% to 72%.

- **MMP Projects Improve Competitiveness**

Data show that 71% of surveyed companies that utilized MMP services reported some improvement in competitiveness. The distribution of responses shows that 34% of companies report that projects led to “substantial” or “very substantial” improvements in competitiveness. However, a substantial portion of respondents (29%) indicated that the project resulted in no change in competitiveness at all.

The mean score in response to this question is 2.5, which falls midway between “slight improvement” and “moderate improvement” on the question’s response scale. Project types with the highest and most reliable mean scores include EDI/communications/LAN, quality/inspection/ISO and process improvements. Mean scores for environmental, plant layout and market development projects were relatively low on this measure.

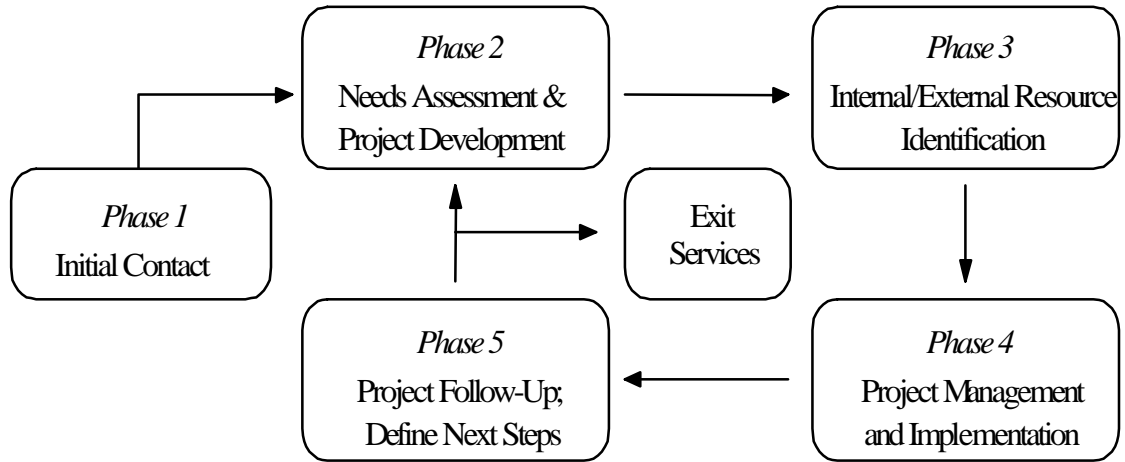
Acknowledgments

Production of this study would not have been possible without the ongoing support and assistance of many people.

It is wholly appropriate to recognize the efforts of the many staff of the Massachusetts Manufacturing Partnership (MMP) with whom the Donahue Institute has collaborated in the last three years. Particular thanks are due to: Fred Ritzau, Statewide Director, MMP; and, Paul Cotnoir, Jerry Rubin, Jim Chapman, Fran Eagle, and Stephen Andrade, Directors of MMP’s regional offices. Thanks must also be directed to Rob Biela for his tireless attention to the collection of data that were instrumental to production of this report.

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Model 1 : MMP Service Delivery Model



Model 2: Evaluation Logic Model

Intervention	Objectives	Goals
Technical Assistance Services	Actions Within Company	Mfg. Changes (Company)
	Company Business Impacts	Economic Impacts

Table 1: Most Served Companies by SIC Code

SIC	Sector	# Served	% of Total
23	Apparel and other finished products		
	Paper & allied products		
	Printing, publishing and allied industries	38	6%
28	Chemicals and allied industries	23	4%
30	Rubber & miscellaneous plastics	59	9%
34	Fabricated metal products	93	14%
35	Industrial & commercial machinery		
	Measuring and analyzing instruments		

