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Estimating Impacts of Industrial Development in Killingly, Connecticut

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I. Introduction

A. The Problem

The Town of Killingly is undergoing significant changes in industrial development. An industrial park encompassing some 300 acres of fields and woodland is included in the Killingly Plan of Development. In considering site improvements in the industrial park, the Town of Killingly requested the assistance of the Eastern Connecticut Resource Conservation and Development Council in evaluating the project. A study was conducted by the Environmental Review Team in January of 1975.[1/] Their report dealt primarily with the natural resources of the site and how industrial development will affect or be affected by the resources. The report does not consider the possible economic effects that can be expected from development of the industrial park.

Regional planners and local officials often lack the data and an appropriate analytical framework for evaluating such economic impacts. Which sectors of the local economy have provided export or basic goods in recent years and which presently provide export activity? What changes might occur in the size and composition of the labor force? What will be the effects on land use planning and public service in the area? The aim of this study was to obtain and analyze information which will help local decision-makers deal with these questions more effectively. The results of this study can be combined with the environmental report to provide a more comprehensive review.

B. Objectives

The basic objectives of this study were:

1/ Eastern Connecticut Resource Conservation and Development Council, Environmental Review Team Report on the Proposed Industrial Park, Killingly, Connecticut, (March 1975)[4].

1. To determine the sources of basic (export) activity in the Town of Killingly and the surrounding trade area and to calculate a basic employment multiplier for the area.

2. To analyze the economic impacts which will occur in terms of total employment changes due to the industrial developments in Killingly.

C. Procedure

The procedure involved three steps:

1. The relevant area within which the impacts of the Killingly industrial developments will occur was defined. Central place theory was used to delineate the study area.

2. The primary employment increases were determined. The primary employment increases are the new jobs created by firms locating in the Killingly industrial park. Another important new source of employment is the Frito-Lay factory located just outside the Industrial Park proper. The impact of the Frito-Lay plant is also included in this study due to its proximity to the industrial park.

3. The secondary or induced employment increases and the total employment increases were estimated. An economic base model was used to determine the secondary or induced effects from the primary employment changes.

D. Data Sources

Estimation of the primary employment increases required primary data collection. Interviews with persons knowledgeable of the industrial developments in Killingly were conducted to obtain reliable estimates. Secondary data sources provided the information necessary to estimate the induced employment changes and, consequently, the total employment increases. The main source of

employment data was the Northeast Rural Development Data Tape for New England Towns.[2/] The data set contains the Dun & Bradstreet employment survey. In addition, several regional, state and federal publications on population and socioeconomic characteristics were utilized to provide necessary statistics for the economic base framework.

II. Theoretical Framework

Total employment changes from development of the industrial park consist of two parts. An initial, primary employment increase occurs as a result of industrial development through plant hirings from the local labor force and in-migrating laborers. A secondary impact will occur throughout the local economy. This is an induced effect created by increased incomes and purchases within the local economy.

The method used to estimate the secondary employment changes from the primary impact is the economic base multiplier. The economic base employment multiplier indicates how the primary change in employment will affect total employment in the area. Economic base theory postulates that changes in total employment result from changes in the basic or export sector. The employment multiplier must therefore be applied only to changes in basic employment. The employment associated with an industrial park will generally be of the export type.

A. Defining the Study Area

Initially it was necessary to determine the area within which the impact of employment changes are expected to occur. Central place theory was used

2/ This data set was compiled and made available by Dr. Frank Goode and the Pennsylvania State University. [8].

to delineate the study area. The concept of central places was used in a manner which facilitates local planning. Central place theory defines a central place as a city or community in which residents of the surrounding area will spend the greatest portion of their incomes. A central place is the center of trade for a given region. The towns of Killingly and Putnam have been selected as central places for this study. The complementary areas for the two chosen central places include the towns listed in Table 2. A recent survey conducted by the Northeastern Connecticut Regional Planning Agency found that approximately 73% of the persons living within the Northeastern Connecticut Planning Region (NCPR) who were surveyed usually shop in this 10-town region.[3/] In addition, 83% of these persons who shop within the region usually shop in the towns of Killingly and Putnam.[4/] These statistics support the decision of selecting Killingly and Putnam as central places and the surrounding eight townships as the complementary area. Those persons surveyed were also asked where they were employed. It was reported that 74% of those surveyed worked within the region, 25% reported the Town of Killingly as their place of employment.

The above survey results support our decision to define the NCPR as our study area. The survey was conducted in 1976. We therefore need to assume that the commuting and shopping patterns have remained the same over the past few years. This does not seem to be a limiting assumption. As the costs of travel increases it is likely that a larger percentage of persons will seek to work or shop within the surrounding area. Therefore we would anticipate that the estimates cited above would be conservative for present conditions.

3/ Northeastern Connecticut Regional Planning Agency, Transportation Needs, (June 1976) [7] pg. B16.

4/ Ibid., pg. B15, (The use of the word "town" is in reference to the minor civil divisions of Connecticut).

The selection of the NCPR as our study area will enhance local planning in several ways. First, the results and information can be made available to the officials of the ten towns in the region. Secondly, the region we have chosen also coincides with the Danielson Labor Market Area. The information resulting from this study can therefore complement the efforts by regional planners and labor officials.

