POSSIBILITIES FOR FERTILITY IMPACT ASSESSMENT OF USAID ASSISTED PROJECTS IN THAILAND

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December, 1980

This report is financed by a grant from A.I.D. No. Otr-G-1702 to the Population Council and is based on the author's visit to Bangkok during October 20-31, 1980 at the request of USAID/Thailand.

SUMMARY AND CONCLUSIONS

Eleven development projects assisted by USAID/Thailand were reviewed during a visit (October 20-31, 1980) to Bangkok. Discussions were held with USAID/Thailand staff and the Population Council's regional staff. This report outlines some criteria for selecting development projects for Population Impact Assessment and develops a simple methodology for this purpose.

While considering population impact assessment of development projects, a distinction is made between population impact statements and population impact studies. Statement refers to the projection of potential demographic (fertility, mortality, and migration) effects of a selected project prior to its design and implementation. Study, on the other hand, refers to the measurement of actual demographic effects of a project once it has been implemented. Thus, by definition, population impact statements will have to utilize assumptions about interactions between demographic and non-demographic factors, whereas population impact studies would test and modify these assumptions, and might also generate new assumptions. The two types of work are seen as complimentary to each other.

The term population impact refers to demographic impact and, thus must include all the three components: fertility, mortality, and migration. This report, however, deals primarily with fertility. Therefore, the term population impact is replaced by fertility impact in this report.

The discussions of criteria for selecting development projects for fertility impact statements or studies are guided by the research

feasibility including availability of appropriate methodology. Development projects that meet the following criteria should be given first priority for fertility impact studies.

1. Organized to directly affect people in the geographic area covered by the project.
2. Designed to influence important social, economic, and cultural conditions.
3. Organized at the sub-national well-defined administrative or geographic units.
4. Cover an area with population of at least 30,000 - 40,000.
5. Have some research plan to evaluate the non-demographic effects of the project.

Items 3, 4, and 5 are not particularly important for fertility impact statements. Thus, development projects that meet the first two criteria listed above could also be selected for fertility impact statements.

USAID/Thailand might consider to incorporate the following two items in the design of selected development projects.

1. To add family planning performance as one of the criteria for selecting provinces or other administrative or geographic units to be included in a development project. The computations required for this purpose are illustrated in this report.

2. To strengthen delivery of services and information about family planning methods in geographic areas selected for development projects. This could be done as a part of the Expanded Population Planning Project in Thailand.

A simple methodology is developed which might be useful in projecting potential fertility impacts of selected development projects. This methodology utilizes similar information currently used in Economic and Social Soundness Analyses of USAID assisted projects in Thailand. The additional information required for fertility impact statements could be collected through baseline surveys usually conducted for Economic and Social Soundness Analyses of USAID assisted projects in Thailand. Two types of information are required for this purpose:

1. Anticipated effects of project inputs on selected key social, economic, or cultural determinants of fertility change in Thailand.

2. Estimated fertility levels prior to the implementation of the selected development project separately for various strata of the population living in the area.

This methodology is illustrated in this report by using household income as one of the important economic factors affecting fertility behavior of couples. This methodology can also be applied by using any of the social or economic factors believed to affect fertility patterns in Thailand.

The methodology for conducting fertility impact studies has to be project specific. Since no project was selected during the visit, this report includes a general discussion. Briefly, the purpose of these studies would be to estimate actual fertility change that can be attributed to specific project inputs. Experimental designs -- natural or planned -- and/or statistical controls can be used to isolate observed fertility change attributable to specific project inputs. These studies could use prospective designs for new projects, retrospective designs for completed projects,

or a combination of the two for ongoing projects. Experimental prospective designs are ideal but approaches using statistical controls might be more feasible. For a new development project, a fertility impact study using statistical controls would require information from: (a) a baseline survey, (b) monitoring of inputs provided through the selected project and other projects implemented in the geographic area covered by the selected project, and (c) a follow-up survey. A list of items which might be included in these surveys is included as an illustration. One or two projects could be selected for undertaking fertility impact studies. These studies can be undertaken by USAID/Thailand if they could be incorporated within the scope of research and evaluation studies already planned for a project. Otherwise, an outside agency might be considered.

PURPOSE OF THE VISIT

1. To review the USAID/Thailand project portfolio and to determine which new projects may lend themselves to Population Impact Assessment (PIA) studies.
2. To work with USAID staff in developing a methodology for preparing population impact statements.

STEPS IN THE PROCESS

1. Discussions with USAID/Thailand staff.
2. Framework for analysis.
3. Criteria for selection.
4. Review of Projects

- . Items included in the review
- . Brief summary of Projects reviewed

5. Tentative list of potential projects for Fertility Impact Statements or Studies.
6. Development of Methodology
   - . Review of Demographic literature for understanding key determinants of fertility change
   - . Fertility Impact Statements
   - . Fertility Impact Studies
     - Completed and ongoing projects
     - New projects
7. Discussions with USAID staff
8. Revision of the report

Next Steps

Selection of a project(s) for Population Impact Assessment.

Three development projects are to be implemented in the Northeast region of Thailand. These are the Northeast Rainfed Agriculture Development, the Northeast Small Scale Irrigation Project, and the Small Scale Hydro-electric Adaptation Project. It might be useful to consider and to develop a comparative fertility impact study involving geographic areas covered by these three projects.

LIMITATIONS

Ideally, population impact assessment should include all three components of demographic change: fertility, mortality, and migration. I have concentrated on only one component -- fertility. Mortality in Thailand has been declining and has already reached a very low level. There might be some areas with high mortality and especially high infant mortality needing attention. If such areas are covered by a development project, then its potential and actual impact on mortality can be included in the population impact studies. Otherwise, it may not be essential to include the mortality impact of development projects in Thailand. Moreover, any further decline in mortality is unlikely to affect the future course of fertility at the national level. Internal migration is important especially since many of the development projects are likely to create employment opportunities in the geographic area covered by them. If so, they would attract cheaper labor from neighboring areas especially from areas with higher unemployment and under-employment. Such potential in-migration is likely to influence the wage rate, employment, and the income of primary intended beneficiaries of the project. Such in-migration might also affect fertility patterns and quality of life in the areas covered by the project as well as in areas from which migrants would be drawn. The extent to which it might affect the stated objectives of the development project selected for population impact assessment needs to be taken into consideration. The in-migration rate can also be considered to measure the degree of success of the projects under consideration. Inclusion of migration in a population impact assessment

would require information and knowledge about the areas covered by the project as well as outside the project. Due to time constraints, this important component of population change has not been included in this report and for this reason, the term 'Population Impact' is replaced by 'Fertility Impact' in this report.