Figure 1

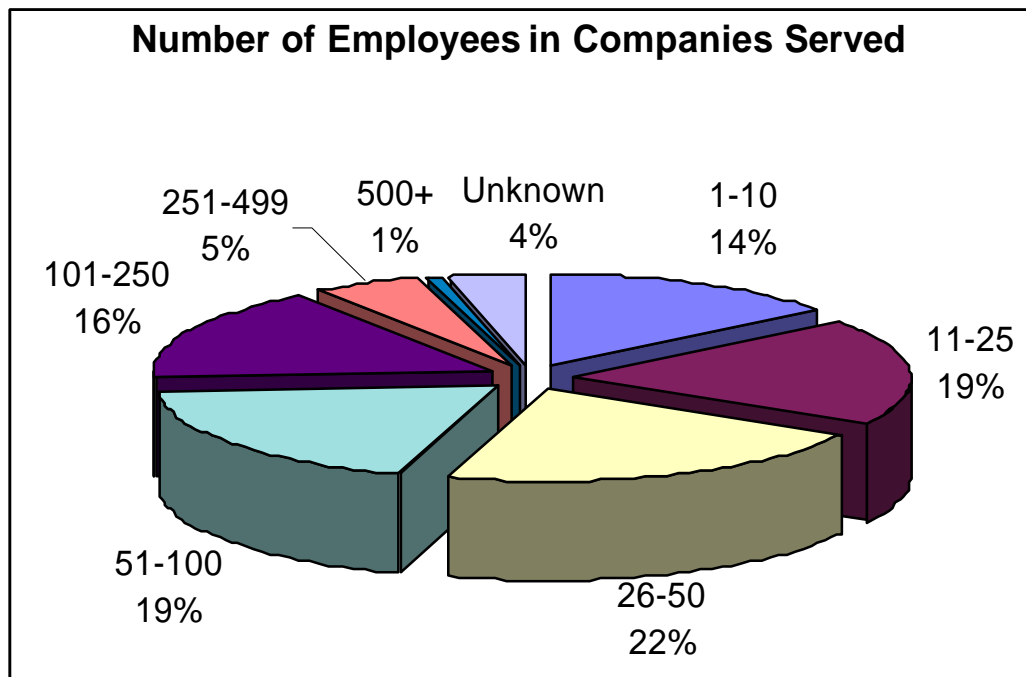
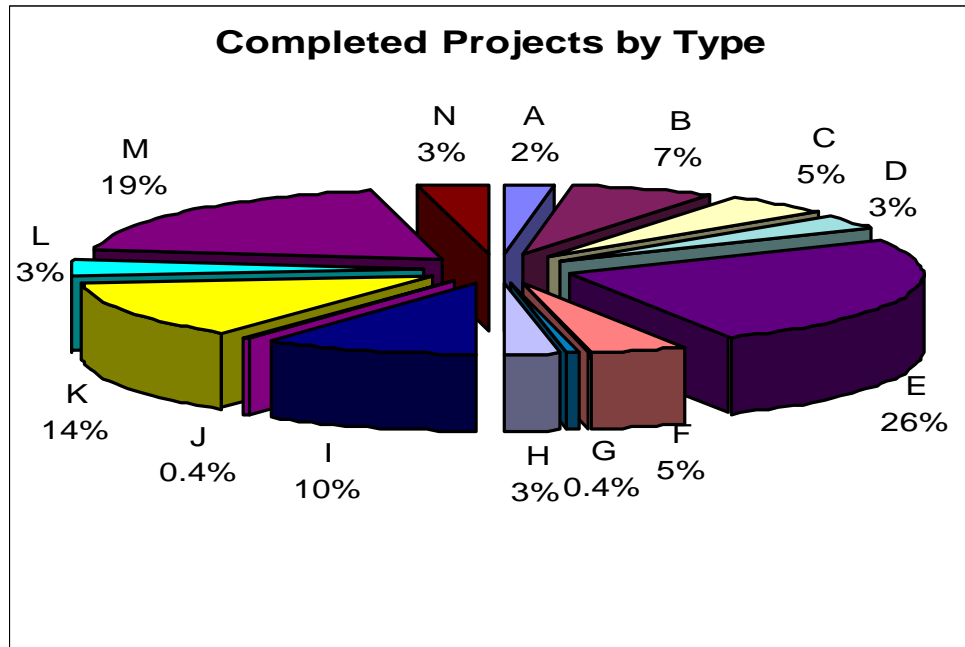


