

Evaluating SME Programs: Learning from the NIST Manufacturing Extension Partnership

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Outline

- **Small manufacturers in the United States**
- **Overview of NIST Manufacturing Extension Partnership**
- **Components of monitoring and evaluation system**
- **Evaluation of the program in Pennsylvania**
- **Uses of evaluation results**



Small manufacturers in the United States

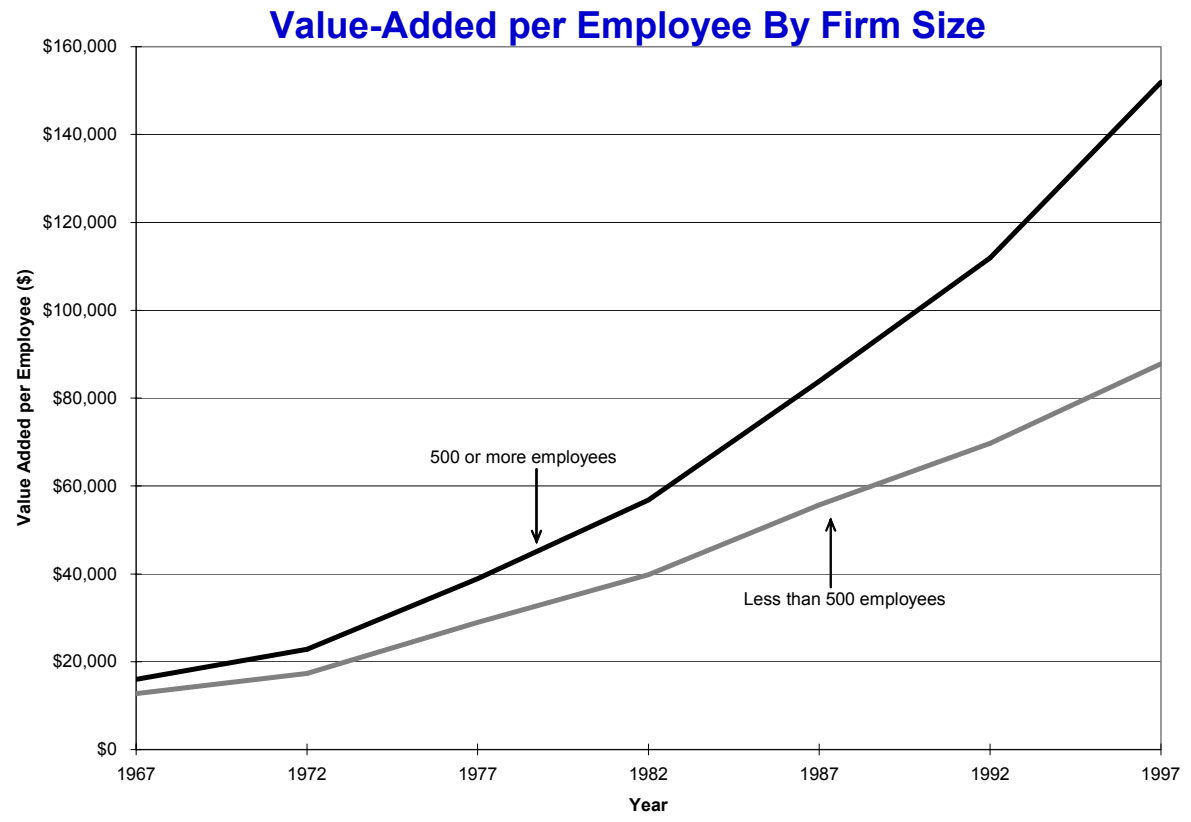
Role of small manufacturers in the United States

- **More than 300,000 manufacturing plants with fewer than 500 employees are operating in the U.S.**
 - Some produce products for sale to final customers.
 - Most supply intermediate goods; many are “build-to-print”
- **Small manufacturers account for a growing share of manufacturing activity and employment**
 - 55% of the total value-added in manufacturing
 - 68% of the total manufacturing labor force
- **But, they invest less in equipment and are less likely to adopt new business and manufacturing practices than larger firms.**



Lagging performance of small manufacturers

- Small manufacturers are less productive than larger firms.
- They also pay lower wages, provide fewer benefits, and offer less job security.