B. Model Specification

It is necessary to determine the amounts of basic and non-basic employment before the response to a change in basic employment can be estimated. Two indirect methods of determining the basic and non-basic employment are utilized in this report; the assumption approach, and the location quotients technique. The assumption approach is by far the simplest method of analysis. It is assumed that certain industrial sectors are basic and all others are non-basic.[5/] This approach is reasonable when applied to small rural economies such as the Northeastern Connecticut Planning Region. The use of location quotients is based on the simple premise: if a community or area specializes in the production of a good or service it is presumed that the good or service is an export item. Location quotients are used to determine the industries in which an area is specialized and the amounts of basic and non-basic employment in each industry. National data are used to calculate the location quotients. We assume that the consumption patterns in the NCPR are similar to those of the nation.

5/ The most frequently used assumptions are that agriculture, mining and manufacturing are basic activities and all other sectors are non-basic. This can be altered by persons familiar with the local economy and by a higher degree of disaggregation.

Using the location quotient technique, the basic and non-basic employment for the i-th industrial sector is calculated as follows:[6/]

(1) $$E_i/E \gtrless NE_i/NE \text{ or } E_i \gtrless (NE_i/NE) \times E$$

(2) If: $$E_i \leq (NE_i/NE) \times E$$

then: $$NBE_i = E_i$$

$$BE_i = 0$$

(3) If: $$E_i > (NE_i/NE) \times E$$

then: $$NBE_i = (NE_i/NE) \times E$$

$$BE_i = E_i - NBE_i$$

(4) $$NBE = \sum_{i=1}^{n} NBE_i$$

(5) $$BE = \sum_{i=1}^{n} BE_i$$

where: E_i = area employment in industry i.

E = total area employment.

NE_i = national employment in industry i.

NE = total national employment.

i = the i-th industry. (i=1,2,3,...,n).

NBE_i = area non-basic employment in industry i.

BE_i = area basic employment in industry i.

NBE = total area non-basic employment.

BE = total area basic employment.

Summation across n industrial sectors, equations (4) and (5), yields the total non-basic and basic employment for the study area.

The relationship between basic and non-basic employment can now be modeled to estimate the proportion of non-basic activity attributable to local basic

6/ A similar model was developed by Nelson [6] for "full employment" economies.

industry. Such a relationship can be expressed as a multiplier which determines the change in total area employment from a unit change in basic employment. An allowance is made in the following procedure for non-basic employment which serves that portion of the area population that neither works in the local labor force nor is supported by a member of the local labor force. This group includes persons who live in group quarters, such as college dormitories and inmates of institutions, and those persons 65 and over not in the labor force.

The employment multiplier is calculated as follows:

(6) $$ESNW = (NW/POP) \times NBE$$

(7) $$MULT = (E - ESNW) / BE$$

where: ESNW = area non-basic employment serving persons neither working in nor supported by workers in the local labor force.

NW = those persons neither working in nor supported by workers in the local labor force.

POP = total area population.

MULT = the employment multiplier for the study area.

The multiplier is applied to the change in basic employment to estimate the change in total employment.[7/] We assume that the new basic jobs will be filled by either in-migrating workers or previously unemployed workers. If the rate of unemployment in the study area is above the "full employment" level, an adjustment must be made for the number of unemployed persons hired.[8/]

7/ The employment multiplier must be applied only to that portion of the new employment which is basic (export) activity.

8/ The "full employment" level is consistent with a certain rate of unemployment which represents "frictionally" unemployed persons. It is common to consider a 4% or 5% rate of unemployment representative of "full employment." See Bronfenbrenner, Martin, Macroeconomic Alternatives, [1] pp. 15-18.

The amount of unemployment compensation previously received by these workers represents a "leakage" to the multiplier process. The multiplier is applied only to the additional income which these workers receive by accepting a job.[9/] New Basic employment filled by in-migrating workers will result in a full multiplier effect on the local economy.

Employment changes in the study area can be expressed mathematically as:

(8) $$\Delta BE = E_m + E_u$$

(9) $$\Delta BE_a = E_m + E_u(1 - \frac{C}{W})$$

(10) $$\Delta E = (E_m + E_u(1 - \frac{C}{W})) \times MULT + E_u(C/W)$$

where: ΔBE = change in area basic employment.

ΔBE_a = adjusted change in area basic employment.

E_m = in-migrating workers hired.

E_u = unemployed workers hired.

C = annual level of unemployment compensation for the study area.

W = annual income for the new jobs created.

ΔE = change in total area employment.

An economy operating at full employment will have the full multiplier effect for all jobs created. It is important to note that although the new jobs filled by unemployed workers will not stimulate the local economy by a full multiplier effect, they are included to the full extent when calculating the total change in employment for the area. The final term in equation (10) makes this necessary adjustment.

9/ The adjustment for unemployment must be expressed in terms of "jobs," the unit of measurement used in the model. To do this we selected a standard salary (W) to represent the money value of a job. The ratio of unemployment compensation (C) to the standard salary (W) is a pure number which can be used to determine what fraction of a job unemployment compensation represents.