Figure 2



- | | |
|-------------------------------------|----------------------------------|
| A: CAD/CAM | H: control system integration |
| B: EDI/communications/LAN | I: market development |
| C: business systems/management | J: material engineering |
| D: environmental | K: process improvements |
| E: quality/inspection/ISO | L: product or design development |
| F: plant layout/manufacturing cells | M: human resources |
| G: automation robotics | N: technical training |

Figure 3

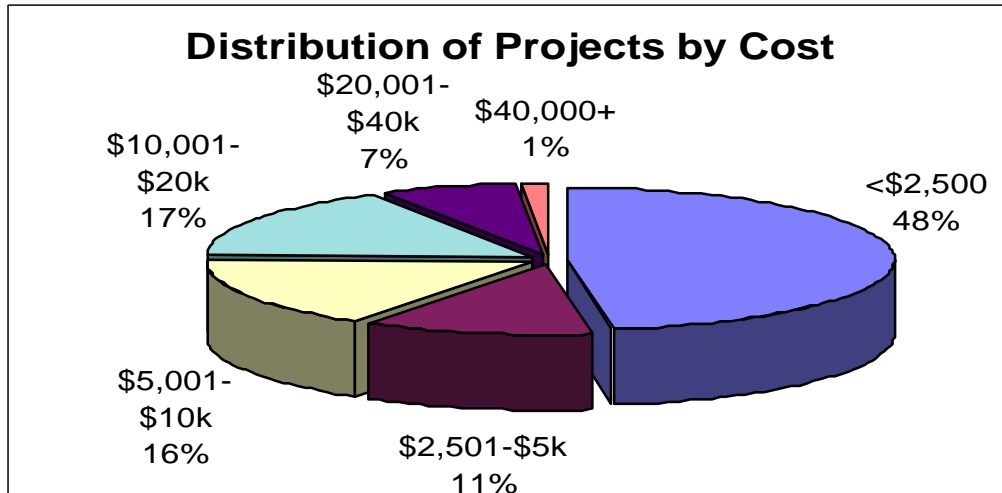


Table 2: Mean Cost by Project Type

Project Type	n	Mean Cost
Technical Training	36	\$1,719
Material Engineering	4	\$3,281
Human Resources	209	\$3,502
CAD/CAM	24	\$3,757
Market Development	107	\$4,030
Environmental	35	\$6,456
Business Systems/Management	56	\$8,074
Plant Layout/Mfg. Cells	50	\$8,913
EDI/Communications/LAN	70	\$9,217
Control Systems/Integration	27	\$9,870
Process Improvements	145	\$10,550
Quality/Inspection/ISO	270	\$11,511
Product or Design Development	37	\$15,663
Automation/Robotics	4	\$15,813