Time constraints also precluded discussions with project managers. Preliminary discussions with project managers between steps 5 and 6 would have been useful in narrowing down the options.

ANALYTICAL FRAMEWORK

The analytical framework for understanding the effects of inputs provided through a development project on fertility is shown schematically in Figure 1. This framework is based on the following assumptions:

1. Project inputs determine its output which changes existing social, economic, and cultural factors at the individual and the community level. Here, inputs include not only physical infrastructure, but also the design and implementation of a project.
2. Changes in social, cultural, or economic factors affect the demand for children.
3. The fertility effects of social, economic, and cultural factors are transmitted through one of the four important intermediate factors: marriage patterns, breastfeeding associated infecundity, use of contraception, and use of induced abortion. Thus, changes in any social, economic, or cultural

factors cannot affect fertility without affecting one or more of these intermediate factors. Fertility outcomes as well as intermediate factors can change with or without any changes in the demand for children or any change in such social, economic, or cultural factors as education, income, employment, consumption, inter- and intra-household relationships. Changes in intermediate factors could be compensatory and thus may not produce any change in fertility. For example, the fertility effect of increased use of contraception or induced abortion could be compensated by a decrease in breastfeeding associated post-partum anovulation period or a simultaneous decrease in age at marriage.

4. External factors, that is, factors outside the domain of the development project under consideration, such as conditions in a community existing prior to the introduction of the selected project and inputs provided through other projects implemented at the national or the sub-national level can modify the selected project inputs, design, implementation, and can also directly affect the social, economic, and cultural factors at the individual and the community level.
5. Some projects can directly affect intermediate variables and thus the fertility outcome. For example, a population project can directly affect the use of contraception and induced abortion by making these methods easily accessible without first changing social, economic, or cultural factors.

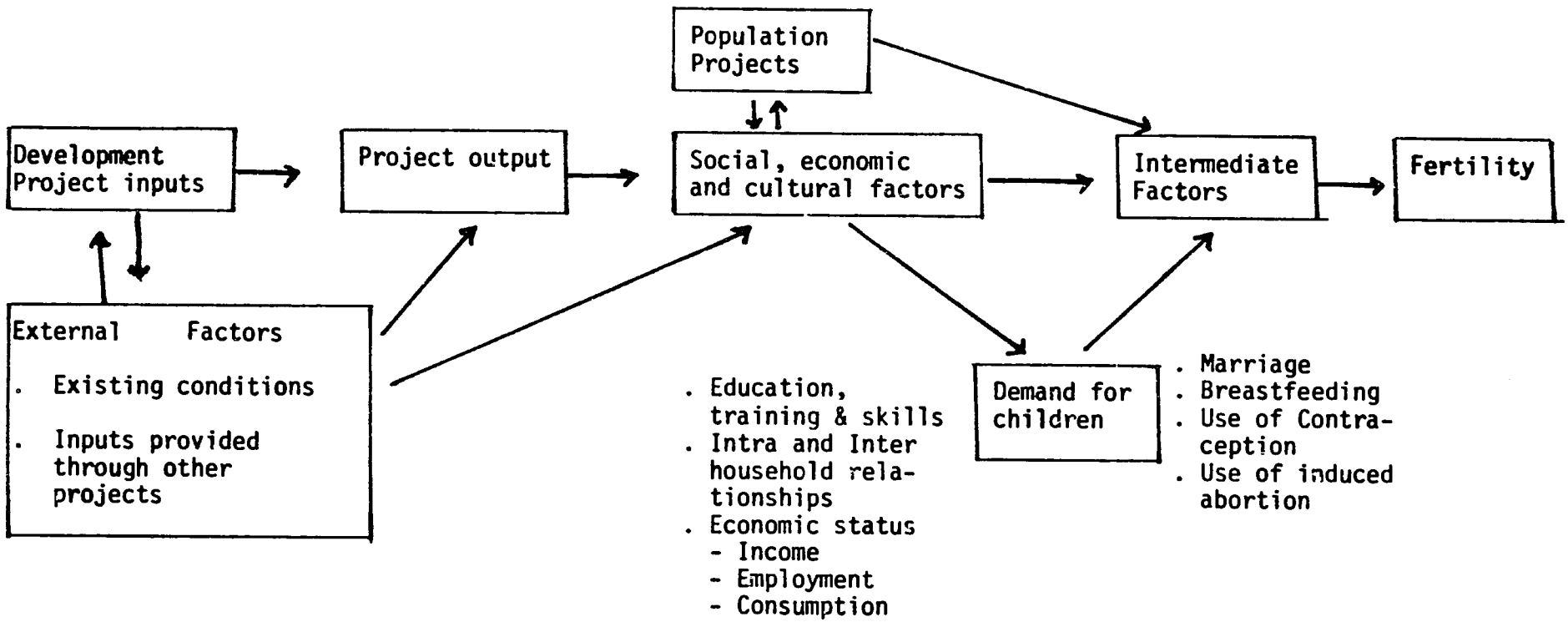

Figure 1: A Schematic Presentation of Fertility Effects of a Development Project.

CRITERIA FOR SELECTION OF PROJECTS FOR FERTILITY IMPACT ASSESSMENT

The fertility impact assessment of a development project includes two types of work: (1) fertility impact statements and (2) fertility impact studies. The fertilility impact statement refers to the projection of potential fertility effects of inputs provided through a development project. The fertility impact study, on the other hand, refers to the measurement of actual fertility change attributable to inputs provided through a development project. A similar classification can also be used for the other two components of demographic change (mortality and migration). It would be desirable to include fertility impact statements in most of the development projects and to conduct fertility impact studies for a few selected projects. But initially, it would be preferable to select a few development projects even for fertility impact statement because of inadequacies in the knowledge base and the available methodologies. There are two important criteria which can be used for selecting a project(s):

- Purpose and type of the project, and
- Feasibility of incorporating fertility impact statements or conducting fertility impact studies.