Overview of NIST MEP

NIST Manufacturing Extension Partnership

- In 1988, Congress directed NIST to establish a program to provide assistance to small manufacturers
- Currently, 68 centers with over 400 offices throughout the country.
- Annual budget is roughly \$300 million
 - Congress removed sunset provision in 1998
 - Current funding formula divides support into three categories
 - But significant cutbacks in federal funding have been proposed by Administration

FEDERAL FUNDING Maximum of One-Third
CASH MATCH Minimum of One-Third State and Local Grants Customer Fees In-kind Contribution of Full-time Personnel
IN-KIND SUPPORT Maximum of One-Third Part-time Personnel Office Space



Rationale for public support of NIST MEP

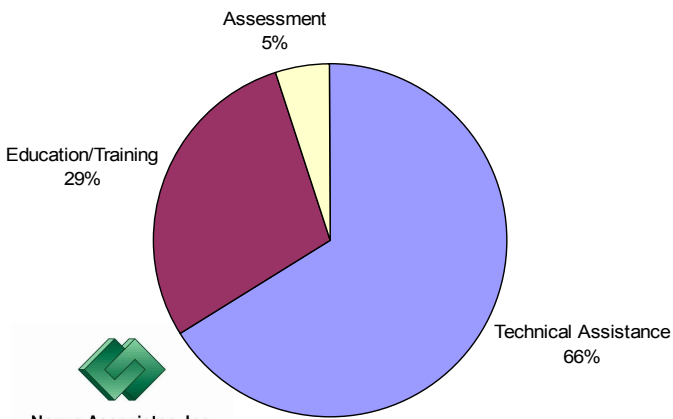
- **Imperfections in training and consulting markets**
 - Needed services are not always readily available
 - Small manufacturers lack information required to make appropriate purchasing decisions (asymmetric information)
 - Purchasing decisions do not reflect broader social benefits (externalities).
- **Market imperfections give rise to economic inefficiencies and justify public intervention.**



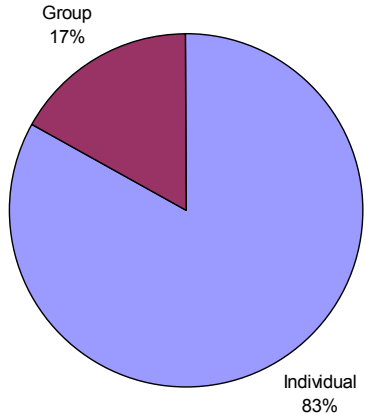
NIST MEP services

- Centers provide consulting and training services to roughly 7,000 companies each year
- Most services are delivered individually, rather than in groups
- Services cover a broad range of subjects, but tend to focus on shopfloor issues

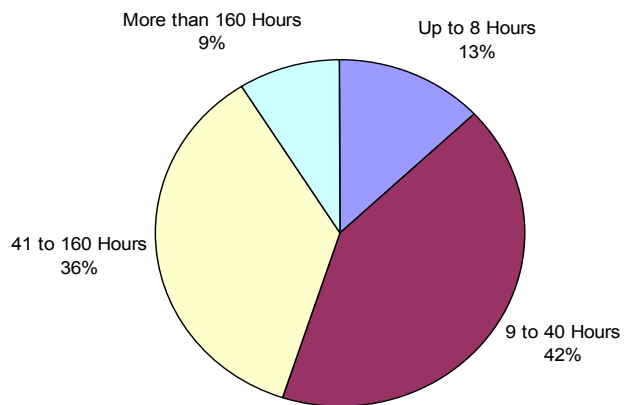
Activity Type
(n=1186)



Activity Mode
(n=1186)



Total Staff and Third-Party Project Hours
(n=1185)



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Components of M&E system

Monitoring of center performance

- **Three-fold purpose:**
 - Document performance trends
 - Identify operating issues that need to be addressed
 - Ensure center accountability
- **Centers are required to submit data on inputs and activities every month**
- **Benchmarking used to compare performance and facilitate learning**
- **Centers undergo formal annual reviews.**

Measure	Median	Center	Percentile
Percentage of staff available hours charged to projects	13.9 %	19.1 %	70%
Operating cost per project hour	\$ 392.4	\$ 196.1	90%
Percentage of center expenses covered by project revenues	23.3 %	27.4 %	53%



Evaluation of relevance and impacts

- **Case studies of exemplary projects**
- **Ongoing client surveys**
- **Special studies**
- **Quasi-experimental designs**



Case studies of exemplary projects

- **Method**

- Case studies are based on an explicit program logic model (PLM) and account for rival hypotheses.

- **Data**

- Program records
- Interviews with NIST MEP staff and company managers
- Field visits to plants to observe changes

- **Results**

- Cases have demonstrated the sequence of cause and effect relationships between services and outcomes.
- Companies have made changes in their operations as a result of services which led to intermediate outcomes (higher quality, lower unit costs, improved delivery performance), and in turn led to increased productivity and/or sales.