Figure 4

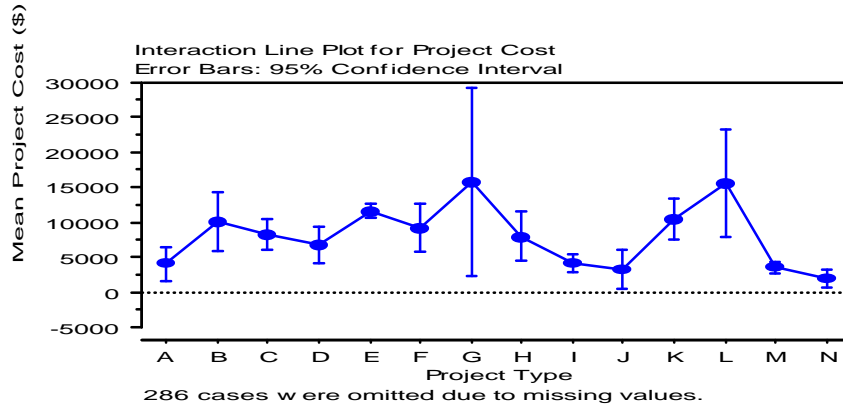


Table 3: MMP Understanding of Needs, Mean Scores by Type

Project Type	Mean Score	n
Automation/Robotics	4.0	1
Business Systems/Management	4.8	12
CAD/CAM	4.4	5
Control Systems/Integration	4.6	8
EDI/Communications/LAN	4.4	22
Environmental	4.8	13
Human Resources	4.4	31
Market Development	4.5	28
Material Engineering	4.0	2
Plant Layout/Mfg. Cells	4.6	14
Process Improvements	4.5	31
Product or Design Development	4.7	6
Quality/Inspections/ISO	4.4	80
Technical Training	4.3	7
All Types	4.4	260

Figure 5

Would Company Have Undertaken Without MMP

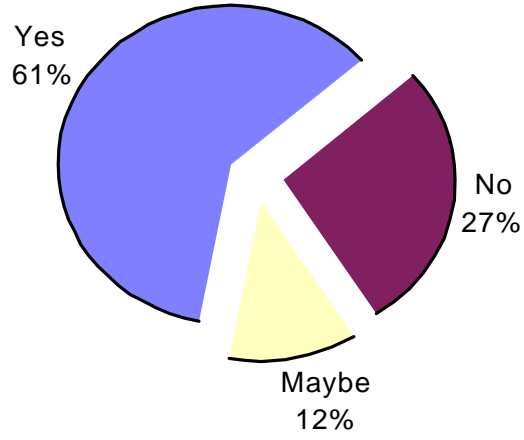


Figure 6

If Yes, When Would You Have Taken Action On This Project?