Each of these criteria can be further sub-divided into smaller components in order to be helpful in selecting projects for fertility impact statements and/or studies.

1. Purpose and Type of Project

Here, the intention is to select a project that is not too far removed from the ultimate outcome -- fertility -- and at the same time is not too close to the ultimate outcome. It is assumed that fertility impact statements will be incorporated in projects which are especially designed to affect fertility outcomes. Fertility impact studies of many such projects have been done since early 1960s and as such they fall into a separate category. On the other hand, if the project is too far removed from fertility, it would be very difficult to project or evaluate its fertility impact because many intervening steps and linkages cannot be identified.

Thus, it will be useful to initially select projects that are organized to directly affect people in a geographic area. This will exclude those projects which transmit benefits to people primarily through subgrants to other organizations or through training of civil servants. The benefits of such projects at the individual family level would be diluted or the time frame during which such benefits are likely to accrue is usually extended.

To further narrow the selection process, it would be useful to concentrate on those projects that are especially designed to influence those social, economic, and cultural factors that are believed to influence the fertility behavior of couples.

2. Feasibility

The political, administrative, and research feasibility of undertaking fertility impact statements or studies has to be carefully assessed

before selecting a project for this purpose. Geographic area, population size, duration of project, and plans for evaluation of non-demographic effects, (for example, the economic effects of a project at the household level) are some of the items that can be considered in assessing the research feasibility especially of designing a prospective study to evaluate the fertility effects of the project.

a. Geographic Coverage: National vs. Sub-national

Some projects are organized at the national level and others at the sub-national level. It is preferable to select projects organized at the sub-national level in a well defined geographic area, because the identification of developmental inputs and their effects on changes in demographic behavior may be more feasible in smaller administrative units. Projects organized at the national level and the area covered by such projects are usually very large and it may be very difficult to link specific inputs to the potential or actual benefits at the individual family level.

b. Population of the Area Covered by the Project

It will be useful to select projects that cover geographic areas with population of at least 30,000 to 40,000 people. Assuming a birth rate of about 30 per 1,000 population, such projects will provide a reasonable population base to detect non-random changes in fertility. For projects which cover geographic areas with 5 to 10,000 people it may not be feasible to separate changes in the birth rate attributable to project inputs from changes in the birth rate due to random fluctuations or due to deficiencies in data collection.

c. Duration of the Project

It will be useful to select projects of about 5 years of duration. The process from project inputs to changes in fertility is likely to take several years. Thus it may not be feasible to detect fertility changes for projects of short duration. Long drawn projects, on the other hand, usually lose the interest of donor agencies as well as of implementing agencies because of changes in personnel, attitudes, and priorities. Five years appear to provide a reasonable balance between the two. If fertility impact studies can be incorporated in the regular research and evaluation plan of the project, a longer duration may be feasible.

d. Research and Evaluation Plan

It will be useful to select projects which incorporate research plans to evaluate their intended or direct effects on people's economic levels. This will make it more feasible to extend the evaluation plan to incorporate fertility as one of its dimensions.

In sum, first priority should be given to those development projects that meet the following criteria:

1. Organized to directly affect people in the geographic area covered by the project.
2. Designed to influence important social, economic, and cultural conditions.
3. Organized at the sub-national well-defined administrative or geographic units.
4. Cover an area with population of at least 30,000 - 40,000.

5. Have some research plan to evaluate the non-demographic effects of the project.

Items 3, 4, and 5 are particularly important for fertility impact studies. Thus, development project that meet the first two criteria may also be selected for fertility impact statements.

REVIEW OF USAID ASSISTED PROJECTS IN THAILAND

In all, 11 projects were reviewed. Information was obtained from three types of documents: Congressional Presentation: Fiscal Year 1981 (FY 81), Project Identification Documents (PID), and Project Papers. A brief summary of these projects is included in Table 1. The following items were included in this review:

- Purpose
- Geographic coverage
- Population covered
- Cost
- Input
- Output
- Beneficiaries
- Type of benefits
- Timing and duration of the project
- Role of women
- Research and evaluation studies

Project numbers 1, 2, 3, 4, and 11 do not lend themselves to fertility impact statements or studies. Ultimate beneficiaries in all these

Table 1: A Brief Summary Review of USAID/Thailand Project Portfolio

Project	Purpose-Objective	Geographic Coverage	Population Covered	Cost $ (M)	Input	Output	Beneficiaries	Type of Benefits	Potential Candidates for Population Impact
1. PVO Co-Financing Project 493-0296 1981-85 FY 81	To provide support for the development activities of U.S. and Thai Private and Voluntary Organizations (PVOS) in their efforts to assist low income groups to improve their social and economic status	Rural		5.0 G	27 sub-projects Food production, nutrition, allied rural development activities & human resource development		200,000 primarily rural poor people		No
2. Provincial planning and development 493-0315 1980-84 5 Years PID 80	To strengthen the ability of provincial and local government, with the involvement of rural communities, to plan the use of and administer development resources for the benefit of low-income households.	4-6 Provinces 500 villages	500,000	7.0 L 3.0 G 7.5 RTG 17.5	·Training 1.7 ·Technical Assistance1.5 ·Equipment .7 ·Studies & Evaluation .3 ·Rural Development Projects 12.0 500 village level rural works & occupational promotion projects		500+ civil servants 500,000 rural people	Upgraded skills Economic	No
3. Emerging problems of Development 493-0309 1980-85 5 Years FY 81	To facilitate planning & implementation of policies and programs designed to address emerging development problems.	National		4.0 G 1.25RTG 5.25	·Training ·Technical Assistants ·Seminar & Conferences ·Special Studies	2000 pm 200 pm 10 10	Those rural poor people who will receive more effective government programs & services	1.Greater decentralization of public services 2.Check widespread deforestation 3.To distribute new industrial investment 4.Strengthen Thai agricultural cooperatives 5.To facilitate land reform.	No