Ongoing client surveys

- **Method**
 - Participant judgment of firm-level impacts
- **Data**
 - National survey of companies that completed major projects, which are defined as activities requiring eight or more hours
 - Clients are surveyed nine months after project completion
 - Clients are asked about impacts experienced in the previous twelve months as a direct result of services



Estimated firm-level impacts for 2000

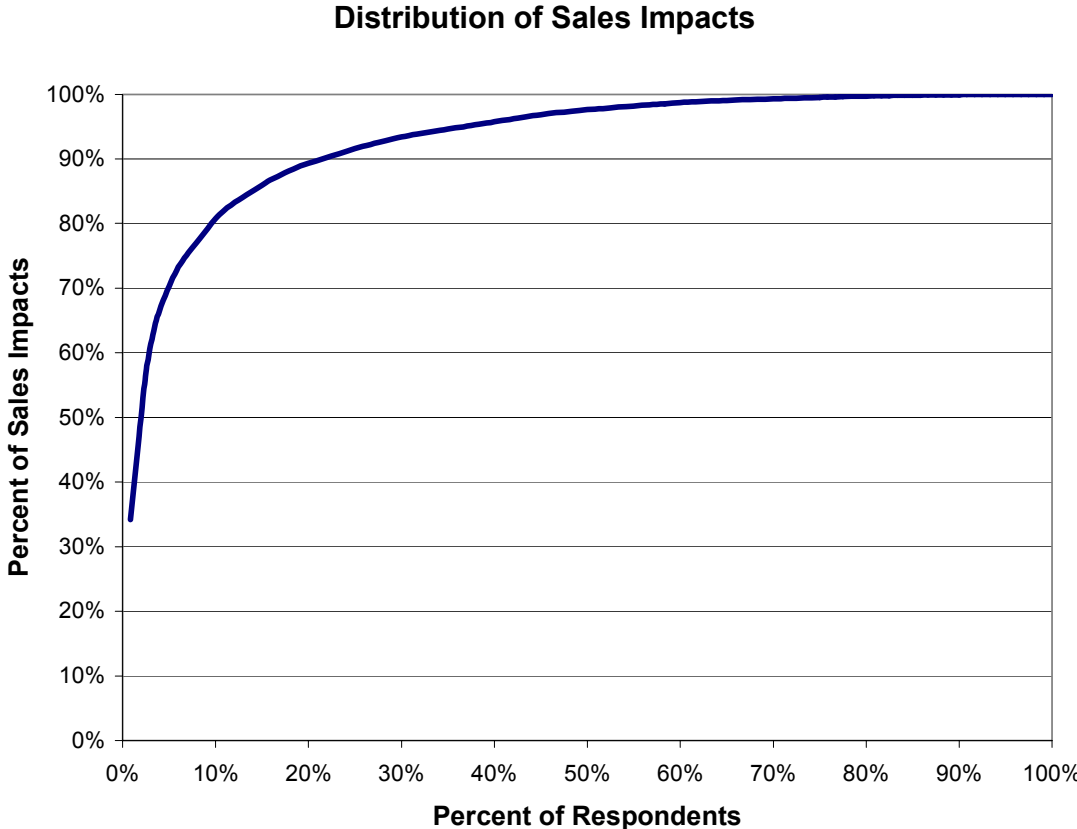
Impact	# of Clients Reporting Quantitative Impacts	Estimated Impacts in 2000
Sales:		
- Increases	874	\$ 557,403,032
- Retention	1165	\$ 1,249,831,914
Cost Savings	1687	\$ 201,634,270
Jobs:		
- Retention	1133	10,868 jobs
- Creation	1073	6,971 jobs
- Reduction	402	(3,711 jobs)
Additional Investment in:		
- Plant or Equipment	1270	\$ 497,843,804
- Information Systems or Software	1134	\$ 74,102,495
- Workforce Practices or Employee Skills	1316	\$ 33,095,654
- Other Areas of Business	341	\$ 120,235,844
Avoided Unnecessary Investments	950	(\$ 115,963,107)
Saved on Investments Made	589	(\$ 41,687,477)

Source: Based on NIST MEP follow up survey for the period Q3 2000 to Q2 2001.



Reported impacts are highly skewed

- Relatively few companies account for the bulk of reported impacts.
- Larger companies and/or companies that have received more intensive assistance are more likely to report greater benefits.



Source: Based on NIST MEP follow up survey for the period Q3 2000 to Q2 2001.