The changes in total area employment derived can be used to estimate changes in the area population, per capita income, and additional tax revenues and costs which can be expected from the industrial developments.

III. Empirical Results

A. Estimation of Primary Employment Changes

Primary data were collected through interviewa with persons knowledgeable of the changes in development. The primary employment increases in the Killingly Industrial Park can not be precisely estimated. There are no firm commitments by industries to locate in the park in the near future. The present plan for the park is to attract 10-15 firms of 50-60 employees each. This will serve to create a diversified economic base for the economy. Increased employment from the Frito-Lay plant has been estimated from engineering plans for the factory under construction. At the date which production will begin, 200 persons will be employed. Approximately 6-9 months from that date (June 1980) it is anticipated the plant will be operating at full capacity employing 600 persons.

The above factors were combined to provide a range of possible primary employment changes. Situation A, considered the primary employment change from the Frito-Lay plant. This represents a reliable estimate for the impacts which will occur within the next year and was included in all the hypothetical situations. Four additional hypothetical situations were included according to the level of development for the Killingly Industrial Park. Situation B considered the addition from the Frito-Lay plant plus the primary effects of 10 firms locating in the Killingly Industrial Park and hiring 50 employees each.

Similarly, situations C, D and E considered the change associated with Frito-Lay plus 10 plants hiring 60 employees, 15 plants hiring 50 employees, and 15 plants hiring 60 employees, respectively. These hypothetical situations are summarized in Table 1. The totals represent the amount of primary employment change in the area after an adjustment for unemployment in the study area.

Table 1. Range of Primary Employment Changes from Economic Development Around the Killingly Industrial Park (# of Employees).

		Combined Changes from Frito-Lay and the Killingly Industrial Park			
Source of Employment	Frito-Lay A	B	C	D	E
Frito-Lay[a/]	600	600	600	600	600
Killingly Ind. Park[b/]	---	500	600	750	900
TOTAL Employment Change	600	1,100	1,200	1,350	1,500
Unemployment Adjustment[c/]	-260	-423	-423	-423	-423
TOTALS (adjusted)	340	677	777	927	1,077

a/ Obtained from engineering estimates of full production by Mr. Bill Ludwig of Frito-Lay.

b/ The planned level of development of the park according to estimates by Mr. Tom Dwyer, the town manager for the Town of Killingly, in October 1979.

c/ An unemployment adjustment figure of -423 can be calculated only if 960 unemployed persons are hired.

It was necessary to adjust the primary employment change because of the high rate of unemployment within the study area. The study area is consistent with the delineation of both the Northeastern Connecticut Planning Region (NCPR) and the Danielson Labor Market Area. The rate of unemployment for this area was estimated at 7.1% for August of 1979.[10/] This represents approximately 2200 workers.

We have chosen an unemployment rate of 4% to represent "full employment" in the Danielson Labor Market Area and our study area. An unemployment rate of 4% represents approximately 1240 workers. Subtracting the number of "frictionally" unemployed workers from the present number of unemployed workers will give us the number of unemployed workers available to fill the jobs created by the

10/ Connecticut Labor Department, Connecticut Labor Situation, (October 1979)[2].

industrial development. In assuming that the jobs created will first be filled by presently unemployed workers, we must further assume that persons presently not in the labor force will not seek jobs from the industrial development. There may be a large amount of movement between firms by presently employed persons. The net number of jobs remaining after these movements between firms are accounted for should be approximately equal to the number of new jobs which were created. It seems reasonable to assume that these jobs will be filled by unemployed persons.

We used $11,290 as the annual income for the new jobs created (W) in making the adjustment for the number of unemployed workers hired.[11/] The average annual unemployment compensation for the Danielson Area (C) is presently $4,977.[12/] Using these figures and the number of unemployed workers available, 960 persons, the unemployment adjustment figure was calculated and appears in Table 1.[13/]

B. Estimation of Secondary Employment Changes

To determine the employment multiplier for the Northeastern Connecticut Planning Region (NCPR) we first estimated the amount of basic, non-basic and total employment for the area. Employment data were collected from the Dun & Bradstreet employment survey by industry for each town in the area. The data were aggregated for 17 industrial sectors according to Standard Industrial Classification (SIC) codes. The employment estimates were then adjusted for

11/ The average weekly earnings for manufacturing, production, maintenance and related workers multiplied by 52.
Source: Connecticut Labor Department, Connecticut Labor Situation, (October 1979)[2].

12/ Estimated by the Connecticut Labor Department - Research Department (unpublished statistic - September 1979).

13/ This represents the leakage, in terms of employment, from hiring unemployed workers. For example: E_u (C/W) = 960 (4977/11290)
= 960 (0.44).

the number of firms in each industrial sector who did not report any information. The number of firms who did not report were obtained from the Dun & Bradstreet employment files and are listed by four digit SIC code in Appendix A. An average size per firm for these SIC codes was determined for Windham County and for the State of Connecticut (all ten towns in the NCPR are located in Windham County). The average firm size for the State of Connecticut was used to adjust the employment data. The average firm size for Windham county was not used for two reasons:

(1) In several cases the missing SIC industries were not reported in Windham County.

(2) In many of the missing SIC industry sectors there were only a small number of firms to use in computing the average.