Project	Purpose-Objective	Geographic Coverage	Population Covered	Cost $ (M)	Input	Output	Beneficiaries	Type of Benefits	Potential Candidates for Population Impact
4. Seed Development II 493- 1982-85 4 Years PID 82	To produce, process, and distribute high quality improved seed of Thailand most important food crops leading to expanded market demand and larger private sector seed industry investments.	National		3.6 L 1.7 G 10.3 RTG 15.6	-Technical Assistance .65 -Training 1.25 -Evaluation 1.50 -Fix assets 3.65 -Working Capital Fund 7.30		All farmers Seed industry Low-income farmers who will receive seeds through the government programs.	Increase in -Yield -household income -Farm-employment	No
5. Small Scale Hydro-electric Adaptation 493-0324 1982-85 4 Years PID 82	It will seek to determine the optimum investment mix for small scale hydro-electric systems. · Adaptation of Technology Different mix of · Equipment · Management Systems-cooperatives, quasi-cooperatives, existing electricity supply authorities			6.235 L 1.925 G 4.680RTG 12.840	-Technical 1.375 -Training .375 -Equipment & Material 1.95 -Construction 5.00 -Extension services .30 -Surveys .50 -Evaluation .70	2 U.S.hydro-electric hardware to replace diesel generation (100-500Kw) 4 Local hydro installation (30-200Kw) 1500 KW with a load faster of 50% Local user cooperatives	37,000 Thai Farm families others Issue Electricity might be used principally by the upper income groups for domestic purposes	Access to electricity or reduction in price-shift from diesel generated power to hydro electric power. Farm productivity increase in employment	Yes

Project	Purpose-Objective	Geographic Coverage	Population Covered	Cost $ (M)	Input	Output	Beneficiaries	Type of Benefits	Potential Candidates for Population Impact
6. MAE CHAEM Watershed Development Project 493-0294 1980-84 5 Years Project Paper	To increase real income & access to social services of the rural poor in the Mae Cham Watershed while restoring and maintaining important environmental attribute of the watershed.	MAE CHAEM District in Chiang Mai Province in North Region. 7 Tambon	40,000	10.0 G 11.0RTG 21.0 B/C=1.30 IRR=16% No increase in cash crop B/C=.66 IRR=8%	·Equipment & commodities 1.431 ·Technical assistant .86 ·Operation units .845 ·1F teams 1.188 ·RTG staff support 2.896 ·Construction 6.474 ·Watershed maintenance .589 ·Evaluation/ research .300 ·Credit 1.250	55 Trained Interface teams (3 persons/ team) ·Water-works 102 ·Rice Bank 55 ·Rehabilitation of road 100km ·Land Development 20,750 rai	40,000 & especially Poor People (30,000)	·Increase in land utilization from 85% to 100% ·Increase in annual yield of rice by 6% ·Second cropping from 30% to 45% of wet-rice land ·Increase in cash crop by 10-30%.	Yes
7. NE Rainfed Agricultural Development Project 493-0308 1981-86 6 Years PID 80 & Consultant Report	To improve the agricultural productivity and hence the livelihood, of low-income farm families in areas not included within the service zones of major irrigation projects.	2 districts in each of the three provinces in northeast region. Sisaket Roi Et Chaiyaphum	200,000 30,000 families	6.3 L 3.7 G 8.6RTG 18.6	·Infrastructure & equipment 7.2 ·Agriculture promotion 6.0 ·Training 1.6 ·Technical assistance 1.5 ·Studies Feasibility .5 ·Evaluation .3	200 small land water resource development. ·Development of new rainfed technology package ·Adoption of new rainfed technology.	30,000 farm families. 200,000 people.	·Increase in farm family income to above poverty line. Increase utilization of available land and family labor. Land development Soil fertility Identification & expansion of market outlets.	Yes

Project	Purpose-Objective	Geographic Coverage	Population Covered	Cost $ (M)	Input	Output	Beneficiaries	Type of Benefits	Potential Candidates for Population Impact
8. Northeast Small Scale Irrigation 493-0312 1980- 6 Years Project Paper	To establish a replicable approach and the necessary institutional capabilities for increasing agricultural incomes for the rural poor in Northeast Thailand.	Northeast Rural 7 sites	4600 h.h.	5.8 L 2.8 G 8.35RTG 16.95 ·Average EIRR 31.41 (20.38-46.85) ·B/C Ratio to farmer 1.46-2.63	·Construction rehabilitation 7.01 ·O & M of Dams and main systems .565 ·RTG staff support .520 ·Technical support 2.070 ·Grant support .400 ·Evaluation .100	·Water delivery infrastructure ·Access 10+M Roads ·Irrigation service centers ·Water management system & organization ·Agriculture support services 7 medium-scale Irrigation Tanks	35,000-40,000 People 55% of the h.h. are poor	·Increase in crop area by 100% to 14,000 hectors ·Increase in cropping intensity 125% ·40% increase in net farm income to about $1,300/h.h. ·Increase in crop area (dry season) from 1,500 to 5,330 hecters ·Increase in employment.	Yes
9. Rural Water and Sanitation	To increase the availability and use of clean (potable) water & sanitary laterines in approximately 300 villages in Northeast.	Northeast Rural 300 villages ·Willing to make a significant contribution in cash or kind to the costs of installation ·Prepared to make a serious commitment to expanding the availability and use of sanitary lattrines and making other sanitary improvements	300,000	6.0 L 1.5 G 7.9 RTG 15.4	·Water supply .300 ·Training & technical assistance .6 ·Field testing.5 ·Financing of small piped water system 8.4 ·Diesel installation of nonpiped water system2.8 ·Sanitation ·Training .9 ·Latrine installation1.9 ·Field testing.3	new piped water systems in villages of less than 2,000 population.	300,000	·Reduction in Diarrhea skin disease Malnutrition ·Increase in household income from animal raising, vegetable gardening, & production of handicrafts	Yes