Special studies

- **NIST MEP has commissioned a number of studies to address specific issues**
- **Examples include:**
 - Barriers faced by small manufacturers in obtaining assistance
 - Competition and collaboration with private consultants
 - Impact of center business models on operating performance
 - Potential impact of cutback in federal funding



Some conclusions

- **NIST MEP addresses imperfect information by better aligning their interests with those of their customers**
- **Raising client-paid fees would hurt financial performance of centers and prove detrimental to the public mission of NIST MEP**



Responding to market imperfections

- The odds of a company reporting that they improved their performance as a result of consultants' recommendations were 5.4 times greater if the company secured the consulting services through a NIST MEP center than on their own.

Why would you choose to purchase consulting or training services from the MEP center?	% of respondents agreeing with statement	% of respondents stating as most important factor
Is more likely to offer advice or sell services that you really need than other service providers	85.3%	22.7%
Has built a more positive and trusting relationship with your company than other providers	83.0%	12.3%
Has lower prices than other service providers	81.3%	16.7%
Has more experience in working with companies of your size than other service providers	69.0%	10.0%
Location is closer to your company than other service providers	64.0%	3.3%
Offers greater expertise than other service providers	58.0%	19.0%

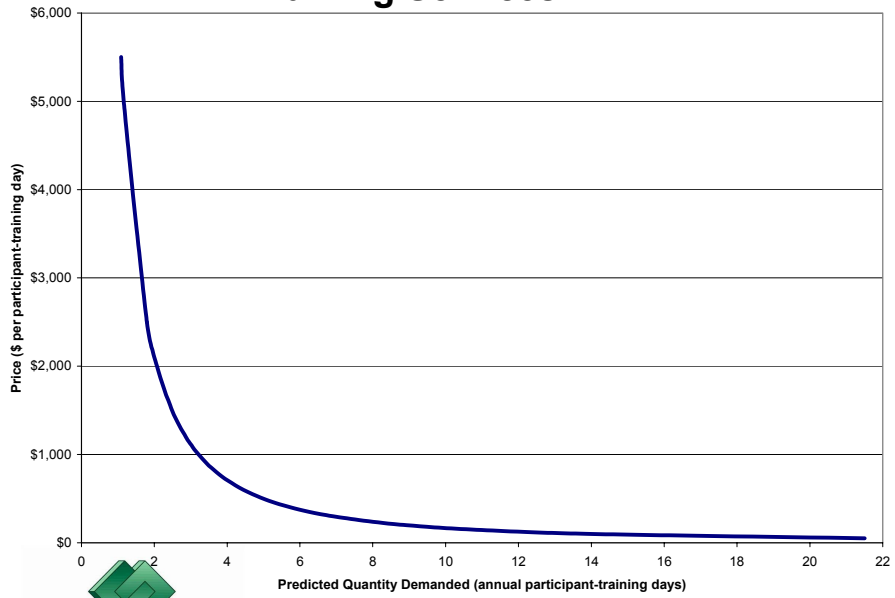
Source: Survey of NIST MEP clients conducted by Nexus Associates, 2002.



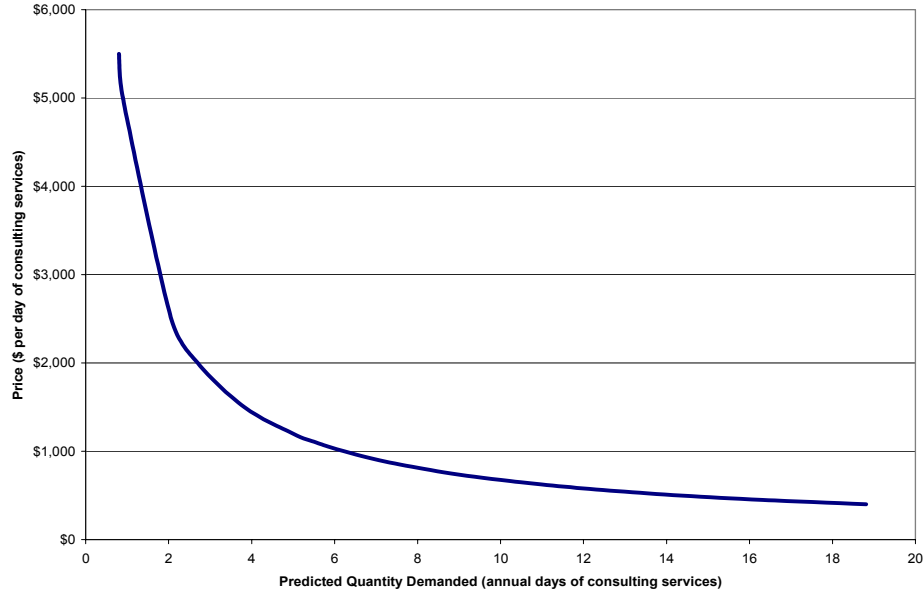
Responding to price sensitivity

- Higher fees would lead to a reduction in demand and revenue
- It would be difficult for centers to generate sufficient revenue to offset proposed cutbacks in public funding