The average firm size for the State of Connecticut was then multiplied by the number of firms in the NCPR who did not report. This was done at the 4-digit SIC level and aggregated into the appropriate industrial sectors as displayed in Table 2. (See Appendix A).

The basic and non-basic levels of employment were determined using the adjusted employment estimates of Table 2. We assumed that all employment in agriculture is basic to the area. It is normally also assumed that all mining and manufacturing are basic. These assumptions were altered slightly to attempt to more realistically estimate true basic employment. For example, in the mining sector a majority of employment represents stone and gravel banks. Such employment often supports local demand. Similarly, bakeries (food & kindred), local newspapers (printing and publishing), and local sawmills (furniture, lumber & wood products) often support local demand. We chose to use location quotients for these sectors and for the transportation; communication and public utilities; wholesale trade; retail trade; finance, insurance and real estate;

Table 2. Employment by Industry for the Towns in the Northeastern Connecticut Planning Region[a]

Industry	Brook-lyn	Can-ter-bury	East-ford	Kill-ingly	Plain-field	Pom-fret	Put-nam	Ster-ling	Thomp-son	Wood-stock	N.E. Region Totals	
											Act.	Adj.[b]
Agriculture, forestry and fisheries	28	6	47	8	27	18	9	12	0	7	162	200
Mining	0	0	0	1	0	0	0	0	0	0	1	16
Construction	46	26	36	126	87	5	44	1	73	49	493	672
Manufacturing:												
Food & kindred	0	6	0	130	0	0	28	0	100	2	266	266
Textile & apparel	0	0	0	764	1222	8	1091	125	231	0	3,441	3,568
Furniture, lumber, & wood products	0	0	15	11	465	0	125	48	101	8	773	800
Printing & publishing	24	0	0	10	0	0	40	0	1	0	75	157
Chemicals & allied	11	0	0	1895	724	0	386	0	385	80	3,481	3,624
Metal products & machinery	8	3	35	748	953	30	537	0	163	81	2,558	3,371
Misc. manufacturing	0	0	0	216	0	0	200	0	0	0	416	426
Transportation	0	0	8	105	90	1	17	0	1	3	225	339
Communication and public utilities	5	8	0	24	0	0	0	0	0	1	38	50
Wholesale trade	7	1	0	127	133	161	51	0	198	42	720	802
Retail trade	97	47	54	661	476	82	615	11	131	37	2,211	2,453
Finance, insurance, and real estate	0	0	0	11	6	1	33	0	24	3	78	163
Services	138	3	3	482	50	23	651	1	52	5	1,408	2,796
Public administration	0	0	0	15	0	0	0	0	0	0	15	15
TOTALS	364	100	198	5,334	4,233	329	3,827	198	1,460	318	16,361	19,718

a/. Source: The Northeast Rural Development Data Tape (At the University of Connecticut Computer Center) [8]
b/. Adjusted at the 4 digit SIC code level by the average size of the firms in Connecticut.

services; and public administration sectors as well. It would be possible for a person more familiar with the characteristics of the study area to make further adjustments to this approach since employment data from the Dun & Bradstreet files are available at the four digit SIC code level for each town. The results of the assumption - location quotient method are displayed in Table 3. As shown, the amount of basic employment is estimated at 11,612 while non-basic employment accounts for 8,106 workers. The use of location quotients shows two of the manufacturing sectors, food and kindred and printing and publishing, to be non-basic in this area. The third manufacturing sector to which location quotients were applied shows a significant level of basic activity. Approximately 49.5% of the employment in the lumber and wood products industries appears to be export activity. Also noteworthy are the 27 employees (3.4%) in the wholesale trade sector which represents basic (export) activity.

The same employment figures of Table 2 were then used to estimate basic and non-basic employment by a strict location-quotient technique. In using this technique the agricultural sector no longer indicates any basic employment. The other sectors assumed basic in the previous method were again determined to provide basic activity to the local economy. However, a certain portion of the employment in each sector is allocated to satisfy local demand. Only those sectors in which the area proves to be specialized will show any level of basic or export employment. As shown in Table 4, the basic activity or employment is considerably less than our prior estimate and the non-basic employment is considerably larger. Basic and non-basic activity account for 8,025 and 11,693 jobs, respectively. Given that location quotients have been demonstrated to under-estimate export activity anywhere from 25% to 85% we must consider the

Table 3. Determination of Basic Employment for the Northeastern Connecticut Planning Region (Assumption - Location Quotient Approach)