Project	Purpose-Objective	Geographic Coverage	Population Covered	Cost $ (M)	Input	Output	Beneficiaries	Type of Benefits	Potential Candidates for Population Impact
10. Grassroots action in Nutrition Project 1982-84 3 Years PID 82	To make significant reduction in first, second and third degree malnutrition among infants and pre-school children in northeast	Northeast 16 Provinces 500 villages for experimental strategy		5.6 G 4.7 RTG 9.7	Nutrition edu. 1.2 Village level workers .7 National level nutrition policy .3 Private Sector involvement .5 Supplementary food production private sector .7 village level 2.4 Research .7 Provincial level training .9 RTG staff 2.0	·Growth chart ·Availability of oral rehydration salt in every village ·Village food production units in 500 villages ·Commercial development of supplementary food.	1.2 million children Province Normal 40% 1 42 2 15 3 3 Villages	25% reduction in malnutrition 25% reduction in first degree 50% in second degree Eliminate third degree	Yes
11. Expanded Population Planning Project 1982-84 3 Years PID 82	a. To assist the RTG in its efforts to make comprehensive family planning and information and services available to those who want and need such services; b. To strengthen the RTG capability to assess the determinants and consequences of high fertility.	National ·Low performance provinces (18 out 72; CU 30%) ·Low income rural population	47 million BR 29.9 DR 7.9 GR 2.2 CU 50%	8.0 G 11.05 RTG 18.05	·Intensified services/community Based Delivery Services 3.7 ·Experiments evaluation .8 ·Training ANM 1.1 ·IE & C 3.7 ·Commodities 5.5 ·Pop.&Dev. .3 ·Voluntary surgical contraception 4.3		Six million new and continued acceptors National	·Improved maternal & child health resulting from fewer high parity children & longer birth interval ·Increased per capita income, food supply, disposable income & opportunity to make qualitative investments in children ·Reduced public expenditures for services such as health, education, transportation, water, housing.	No

cases are people but in the first four cases there are likely to be many unknown links between project inputs and ultimate benefits to the people. These unknowns and the geographic coverage of these projects would make it very difficult either to quantify their fertility impacts in advance or to design studies to prospectively evaluate their fertility impacts. The last project -- the expanded poulation project -- is specially designed to affect fertility patterns by increasing the use of contraception throughout the country and especially in the low performance provinces. Due to its nature and geographic coverage, this project is also not included in the list of selected projects. Presumably the potential fertility effect of this project would be assessed anyway.

The following list includes the remaining six projects that may lend themselves to fertility impact statements or studies. The feasibility of doing fertility impact statements, or initiating studies to evaluate their fertility impacts has not been carefully assessed. This can best be done in consultation with USAID staff and implementing agencies.

No. (See Table 1)	Project
5	Small-scale hydro electric adaptation
6	Mae Cham Watershed Development Project
7	Northeast Rainfed Agriculture Development
8	Northeast Small Scale Irrigation Project
9	Rural Water and Sanitation Project
10	Grassroots Action in Nutrition Project

Development projects can be grouped into the following categories depending upon their nature and primary inputs.

- Agriculture
  - Irrigation
  - Non-Irrigation
- Non-Agriculture
- Infrastructure
  - Electrification
  - Roads
- Social Services
  - Education
  - Water and Sanitation
  - Health and Nutrition
  - Contraception/abortion/sterilization

As mentioned earlier, a distinction is made between fertility impact statement and fertility study. The statement refers to the work done before implementing a development project and, thus, by definition, it refers to the projection of potential effects on fertility. In comparison, the study refers to the measurement of actual effects on fertility attributable to project inputs. The measurements of actual fertility effects of a development project can be done prospectively, if the project has not yet started or it can be done retrospectively, if the project has been completed. A combination of the two designs can be used for ongoing projects. Thus, the timing of the project will determine the type of

fertility impact statement or study and the type of design used for conducting the study.

. Fertility Impact Statement

Projection of potential effect, to be prepared along with the Project Paper

. Fertility Impact Study

- Completed Projects (Retrospective)
- Ongoing Projects
- New Projects (Prospective)

The following table shows potential projects that might lend themselves to fertility impact assessment by type of project and type of fertility impact assessment.

Type of Project	Fertility Impact Statement	Fertility Impact Study		
		Completed (Retrospective)	On-going Projects	New Projects (Prospective)
. Agriculture				
- Irrigation			. Small Scale Irrigation . Water Shed Development	
- Non Irrigation	. NERAD			. NERAD
. Non Agriculture				
. Infrastructure - Electricity	. Small Scale hydro-electric			. Small Scale hydro-electric
. Social Services	. Rural Water & Sanitation . Nutrition			. Rural Water & Sanitation . Nutrition

Some cells in the above table are empty because none of the projects included in the tentative list fall into these cells. Fertility impact statements or studies for non-agricultural projects can be considered if USAID/Thailand develops such projects in the future. Projects that have been completed will have to be reviewed to decide about the feasibility of conducting retrospective studies.

METHODOLOGY

As mentioned earlier, the fertility impact statement refers to the projection of potential effect of a development project on fertility whereas the fertility impact study refers to the measurement of the actual fertility effect of that development project. The projection of potential fertility effect of a development project prior to its implementation, by definition, will have to use certain assumptions about interrelationships between fertility, other demographic, and non-demographic factors. Initially, these assumptions will have to utilize existing knowledge and then they can be improved and tested empirically while measuring the actual fertility effects of that development project.

In general, three steps are required to project potential fertility effects of a development project:

1. to identify key social, economic, and cultural determinants of fertility behavior or fertility change;

2. to anticipate or estimate the potential effects of project inputs/outputs on these selected key determinants of fertility change; and

3. to anticipate or estimate the potential effects of project inputs/outputs on fertility behavior or fertility change.

The methodology for fertility impact studies has to be project specific. Since, no development project was actually selected for this purpose, a brief description of general methodology is included as an illustration. The purpose of fertility impact studies would be to document and estimate actual fertility changes attributable to project inputs. This can be done by using experimental designs -- natural or planned -- and/or statistical controls. The studies could be prospective, or retrospective or a combination of the two.

This section is divided into three sub-sections. The first sub-section presents a brief review of key determinants of fertility change in Thailand, the second develops a simple methodology for fertility impact statements, and the third briefly describes various methods for fertility impact studies.