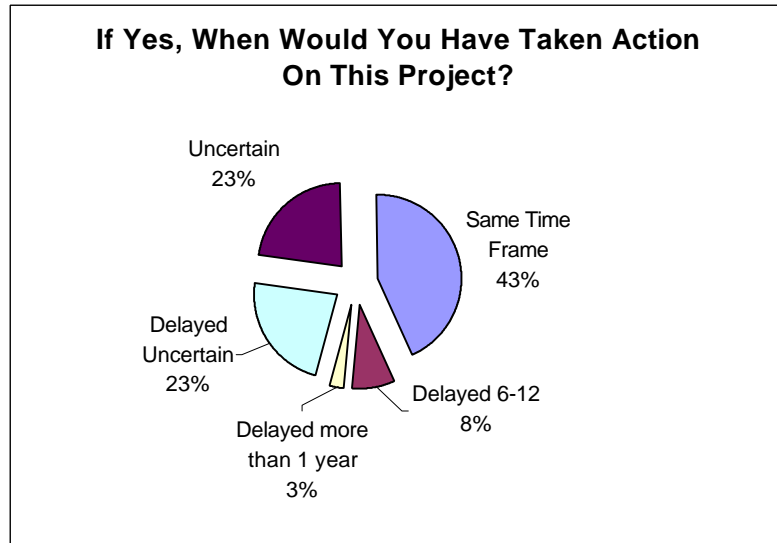


Figure 7

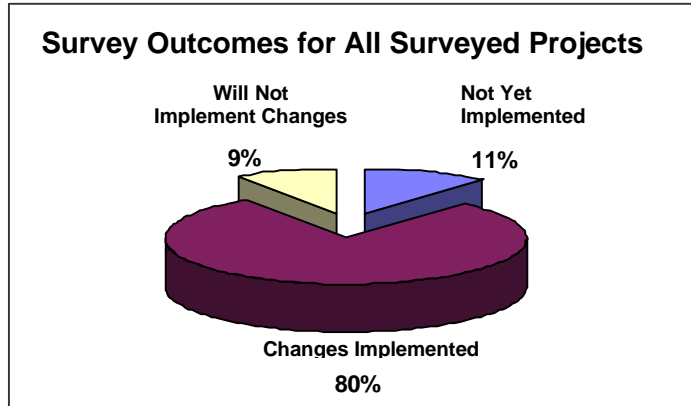


Table 4: Frequency of Reported Impact

Project Type	Mean	n
E Quality/Inspection/ISO	.94	108
F Plant Layout/Mfg.	.93	14
L Product or Design Development	.92	12
K Process	.87	30
M Human Resources	.72	74
C Business	.71	17
B EDI/Communications/LAN	.69	16
I Market	.69	36
All Types	.81	342

Figure 8

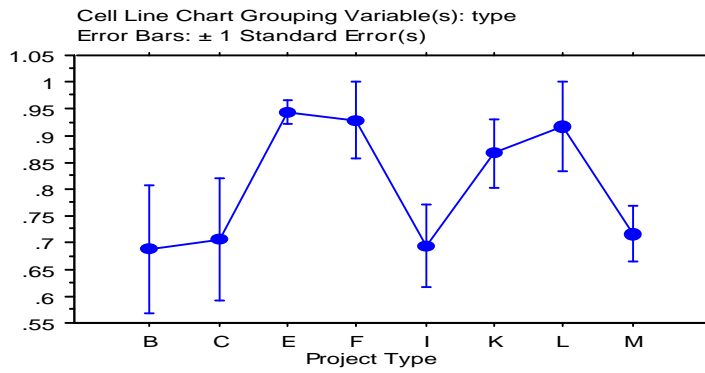


Table 5: Frequency of Reported Impact

Project Type	Mean	n
< \$2,500	.66	126
\$2,501-	.81	43
\$5,001	.93	74
\$10,001-	.90	71
\$20,001-	.92	24
\$40,001	1.00	4
All Types	.81	342

Figure 9

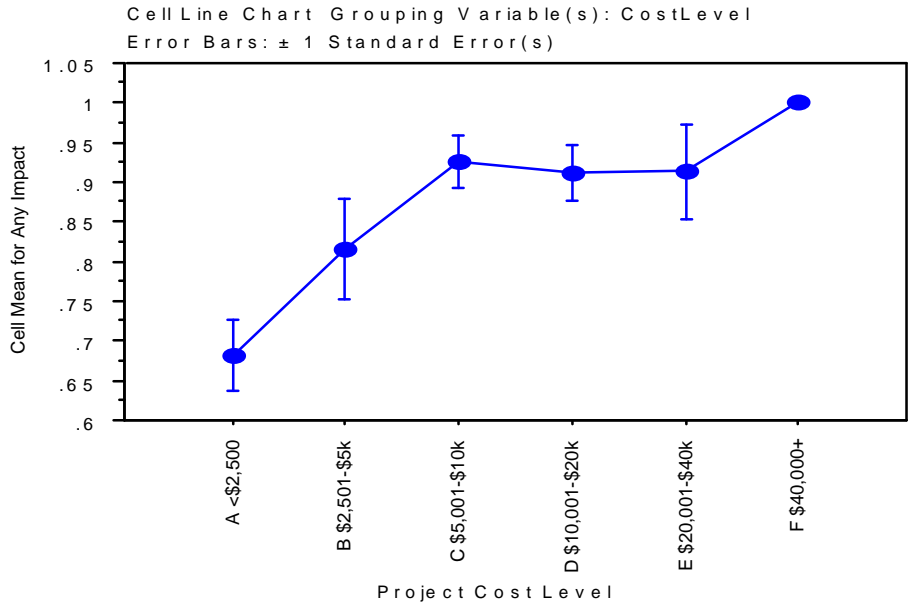


Table 6: Frequency of Reported Impact

Company Size	Mean	n
1 - 10	0.67	28
11 - 25	0.81	50
26 - 50	0.82	74
51 - 100	0.85	50
101 - 250	0.88	56
251 - 499	0.74	14
500+	0.50	1
Total	0.81	273