Training Services



Consulting Services



Evaluation of the Industrial Resource Centers in Pennsylvania

Three basic questions

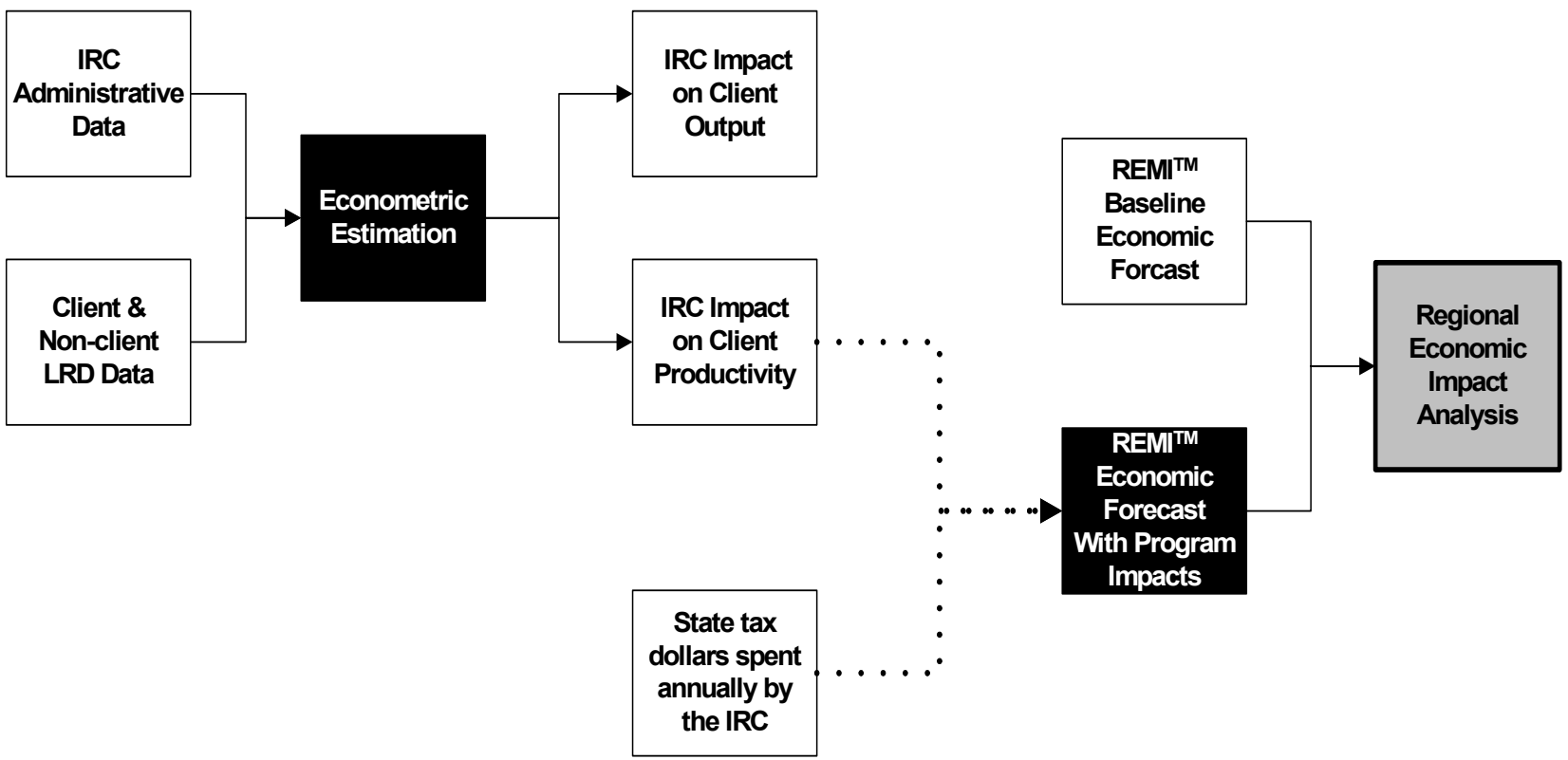
- **What impact has the IRC program had on the performance of clients with respect to output and productivity?**
- **What impact has the IRC program had on the economy in Pennsylvania in terms of gross state product?**
- **What impact has the IRC program had on the Pennsylvania treasury?**