Industry	U. S. Employment (1975)[a] # (000's)	U. S. Employment (1975)[a] %	Northeast Region Employment[b] #	Northeast Region Employment[b] Estimated Non-Basic	Northeast Region Employment[b] Estimated Basic
Agriculture, forestry and fisheries	3,476	(4.10)	200	0	200[c]
Mining	732	(0.86)	16	16	0
Construction	5,015	(5.91)	672	672	0
Manufacturing:					
Food & kindred	1,843	(2.17)	266	266	0
Textile & apparel	2,245	(2.65)	3,568	0	3,568[c]
Furniture, lumber, & wood products	1,734	(2.05)	800	404	396
Printing & publishing	1,133	(1.34)	157	157	0
Chemicals & allied	2,804	(3.31)	3,624	0	3,624[c]
Metal products & Machinery	9,092	(10.72)	3,371	0	3,371[c]
Misc. manufacturing	424	(0.50)	426	0	426[c]
Transportation	3,251	(3.83)	339	339	0
Communication and public utilities	2,372	(2.80)	50	50	0
Wholesale trade	3,333	(3.93)	802	775	27
Retail trade	14,137	(16.67)	2,453	2,453	0
Finance insurance, and real estate	4,665	(5.50)	163	163	0
Services	23,759	(28.02)	2,796	2,796	0
Public administration	4,770	(5.62)	15	15	0
TOTALS	84,785	(100.00)	19,718	8,106	11,612

a/ Source: Statistical Abstract of the U. S. - 1978 [11]
b/ Adjusted employment data. Source: The Northeast Rural Development Data Tape for New England Towns [8]
c/ Industrial sectors assumed to be basic.

Table 4. Determination of Basic Employment for the Northeastern Connecticut Planning Region (Location Quotient Approach)

Industry	U. S. Employment (1975)[a] # (000's)	%	Northeast Region Employment[b] #	Estimated Non-Basic	Estimated Basic
Agriculture, forestry and fisheries	3,476	(4.10)	200	200	0
Mining	732	(0.86)	16	16	0
Construction	5,015	(5.91)	672	672	0
Manufacturing:					
Food & kindred	1,343	(2.17)	266	266	0
Textile & apparel	2,245	(2.65)	3,568	522	3,046
Furniture, lumber, & wood products	1,734	(2.05)	800	404	396
Printing & publishing	1,133	(1.34)	157	157	0
Chemicals & allied	2,804	(3.31)	3,624	653	2,971
Metal products & machinery	9,092	(10.72)	3,371	2,114	1,257
Misc. manufacturing	424	(0.50)	426	93	323
Transportation	3,251	(3.83)	339	339	0
Communication and public utilities	2,372	(2.80)	50	50	0
Wholesale trade	3,333	(3.93)	802	775	27
Retail trade	14,137	(16.67)	2,453	2,453	0
Finance, insurance, and real estate	4,665	(5.50)	163	163	0
Services	23,759	(28.02)	2,796	2,796	0
Public administration	4,770	(5.62)	15	15	0
TOTALS	84,735	(100.00)	19,718	11,693	8,025

a/. Source: Statistical Abstract of the U. S. - 1978 [11]
b/. Adjusted employment data. Source: The Northeast Rural Development Data Tape for New England Towns [8]

strict location quotient approach to give a low estimate of basic employment and therefore will tend to over-estimate the employment multiplier.

The basic and non-basic estimates of employment were incorporated into equations (6) and (7) of the economic base model. The estimation of employment multipliers for the two methods of determining basic and non-basic employment are shown in Figures 1 and 1a. An adjustment was made in the calculations for that portion of non-basic employment which serves persons not in the local labor force. The data needed for this adjustment were available from the 1970 Census of Population-Connecticut [10]. The data were not available for 1975. We assumed that the relative size of this group in 1975 was the same as reported in the 1970 Census. This was done to make all data consistent with the year employment data were collected (1975). This assumption does not seem to pose any grave problems and should represent only a small error if any at all.

The multipliers derived in Figures 1 and 1a represent the relationship between total employment and basic employment for the Northeast Planning Region. The location quotient technique resulted in a lower estimate of the basic employment for the economy. This results in a larger employment multiplier than the assumption-location quotient approach used in Table 3. The two employment multipliers are 1.62 and 2.30 for the assumption-location quotient and the strict location quotient techniques, respectively. A change in basic employment by a single job will result in an additional 0.62 or 1.30 non-basic jobs, depending upon the results accepted.

The employment multipliers were then used to calculate the changes in total area employment as described by equations (9) and (10) of the model. To determine the secondary employment changes, the employment multipliers were

applied to the adjusted primary employment changes from Table 1. The total employment changes were calculated as described by equation (10). The results are displayed in Tables 5 and 5a for the assumption-location quotient method and the strict location quotient method. We assumed that all new employment from the changes in industrial activity in the area represent basic employment. This is certainly a valid assumption for the Frito-Lay plant. The plant will supply all the New England States and New York City. The amount of their product consumed in the NCPR is expected to be only a small fraction of the total output. The assumption may pose a problem for the employment from the industrial park. For simplicity we assumed that all firms locating within the park will be basic in nature. In light of the uncertainty of development in the park, any other assumption could prove to be equally as inaccurate.

The amount of locally supported population per job was calculated in Figure 2. This population multiplier can be applied to the estimated number of in-migrating workers to obtain a gross indication of the population change expected for the NCPR. For this study, the number of in-migrating workers was estimated as the total change in employment minus the number of unemployed workers available (960 unemployed available). For situation A, the total change in employment was less than the number of unemployed available. The population multiplier was applied only to the 10 management personnel which will be brought in by Frito-Lay. In all other hypothetical situations the total change in employment is greater than the number of unemployed available and the total population change is estimated as discussed above. The results are displayed in Tables 5 and 5a.