Figure 10

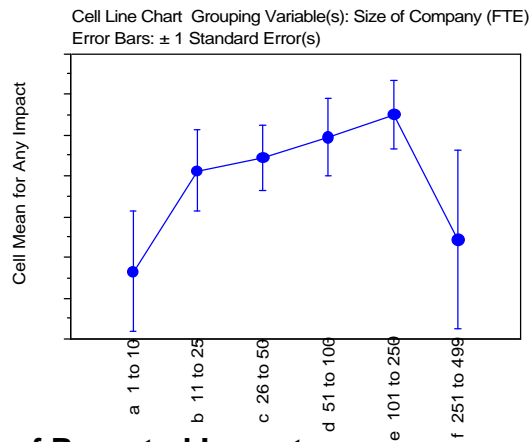


Table 7: Frequency of Reported Impact

SIC	Sector	Mean	n
27	Printing, publishing and allied	0.80	15
28	Chemicals and allied	0.85	13
30	Rubber & miscellaneous	0.85	34
34	Fabricated metal	0.78	51
35	Industrial & commercial	0.78	50
36	Electronics	0.88	40
38	Measuring and analyzing	0.97	35
Total		0.84	238

Figure 11

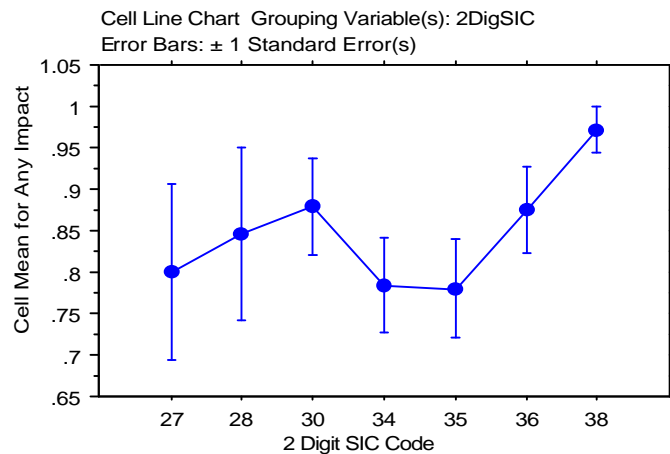


Figure 12

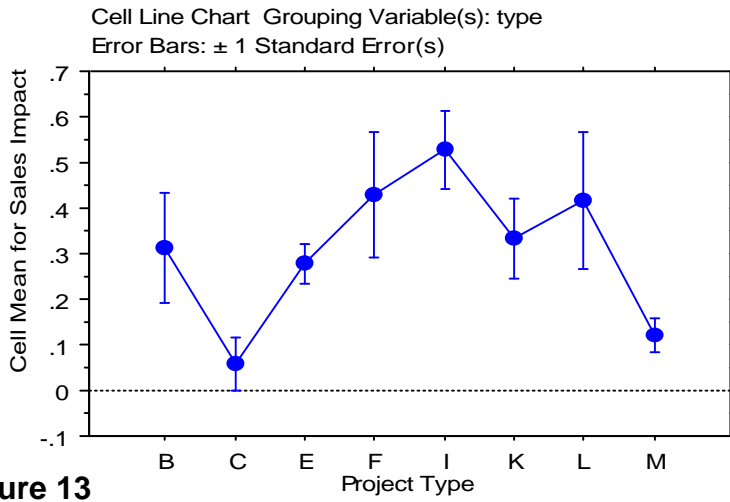
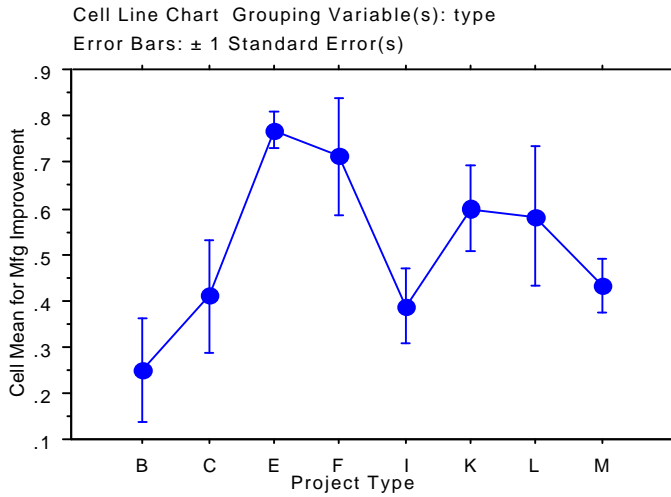