Method

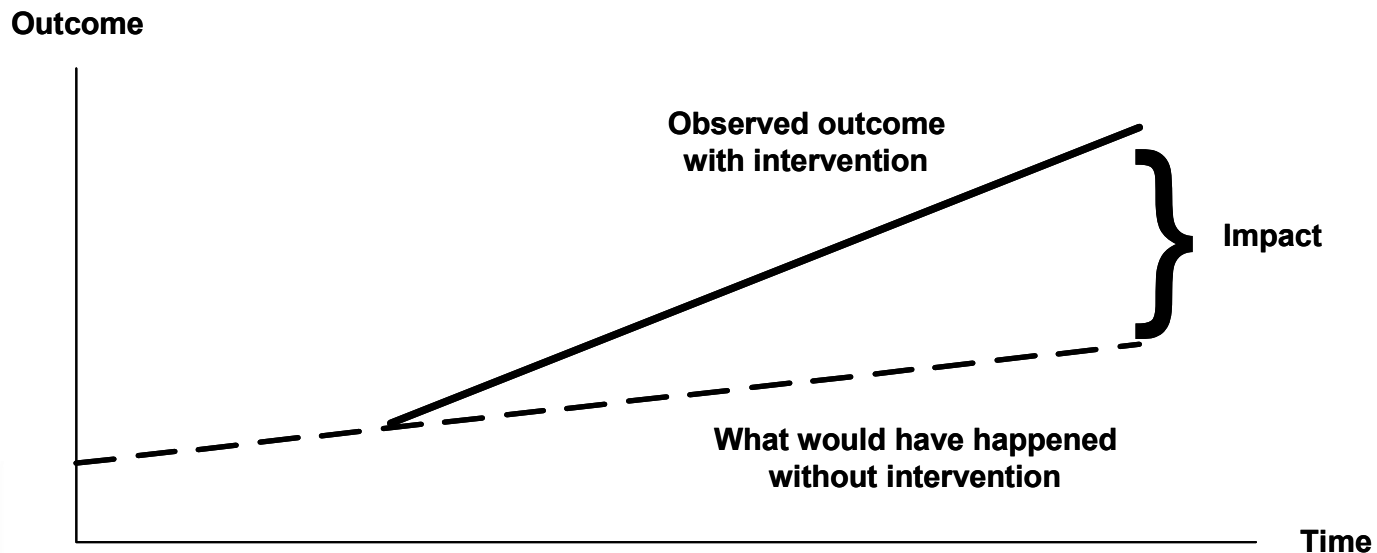
Part One

Part Two



Part One – Estimating impact on clients

- **Challenge was to net out extraneous factors that affect outcomes**
 - Specific events
 - Long-term external trends
 - Maturation
 - Self-selection



Quasi-experiment that specially accounted for selection

- **Compared the performance of IRC clients to that of similar, non-participating firms**
- **Statistically controlled for a range of factors that influence outcomes including those that are related to participation**
- **Estimation procedure involved two stages**
 - Estimated selectivity correction factor
 - Estimated impact using selectivity correction factor



First stage of estimation procedure

- **Estimated the probability of companies becoming IRC clients as a function of firm characteristics**
- **Estimation based on a probit maximum likelihood model**
- **Dependent variable was a dichotomous variable that took the value of 1 if the company was an IRC client and 0 otherwise.**
- **Results used to estimate selectivity correction factor (inverse Mills ratio)**



Second stage of estimation procedure

- Estimated the impact of the IRC on clients after controlling for factors that affect outcomes, including self-selection
- Estimation based on OLS regression using modified Cobb-Douglas production function

$$Q_{it} = A_{it} \exp(\alpha_1 SIC_i + \alpha_2 MSA_i + \alpha_3 IRC_i) K^\beta L^\theta M^\lambda$$

- Dependent variables were growth in output and productivity between census years
- Levels transformed into growth rates based on differences in natural logarithm. This canceled out most of the firm-specific, time-invariant factors
- Inverse Mills ratio used to control for potential selection bias



Data sources

- **Administrative records**
 - Identify companies that received services from FY1988-89 to FY1998-99
 - Eliminated duplicate companies and constructed a unified record of interactions with each firm
- **Longitudinal Research Dataset (LRD)**
 - Maintained by the Center for Economic Studies at the U.S. Bureau of the Census
 - Compiled from the Census of Manufactures carried out every five years and the Annual Survey of Manufactures
 - Plant-level data on shipments, employment, factor costs, industry classification, and other legal and administrative identifiers
 - Use required "Special Sworn Status"
- **Companies included in administrative records were linked to the LRD using specific matching procedure**



First stage results (probit)