The impacts which are expected to occur within the Town of Killingly were then estimated. To calculate these impacts it was necessary to make two

Figure 1. Estimation of the employment multiplier for the Northeastern Connecticut Planning Region.
(Location Quotient Assumption Approach)

$$\text{Local employment serving persons not supported in the local labor force} = \frac{\text{Area population neither working nor supported by workers in the local labor force}^{a/}}{\text{Area population}^{c/}} \times \text{Area non-basic employment}^{b/}$$

$$\frac{6,860}{63,260} \times 8,106 = 879$$

$$\text{Basic employment} = \text{Total employment}^{b/} - \frac{\text{Local employment serving persons not supported in the local labor force}}{\text{Basic employment}^{b/}}$$

$$\text{MULT} = \frac{19,718 - 879}{11,612} = 1.62$$

a/ Includes persons in group quarters, inmates of institutions and persons over 65 not in the labor force.
Source: 1970 Census of Population - Connecticut, General Social and Economic Characteristics [10].

b/ From Table 3. Source: The Northeast Rural Development Data Tape for New England Towns [8].

c/ Source: Social Indicators Profile - WACAP Service Area [5].

Figure 1a. Estimation of the employment multiplier for the Northeastern Connecticut Planning Region.
(Location Quotient Approach)

$$\text{Local employment serving persons not supported in the local labor force} = \frac{\text{Area population neither working nor supported by workers in the local labor force}^{a/}}{\text{Area population}^{c/}} \times \text{Area non-basic employment}^{b/}$$

$$\frac{6,860}{63,260} \times 11,693 = 1,268$$

$$\text{Basic employment multiplier} = \frac{\text{Total employment}^{b/} - \text{Local employment serving persons not supported in the local labor force}}{\text{Basic employment}^{b/}}$$

$$MULT^{a} = \frac{19,718 - 1,268}{8,025} = 2.30$$

Figure 2. Estimation of a population multiplier for the Northeastern Connecticut Planning Region.

$$\text{Area population multiplier} = \frac{\text{Total area population}^{c/} - \text{Area population neither working in nor supported by workers in the local labor force}^{a/}}{\text{Total area population}^{b/}}$$

$$\frac{63,260 - 6,860}{19,718} = 2.86$$

a/ Source: 1970 Census of Population - Connecticut General Social and Economic Characteristics [10].
b/ From Table 4. Source: The Northeast Rural Development Data Tape for New England Towns [8].
c/ Source: Social Indicators Profile - WACAP Service Area [5].

Table 5. Estimated Changes in Total Employment and Population for the Northeastern Connecticut Planning Region.
(Assumption - location quotient approach)

	Frito-Lay	Combined Effects from Frito-Lay and the Killingly Industrial Park			
	A	B	C	D	E
Basic Employment Change[a/]	600	1,100	1,200	1,350	1,500
Total Employment Change[b/]	811	1,520	1,682	1,925	2,168
Total Population Change[c/]	29	1,602	2,065	2,760	3,455

Table 5a. Estimated Changes in Total Employment and Population for the Northeastern Connecticut Planning Region.
(Location quotient approach)

	Frito-Lay	Combined Effects from Frito-Lay and the Killingly Industrial Park			
	A	B	C	D	E
Basic Employment Change[a/]	600	1,100	1,200	1,350	1,500
Total Employment Change[b/]	1,042	1,980	2,210	2,555	2,900
Total Population Change[c/]	235	2,917	3,575	4,562	5,548

a/ From Table 1.
b/ Includes: Total primary employment changes (assumed to be all basic) plus the secondary impacts adjusted for unemployed workers hired.
c/ For Frito-Lay: 10 management personnel x population multiplier (See Figure 2). All other situations: (Total employment change - 960 unemployed workers available) x population multiplier.

assumptions based on the results of the survey by the Northeastern Connecticut Regional Planning Agency. The survey found that 38% of the shopping by NCPR residents was done in the Town of Killingly. They also found that typically 45% of the residents work in the town in which they reside.[14/] We assumed that these characteristics will remain constant. We therefore estimate that 38% of the secondary employment changes will occur in the Town of Killingly and that 45% of the in-migrating workers will seek to reside in that town. (In this case all of the primary employment changes will occur in the Town of Killingly). The results for the NCPR displayed in Tables 5 and 5a were used to estimate similar results for the Town of Killingly. These are displayed in Tables 6 and 6a. A gross estimate of new tax revenues for the Town of Killingly is included in the final row. This was determined by multiplying the most recently available per capita tax levy for the town by the total population change in the town. This figure is obviously a gross estimate. It does not account for any changes in the tax base of the Town of Killingly which may occur. However, it provides an indication of the magnitude of anticipated changes.

lV. Summary and Conclusions

The Town of Killingly will experience substantial employment changes in the next year. The changes will come about through development of the Killingly Industrial Park and the Frito-Lay plant locating in the township. These employment changes are expected to affect not only the Town of Killingly, but also the entire trade area for the economy. This study was concerned with estimating the magnitude of the employment increases in the Town of Killingly and the trade area. It is important that local officials and planners anticipate

14/ Northeastern Connecticut Regional Planning Agency, loc. cit., pp. B12-B16, [7].

Table 6. Estimated Changes in Employment and Population for the Town of Killingly. (Assumption - location quotient approach).