Figure 13



Key: Figure 12 - Figure 14
 B: EDI/Communications/LAN
 C: Business Systems/Mgmt.
 E: Quality/Inspection/ISO
 F: Plant Layout/Mfg Cells
 I: Market Dev't
 K: Process Imprmts.
 L: Product or Design Dev't
 M: Human Resources

Figure 14

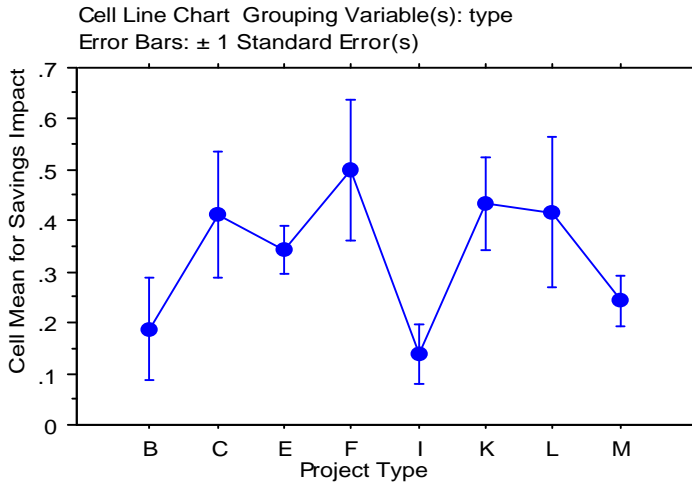


Figure 15

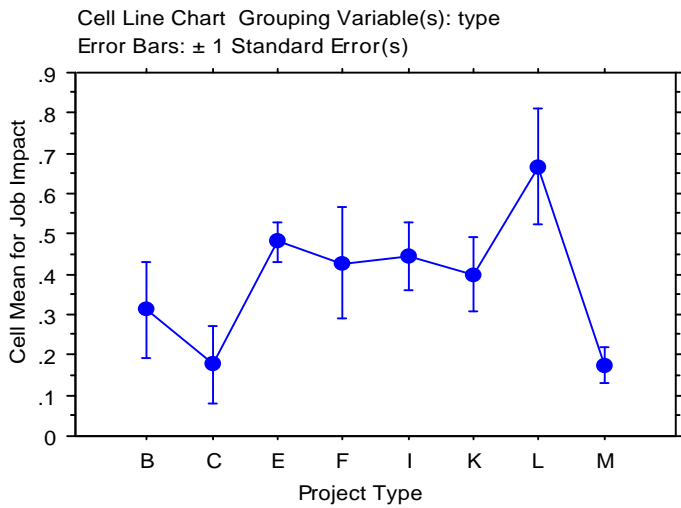
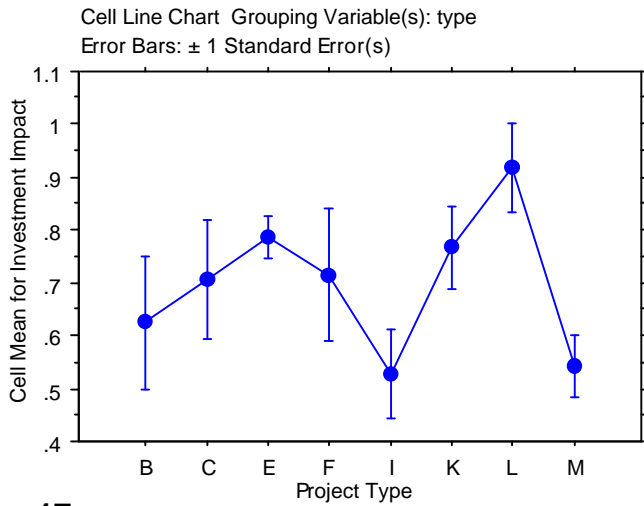