KEY DETERMINANTS OF FERTILITY IN THAILAND

A detailed review of the demographic literature is necessary to identify key social, economic, and cultural determinants of fertility change in Thailand. This can be done by demographers who are familiar with the demographic situation in Thailand. Two possible outcomes of such a review are the following.

1. The use of contraception is the important proximate determinant of fertility change in Thailand since 1970, and other factors such as education, mortality, income, expenditure, and employment are not important

determinants of fertility change. If so, expanding the availability of contraceptive methods is likely to be the most important determinant of fertility change in the future.

2. The availability of contraceptive methods might be the most important determinant of fertility change in the short-term, for example, during 1981-85. But beyond 1985 or from the long-term perspective, changes in such factors as mortality, education, employment, income, and expenditure are likely to be important for continuous fertility decline because changes in these factors are likely to affect the demand for contraceptive services.

A brief review presented below suggests that in addition to family planning program efforts, which started in 1965 when the first family planning clinic was opened in Bangkok, some other conditions in Thai society were favorable to low fertility and might have contributed to the decline in the birth rate observed since 1970.

Mortality

A brief review indicates that the death rate in Thailand has been declining and has reached a low level of about 8-9 in the mid-1970s. A further decline in the death rate is unlikely to have any substantial effect on the birth rate but would affect the rate of natural growth. To better understand the role of mortality decline, decenniel average birth rates and death rates are shown in the following Table.

The numbers shown below depict a typical demographic transition. The birth rate fluctuated between the 1920s and early 1960s with some decline, but the death rate during this period registered a dramatic decline

Decade	Average Birth Rate per 1,000	Average Death Rate per 1,000	Average Rate of Natural Increase (%)
1920-29	49.4	28.3	2.11
1930-39	47.6	25.1	2.25
1940-49	40.6	20.7	1.99
1950-59	44.9	13.8	3.11
1960-69	41.4	10.7	3.07
(Source: ESCAP country monograph quoted in Cochrane, S. 1979. World Bank Staff Paper No. 337, "The Population of Thailand: Its Growth and Welfare.")			
Early 1960s	43-46	10-11	3.2-3.4
By 1970	36-38		2.6-2.9
By 1975	32-36	8-9	2.3-2.6
(Source: NAS Panel Report on Thailand)			

from about 28 in the 1920s to 10-11 in the 1960s. Consequently, the growth rate increased from about 2.1 percent in the 1920s to about 3.2 - 3.4 percent in the early 1960s. Although there is some indication of an acceleration in fertility decline in the early 1970s, "it can not be concluded with confidence that the rate of decline accelerated in the early 1970s" (NAS Panel Report). Nevertheless, the birth rate has declined significantly since the early 1960s and the death rate at that time had reached to quite a low level. A low death rate of 10-11 per 1,000 in the

early 1960s is quite likely to be an important factor contributing to the fertility decline since the early 1960s observed in Thailand.

Education of Women

A brief review indicates that:

. There has been a rapid expansion in education in the recent past reflecting a shift in the education distribution of women.

. Fertility has been declining in all education groups.

Nevertheless, expected family size (actual number of children born plus additional number desired) is estimated to be 4.12 in 1975 and 3.78 in 1978/79. Similar numbers by women's education and place of residence are shown below:

Education (Year)	Rural		Urban	
	SOFT 1975	CPS 78/79	SOFT 75	CPS 78/79
0-3	4.4	4.1	4.1	3.6
4	4.2	3.8	3.6	3.3
5+	3.4	3.4	3.1	2.8
Total	4.20	3.88	3.62	3.29

Source: Knodel, Debavalya and Kamnuansipla; 1980; "Thailand's Continuing Fertility Decline."

Birth order statistics also suggest that there has been a decline in the percentage of all births that are of fourth or higher parity; the decline is from about 40 percent in 1970 to 33 percent in 1975 (NAS Report).

The figures presented above suggest that a further decline in overall fertility would depend upon the decline in fertility of women in all education groups especially upon the extent of decline in percent of fourth and higher order births. However, shifts in education distribution of women in the reproductive ages could also have a non-trivial effect on fertility changes during the coming years. Of course, the magnitude of fertility change attributable to changes in the education distribution of women will depend upon changes in the education distribution. These points are further illustrated in Appendix 1 by using data from Taiwan.

Since there is no education project in the USAID portfolio, the above discussion is not directly relevant except that changes in education distribution and education specific fertility needs to be monitored in order to decompose actual changes in fertility attributable to project inputs and to external factors.

Role of Women

A brief review of the role and status of women in Thai society suggest that:

. about 45% of the labor force consists of women,

. women are employed as unskilled labor, raising animals, in farming, or in part-time jobs,

. care for silkworms, spinning, and weaving are women's jobs whereas cutting of timber and throwing fish nets, are men's jobs,

. there are, with few exceptions, no cultural sanctions or religious sanctions against interchange of sexual roles and functions,

. there is a high societal expectation that women generate and contribute to household income,

. women's status within the family is high in comparison to other Asian societies, and

. women control resources, consumption, expenditure, and savings related decisions within the household.

These observations suggest that women's access to and control over family resources and their relatively high status might be one of the key determinants of fertility behavior. Of course, there has been no significant improvement in their roles and status since the early 1960s and, thus, any fertility decline since that time cannot be attributed to improvements in women's role and status. However, it also implies that conditions during this period were favorable to low fertility as far as women's role and status is concerned. Women's access to and control over resources must have contributed to their power in decisions about family size and investments in the next generation through education, health, and nutrition. If so, and to the extent new development projects would strengthen and enhance women's role and status, these projects would contribute to further and continuous decline in fertility. On the other hand, if the new development projects adversely affect women's role and status and especially their access to and control of resources, these projects might have an adverse

effect on future fertility behavior. A brief review of the section on the role of women included in the project documents, is presented below:

A Review of the Role of Women Section Included in Project Documents

1. PVO Co-Financing Project

Information about its affect on roles of women was not available.

2. Provincial Planning and Development

In general, efforts to increase economic activity, raise incomes, and involve local people in project planning is expected to benefit men and women on a relatively equal basis.