- **The likelihood of a firm becoming a client was greater if**
 - The plant was a single plant located in a rural area in close proximity to a center
 - The plant was larger with growing output, but low productivity growth
- **Results used to calculate the inverse Mills ratio to control for potential selection bias in second stage**



Second stage results (OLS)

- IRCs had substantial impact on clients in terms of output and productivity growth
- Differences in constant terms between client and non-clients were positive and statistically significant

	Pre 92 Cohort		Post 92 Cohort	
	$\Delta \log (Q)$	$\Delta \log (V/L)$	$\Delta \log (Q)$	$\Delta \log (V/L)$
Differential Growth Rate	0.18	0.36	0.20	0.25
t statistic	(2.81)	(3.21)	(3.23)	(2.79)

Source: "The Pennsylvania Industrial Resource Centers: Assessing the Record and Charting the Future," Nexus Associates, Inc. ,October 1999

- Factors that contributed to the decision of companies to become clients were associated with observed outcomes
- Coefficients of inverse Mills ratio were positive and statistically significant



Average annual percentage point gain

Productivity

	Estimate	95% confidence interval
IRC Client Cohort 1 (pre-1992)	3.6 percentage points	1.4 to 5.8 percentage points
IRC Client Cohort 2 (post-1992)	5.0 percentage points	1.5 to 8.6 percentage points

Output

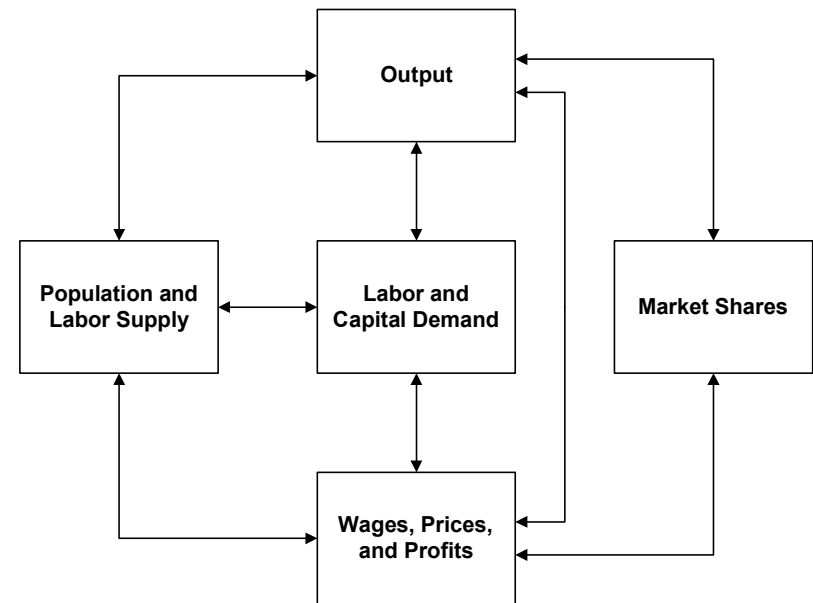
	Estimate	95% confidence interval
IRC Client Cohort 1 (1988 to 1997)	1.9 percentage points	0.6 to 3.5 percentage points
IRC Client Cohort 2 (1992 to 1997)	4.1 percentage points	1.6 to 6.5 percentage points



Part Two – Estimating economic and fiscal impacts

- Client impacts ripple through the economy, giving rise to further impacts in the state.
- The analysis of multiplier effects was based on a regional economic model for Pennsylvania.

Overview of REMI



Five-step process

- **A baseline for Pennsylvania was computed using historical data.**
- **A “reverse” forecast was generated based on productivity gains for IRC clients and taxes required for program funding.**
- **Initial results were adjusted to account for potential displacement effect. Specifically, the model was run a second time reducing output by 14 percent.**
- **Annual economic and fiscal impacts were calculated based on the difference between the baseline and the adjusted forecast.**
- **All monetary values were discounted and adjusted for inflation.**



Economic and fiscal impacts

Economic Impacts

	Estimate	95% confidence interval
Total additional GSP (real \$1992)	\$1.89 billion	\$1.35 billion to \$2.45 billion
Present value of additional GSP per dollar of state investment in IRC program (real \$1992)	\$21.30	\$15.25 to \$27.59

Fiscal Impacts

	Estimate	95% confidence interval
Additional state tax receipts (real \$1992)	\$110 million	\$79 million to \$143 million
Present value of additional state tax receipts per dollar of state investment (real \$1992)	\$1.24	\$0.89 to \$1.61