	Frito-Lay	Combined Effects from Frito-Lay and the Killingly Industrial Park			
	A	B	C	D	E
Basic Employment Change[a/]	600	1,100	1,200	1,350	1,500
Total Employment Change[b/]	680	1,260	1,383	1,569	1,754
Total Population Change[c/]	13	386	544	784	1,022
New Personal Property Taxes (1977 Dollars)[d/]	3,360	99,754	140,586	202,609	264,115

Table 6a. Estimated Changes in Employment and Population for the Town of Killingly. (Location quotient approach).

	Frito-Lay	Combined Effects from Frito-Lay and the Killingly Industrial Park			
	A	B	C	D	E
Basic Employment Change[a/]	600	1,100	1,200	1,350	1,500
Total Employment Change[b/]	768	1,434	1,584	1,808	2,032
Total Population Change[c/]	13	610	803	1,091	1,380
New Personal Property Taxes (1977 Dollars)[d/]	3,360	157,642	207,519	281,947	356,633

a/ From Table 1. All primary employment changes occur in the Town of Killingly.
b/ Includes: Total primary employment changes (assumed to be all basic) plus the secondary impacts adjusted for unemployed workers hired in the Town of Killingly.
c/ Total employment change - 960 unemployed workers hired x 0.45 x 2.86 (pop. mult.).
d/ Per Capita tax levy (1977) x Population change.
Source: State of Connecticut, Information Relative to the Assessment and Collection of Taxes - 1977, pg. 155, (November 1978)[9].

the direction and magnitude of such changes in order that land use and developmental planning can be carried out more effectively.

The objectives of this study were: (1) to determine the sources of basic employment and to calculate an employment multiplier for the study area; and (2) to estimate the gross changes in total employment which will occur from the changes in basic or export employment.

An economic base model was used to develop the employment multiplier and to estimate the total changes in employment. An adjustment was made in the model for the high rate of unemployment in the Killingly area. The major source of data for the study was the Dun & Bradstreet employment survey. The Dun & Bradstreet survey provided the data for estimation of the basic and non-basic employment, and the employment multipliers. Other sources included: primary information on the changes in basic employment, a regional transportation survey, and several census publications.

Initially, central place theory was used to delineate the trade region in which the employment changes will take place. The region was determined to include those ten towns in the Northeastern Connecticut Planning Region. The basic and non-basic levels of employment were then estimated for the study area. The basic and non-basic employment levels were estimated using two different approaches and the resulting employment multipliers were calculated using the economic base model. These multipliers were applied to a range of estimated primary employment changes to obtain the expected gross changes in total area employment. (See Tables 5 and 5a).

The results obtained indicate significant changes in employment and industrial activity in the Northeastern Connecticut Planning Region. The most reliable estimate of primary employment changes in the region is that of the

Frito-Lay plant. The employment figures obtained were estimated by engineering plans for full production at the plant. The best estimate of total employment changes would be calculated using the multiplier from Figure 1 (1.62) and the primary changes associated with only the Frito-Lay plant (600). The estimated total employment change from this impact would be 811 jobs. By including development of the Killingly industrial park with the increased employment from the Frito-Lay plant the range of basic employment changes is 1100 to 1500 jobs. The actual increase in employment will depend upon the level of development in the industrial park. Using the employment multiplier of 1.62 the range of total employment changes is 1520 to 2168 jobs. The estimates represent gross changes since other changes in the industrial structure in the Northeastern Connecticut Planning Region can not be anticipated.

There are several implications associated with these estimates. Initially, we assumed that the full employment level of unemployment was approximately 4%. Economists have recently revised such estimates upward to 4.9% - 5.5%.[15/] If the full employment level of unemployment chosen was to be 5% rather than 4%, the number of unemployed workers available would fall from 960 to 650. In this case, the employment at the Frito-Lay plant will account for nearly all unemployed workers pushing the local economy to full employment. The result will be an increase in the in-migration of workers, increased population and pressure on the existing housing markets. This implies further pressures on land-use and zoning regulations in the local economy. It is thus important that the total effects from these industrial developments are scrutinized so that local officials can plan accordingly.

15/ See: Council of Economic Advisors, "Measuring and Realizing the Economics Potential," (January 1969)[3].

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[4] Eastern Connecticut Resource Conservation and Development Council; Environmental Review Team Report on the Proposed Industrial Park - Killingly, Connecticut; Norwich, Connecticut, March 1975.

[5] Hemphill, Margaret and Marjorie Murdock; Social Indicators Profile - WACAP Service Area; Windham Area Community Action Program, Inc., Danielson, Connecticut, 1977.

[6] Nelson, James R., "An Area Economic Development Impact Model for Extension Application," Southern Journal of Agricultural Economics; Vol. 10, No. 1 July 1978.

[7] Northeastern Connecticut Regional Planning Agency; Transportation Needs; Brooklyn, Connecticut, June 1976.

[8] Pennsylvania State University; Northeast Rural Development Data Tape for New England Towns; University Park, Pennsylvania, November 1978.

[9] State of Connecticut; Information Relative to the Assessment and Collection of Taxes - 1977; Public Document No. 48, Taxation Document No. 369, Hartford, Connecticut, November 1978.