There are, with few exceptions, no cultural sanctions against an interchange of sexual roles and functions in the northeast. There are a few work tasks exclusively reserved for either male or female members of the family. For example,

Men - cutting of timber, throwing fish nets;

Women - care of silk worms, spinning, weaving.

3. Emerging Problems of Development

Information about its affect on roles of women was not available.

4. Seed Development II

Women will benefit primarily from the improved economic conditions of the farm family resulting from project-induced yield increases. Men and women are usually eligible to obtain contracts for seed production, to purchase seed, etc.

The project presently uses women contract farmers.

25% of the officers currently employed are women.

Women will benefit from increases in rural farm employment.

5. Small Scale Hydro-electric Adaptation

Women constitute 45% of the labor force in Thailand. They are involved as unskilled labor, heavy labor, raising animals, farming, various part-time jobs. Electricity will benefit women, who play a key role in the rural household, in various ways:

. crop drying

. pumping of water for domestic and irrigation use

. sense of security

. better health care

. preventive sanitary protection

. better education

6. MAE CHAEM

. IF (Inter Face) teams will include one woman per team.

. Women will benefit as much as men.

. Women will be encouraged to suggest topics for training to IF teams.

. Women will be included in health and literacy training along with men.

. Land and water improvements will benefit entire household and in some cases will benefit women more than men.

  - increase availability of rice for consumption
  - reduction in work for weeding.

. Cash cropping.

. IF teams should encourage joint plots or separate plots for women.

7. NERAD

Project's emphasis on increasing the utilization of household labor should promote greater involvement of women in farm economic activity including field tasks at peak periods of labor requirements, supplemental on farm activities such as horticulture and animal care, basic food processing and preparation and marketing.

8. Northeast Small Scale Irrigation

Women will benefit on a roughly equal basis with men, but special efforts should be made to promote their participation in irrigator's associations.

9. Water and Sanitation

Women are the primary haulers of water in Thailand. As a result of this project women will not be required to spend long difficult hours engaged in carrying water. The increased time available will permit them to engage in more productive activities such as animal raising, vegetable gardening, handicrafts.

10. Grass-roots action in Nutrition Project

Will benefit women in Northeast by improving nutrition status of:

. Pre-natal and post-partum mothers.

. Infants and pre-school children which will reduce nutrition-related illness and thus will reduce women's burden and increase their participation in economic activities.

11. Expanded Population Planning Project

Women bear the major burden of child bearing, both in terms of health, child bearing responsibilities, and opportunities foregone. By enabling couples to choose the number and timing of their children, women will have increased opportunities to seek employment outside the home. In addition to augmenting family income, this activity may also enhance the status of women.

The review presented above indicates that the development projects reviewed here are unlikely to affect women adversely and that women are likely to benefit equally from these projects. Any further analysis would require detailed information about type of work women usually do in the agriculture and non-agriculture sectors of the rural economy and would also require a detailed understanding of how new development projects would affect women-type jobs, interchange between men and women, upgrading of women's skills, their involvement in cooperatives, and their control over new land. As the review presented above indicates, special efforts are planned to incorporate women in cooperatives, joint or independent ownership of land, and in training programs. The extent to which these planned activities would be carried out and would enhance women's status cannot be determined at this stage but is to be evaluated in the future.

Intermediate Variables

As was indicated earlier, fertility outcomes are functions of four intermediate or proximate factors:

. Marriage patterns

. Breastfeeding

. Use of contraception

. Use of induced abortion

Age at marriage in Thailand is quite high; it is estimated to be around 21-22 years and it has not changed since 1960. Thus changes in fertility, since 1960, cannot be attributed to increases in age at marriage. However, differences in age at marriage between regions, between provinces, and between other administrative units (for example, lower age at marriage in the Northeast), might imply that a much higher contraceptive use would be required to bring down the total fertility in that region. Regional differences in the projected proportion married in the 15-19 and 20-24 year age groups suggests that age at marriage might be lower in the Northeast.

	Percent Married				
Age	Kingdom	North	Northeast	Central	South
15-19	25.1	25.8	33.8	27.9	16.0
20-24	60.0	64.5	73.0	62.6	42.1

Source: 1.5 % feasibility study

Changes in the use of contraception alone cannot adequately predict changes in fertility levels without considering the fertility effects of changes in other proximate factors. Predicting fertility decline from increased use of contraception could especially be problematic if use of contraception overlaps with the period of postpartum amenorrhea associated with prolonged breastfeeding or if the increase in use of contraception is

accompanied by a decrease in the breastfeeding associated with postpartum amenorrhea period. A simple model developed by Bongaarts (1978) is applied below to illustrate this point.*

According to this model, the total fertility rate (TFR) can be decomposed in four indices measuring the effect of the four fertilty inhibiting factors mentioned above and total fecundity (TF). Here, total fecundity is the average number of children women will theoretically have in the absence of these four fertility inhibiting factors. This number (TF) usually equals about 15.3 children.

$$TFR = C_m \times C_c \times C_a \times C_i \times TF \quad \ldots \quad (1)$$

The value of these four indices for Thailand can be estimated as follows:

1. Fertility effect of marriage is measured by C_m:

$$C_m = \frac{\text{Total Marital Fertility}}{\text{Total Fertility}}$$

In 1975, the total fertility rate in Thailand was estimated to be 4.85 according to the Survey of Fertility in Thailand (SOFT, 1975). The total marital fertility rate estimated from the age-specific fertility rate and the age-specific proportion of currently married women in 1975 is 7.96.

Thus, $C_m = \frac{7.96}{4.85} = .609$

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* Bongaarts, John. "A Framework for Analyzing the Proximate Determinants of Fertility." Population and Development Review, 4 (1): 105-132. 1978.

2. Fertility effect of the use of contraception is measured by C_c:

$$C_c = 1 - 1.08\ U\ e$$

Here, 1.08 is a constant; U is the average percent of current users of contraception, and e is its average effectiveness. In 1975, the average percent of current users was 40% (average of age specific rates), the average effectiveness of pills, sterilization, etc., is assumed to be equal to .98. Thus,

$$C_c = 1 - 1.08 \times .4 \times .98 = .577$$

3. Fertility effect of induced abortion is measured by C_a. The incidence of induced abortion in Thailand is assumed to be zero for illustrative purposes, that is, C_a is assumed to be one.