Figure 16



Key: Figure 15 - Figure 17
 B: EDI/Communications/LAN
 C: Business Systems/Mgmt.
 E: Quality/Inspection/ISO
 F: Plant Layout/Mfg Cells
 I: Market Devt.
 K: Process Imprmts.
 L: Product or Design Dev't
 M: Human Resources

Figure 17

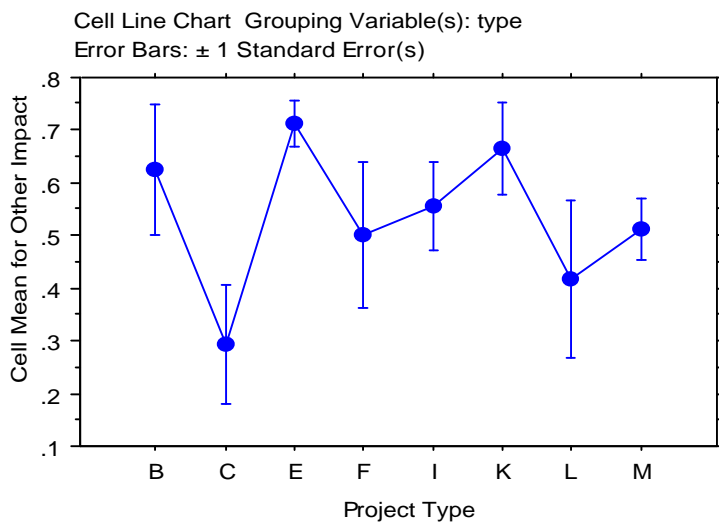


Table 8

Means Table for Change in Competitive

Effect: project type

	Count	Mean	Std. Dev.	Std. Err.
B	22	2.773	1.232	.263
C	10	2.700	1.567	.496
D	12	2.250	1.357	.392
E	75	3.080	1.302	.150
F	13	2.154	1.405	.390
I	27	2.037	1.427	.275
K	30	2.933	1.461	.267
L	5	2.800	1.643	.735
M	28	2.643	1.393	.263

Figure 18

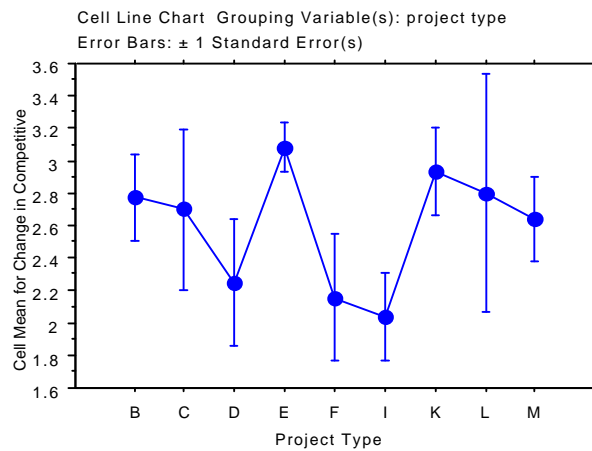


Figure 19