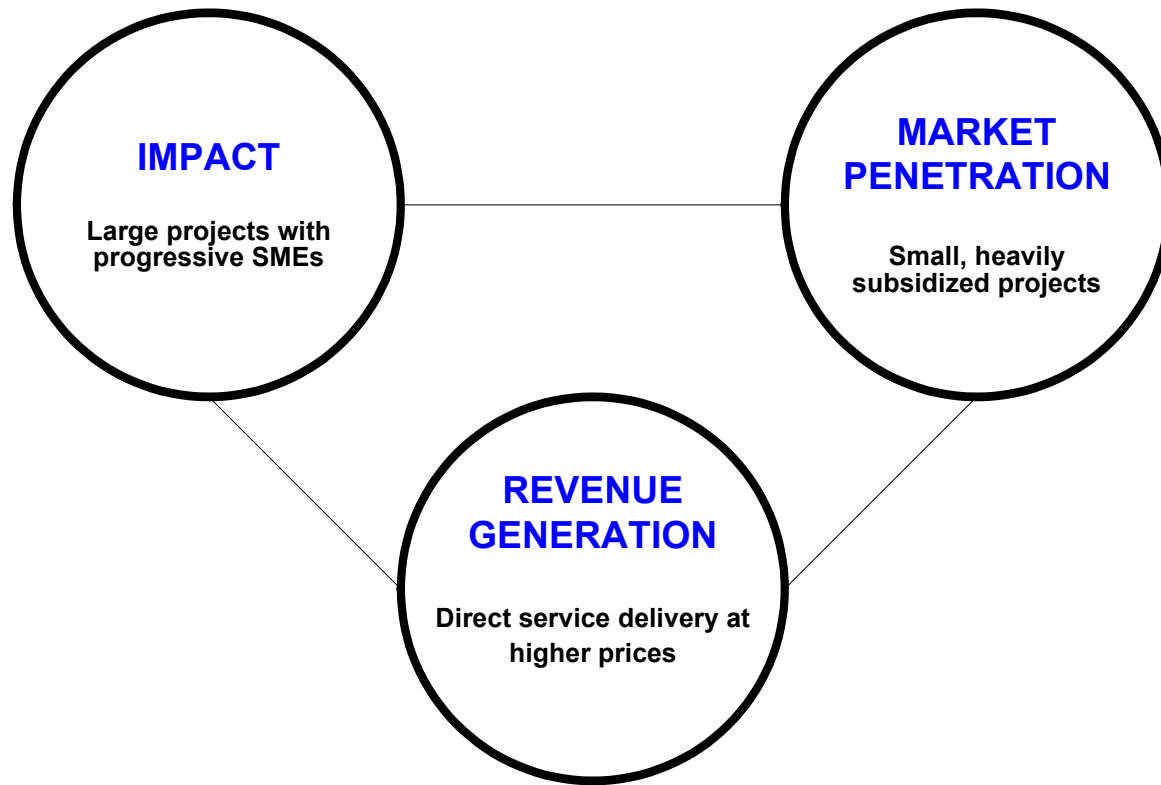
Uses of Evaluation

Evaluations have been used in policy deliberations at the state and national level.

- Reports have been used by proponents in budget debates to support arguments for continued or increased funding.
- The basic rationale for NIST MEP has proven sound – the organization helps to address imperfection in the market for consulting and training services.
- Case studies, participant judgment and quasi-experimental designs have demonstrated that NIST MEP contributes to the improved business performance and economic growth.
- Most centers would be forced to close down entirely if national and/or state funding were eliminated. The ones that remain in business would need take a variety of actions to remain viable:
 - Scale-back operations
 - Raise prices
 - Shift their focus to larger companies
- Each of these actions would be detrimental to the public mission of NIST MEP.



Evaluations have revealed that centers have difficulties in managing conflicting objectives...



... and have been used as a basis for modifying program designs.

- **Target population**
- **Outreach**
- **Service mix**
- **Delivery mechanism**
- **Pricing**



Examples of actions taken by centers

- **Some are focusing on small progressive manufacturers with greater emphasis on larger and more integrated projects**
- **Some are extending their line of services**
 - Extension of lean practices beyond the shop floor
 - Development of business strategies
 - Improvements in the product development process
 - Strategic partnering.
- **Some are structuring services in three tiers**
 - Intensive, long-term engagements with progressive firms
 - Foundation projects built around standard three- to five-day modules
 - Seminars and executive briefings to increase managements' awareness of critical trends in markets and business practices
- **Some are moving to a more explicit pricing policy with subsidies declining over successive engagements**



Conclusion

- **Decisions should be based on accurate and reliable information**
- **Monitoring and evaluation systems are important for accountability and continuous improvement**
- **M&E systems should employ both qualitative and quantitative research**
- **Quasi-experimental designs should be used where possible, but require extensive data, large samples and technical proficiency**