[10] U.S. Bureau of the Census; 1970 Census of Population:
Detailed Characteristics, Connecticut PC(1)-B
General Population Characteristics, Connecticut PC(1)-B
General Social and Economic Characteristics, Connecticut PC(1)-C
U.S. Government Printing Office, Washington, D.C., 1972.

[11] _____; Statistical Abstract of the U.S. - 1978; 98th Edition, Washington, D.C. 1979.

APPENDIX A:

The number of firms which did not report employment in the Northeastern Connecticut Planning Region was obtained by four digit SIC code from the Dun & Bradstreet files. The average firm size for each four digit SIC industry not reporting in the NCPR was computed for Windham County and the State of Connecticut. The data used in computing these averages were also from the same data set. The average firm size for Windham County was not used due to unreported SIC industries and the small number of firms used in computing the averages. The four digit SIC industry adjustment figures were then aggregated according to the format used in Table 2 of Part III. The four digit SIC industries included in the sectors of Table 2 are as follows:

Sector	SIC Industries Included
Agriculture, forestry & fisheries	0000 - 0999
Mining	1000 - 1499
Construction	1500 - 1999
Manufacturing:	
Food & Kindred	2000 - 2199
Textile & Apparel	2200 - 2399
Furniture, Lumber & Wood Products	2400 - 2699
Printing & Publishing	2700 - 2799
Chemicals & Allied	2800 - 3299
Machinery & Metal Products	3300 - 3899
Misc. Manufacturing	3900 - 3999
Transportation	4000 - 4799
Communication & Public Utilities	4800 - 4999
Wholesale Trade	5000 - 5199
Retail Trade	5200 - 5999
Finance, Insurance & Real Estate	6000 - 6999
Services	7000 - 8999
Public Administration	9000 - 9999

Table A1. Average Firm Size for Windham County and The State of Connecticut for Those Firm Not Reporting Employment in the Northeast Planning Region.

SIC Code	# Not Reporting	Average Firm Size: Windham County	Average Firm Size: State of Conn.	Employment Adjustment
0181	1	7.0	11.4	11
0241	2	6.0	5.5	11
0251	1	2.0	10.4	10
0781	1	2.0	5.5	6
1411	1	---	15.0	15
1511	9	2.0	2.3	21
1521	5	4.5	6.2	31
1542	1	7.7	24.1	24
1611	3	7.0	14.9	45
1711	3	2.5	6.7	20
1741	1	6.0	6.1	6
1752	2	0.7	5.4	11
1761	1	5.5	6.0	6
1781	1	11.0	4.5	5
1794	2	3.9	5.5	11
2391	2	225.0	63.3	127
2426	1	10.0	10.0	10
2499	2	20.5	8.7	17
2711	1	29.0	82.1	82
2819	1	---	142.6	143
3483	1	---	789.7	790
3599	2	3.1	11.7	23
3993	1	---	9.9	10
4119	1	---	12.4	12
4212	4	3.4	8.6	34
4213	3	22.2	19.7	59
4226	1	---	8.9	9
4953	2	7.0	6.0	12
5041	1	13.0	6.3	6
5078	1	---	7.8	8
5086	1	---	10.6	11
5093	1	7.0	13.7	14
5098	1	---	23.6	24
5099	1	1.7	8.9	9
5146	1	8.0	10.1	10
5261	2	2.5	4.4	9
5411	2	8.9	9.6	19
5423	2	12.0	5.8	12
5511	1	13.3	22.3	22
5531	1	6.6	5.2	5
5541	5	3.3	4.4	22
5611	1	5.3	5.6	6
5714	1	3.0	5.2	5

Table A1. (Cont.) Average Firm Size for Windham County and The State of Connecticut for Those Firms Not Reporting Employment in the Northeast Planning Region.

SIC Code	# Not Reporting	Average Firm Size: Windham County	Average Firm Size: State of Conn.	Employment Adjustment
5722	1	3.6	4.9	5
5812	6	11.8	11.7	70
5813	1	8.8	10.0	10
5921	2	1.9	2.2	4
5941	1	2.8	3.5	4
5944	1	2.6	4.8	5
5947	1	2.9	3.7	4
5949	2	4.7	3.5	7
5983	3	5.9	7.8	23
5999	2	2.8	4.9	10
6512	2	9.0	9.3	19
6513	1	3.0	4.4	4
6519	1	---	2.5	3
6531	5	5.5	8.8	44
6553	1	---	6.6	7
6611	1	---	7.7	8
7011	1	16.7	26.3	26
7032	1	---	12.4	12
7033	1	---	5.9	6
7215	2	3.0	4.0	4
7261	2	2.9	3.5	7
7399	3	13.5	11.1	33
7623	1	1.3	3.2	3
7629	1	1.7	3.3	3
7948	1	14.0	7.8	8
7997	1	---	22.4	22
8021	1	---	3.0	3
8059	1	83.0	75.2	75
8091	1	---	83.3	83
8211	2	30.0	58.4	117
8221	1	---	895.5	896
8361	1	---	57.2	57
8661	1	30.0	14.6	15
8931	1	---	18.5	19
9999[a/]	11	---	----	--

a/ Unclassified firms which did not report.