4. Fertility effect of breastfeeding is measured by C_i:

$$C_i = \frac{20}{18.5 + i}$$

Here, i is the average months of postpartum amenorrhea. In the absence of breastfeeding i equals 1.5 and, therefore, C_i equals one.

In Thailand, the average duration of breastfeeding was estimated to be 20.9 months in rural and 9.7 months in urban areas (Knodel and Debavalya. 1980)*. From these figures an overall average for Thailand can

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* Knodel, John and Nibhon Debavalya. Trends and Differentials in Breastfeeding in Thailand: An Analysis of Survey Data 1969-79. Institute Population Studies. Chulalongkorn University, Paper No. 36. 1980.

be estimated to be about 19 months. This duration of breastfeeding can be estimated to be associated with about 9 months of postpartum amenorrhea. Thus,

$$C_i = \frac{20}{18.5 + i} = \frac{20}{18.5 + 9.0} = \frac{20}{27.5} = .727$$

In the absence of induced abortion, the estimated total fertility rate from equation (1) would be:

$$TFR = .609 \times .577 \times .727 \times 15.3 = 3.91$$

This estimate of TFR is much lower than 4.85 estimated by the Survey of Fertility in Thailand, (SOFT), for 1975. A total fertility rate of 4.85 would imply a total fecundity of 19.0 children which is much higher than the normal range. Inclusion of abortion will further increase the discrepancy observed.

A possible explanation of these discrepancies could be an over-estimation of individual fertility inhibiting effects of marriage, contraception, and breastfeding or some overlap between the use of contraception and the period of postpartum amenorrhea. Two alternatives are shown below:

a. An implied estimate of the effect of breastfeeding which will be consistent with the values of other indices in equation (1) can be obtained as follows:

$$4.85 = .609 \times .577 \times C_i \times 15.3$$

$$\text{or } C_i = \frac{20}{18.5 + i}, \text{ or } i = -0.5 \text{ months}$$

This estimate of i implies that prolonged breastfeeding (i.e., an average of 19 months) in Thailand has no effect on postpartum amenorrhea. This might be possible if supplementary feeding is introduced very early (reported to be one week after childbirth in some parts of Thailand). If so, it will reduce the frequency and intensity of suckling - a mechanism believed to suppress ovulation.

b. An implied estimate of the effect of contraception which will be consistent with the estimate of other indices can be obtained from equation (1) as follows:

$$4.85 = .609 \times C_c \times .727 \times 15.3$$

or, $C_c = .716 = 1 - 1.08\ Ue$

or, $Ue = .263$

That is, either U = 26.8 (if e = .98) or,

e = .658 (if u = .40). A combination of the two is more likely.

The brief review of key determinants of fertility change in Thailand can be summarized as follows:

1. There is a strong empirical evidence to suggest that increased use of contraception has been the primary determinant of fertility decline since the early 1970s.

2. Conditions prior to 1970s were favorable to fertility decline e.g. fertility had started declining in the early 1960s, the death rate had reached a low level of 10-11 per 1,000 population, the average age at marriage had been relatively high, there has been an expansion in the education system, and the status of women within their families has been high relative to other Asian societies. There has been no significant change in

these factors but their potential contributions to the fertility decline since 1970 cannot be ignored.

The delivery of services and information about contraception need to be enlarged and strengthened especially in the low performance areas. At the same time, fertility impact studies need to be initiated to better understand determinants of fertility changes and to contribute to fertility decline in Thailand.

Expansion of family planning delivery is the primary responsibility of the Expanded Population Project in Thailand. But USAID/Thailand might consider two items described below for selected development projects.

A. Add family planning performance and/or change among the criteria for selecting geographic units for a development project.

Whether or not the geographic units finally selected would be different if family planning performance is included among the criteria for selection is an empirical question. But the inclusion of family planning performance among the criteria for selecting geographic units for a development project will provide some visibility to family planning related concerns. An application of a simple methodology to include family planning performance among the criteria for selecting geographic units for a development project is illustrated below.

In the Northeast Rainfed Agricultural Development Project (NERAD), the following criteria were used for selecting provinces:

- per capita income,
- rate of growth of per capita income during 1970-76 in constant prices,
- rate of growth in paddy yield (per rai planted) during 1963-1977,
- paddy risk as indicated by the ratio of the standard deviation of annual yields to average yield over the period 1963-1977, and
- proximity to primary agricultural research stations in the Northeast.

Fifteen provinces in the Northeast region were ranked from highest (1) to lowest (15) for per capita income, rate of growth of per capita income, and paddy yield. They were ranked from lowest (1) to highest (15) on the measure of paddy risk. The unweighted sums of these ranks, denoted by "Indicator Sums," were used to initially select four provinces. By using access to a research station, three provinces were selected. These are: Si Sa Ket, Roi Et, and Chaiyaphum. Roi Et was high on "Indicator Sum" as well as having a + on the access to research; Si Sa Ket was high on "Indicator Sum" but had a - on the access to research; Chaiyaphum was low on "Indicator Sum," with a - on the access to research but had the lowest rate of precipitation.

Table 2 shows the steps required for calculating "Indicator Sum" for 15 provinces in the Northeast region of Thailand with and without % active users of family planning methods in September 1979. Columns (1) to (5) show the calculation of "Indicator Sum" without family planning

Table 2 : Calculation of "Indicator Sum" for Ranking and Selecting Provinces in Northeast Region in Thailand

Province	Ranks of Provinces Based on				Original Indicator Sum (5)=(1)+(2)+(3)+(4)	Ranks based on % Users of Contraception Sep. 1979 (6)	Revised "Indicator Sum" (7) = (5) + (6)	Ranking of Provinces*	
	Per Capita income (1)	Income Growth rate (2)	Paddy Yield (3)	Paddy Risk (4)				Without Fam. Planning (8)	With Fam. Planning (9)
Nongkhai	1	1	6	11	19	6	25	13	13
Korat	2	9	9	7	27	2	29	8	11
Udon	3	4	4	5	16	8	24	14	14
Sakhon Nakhon	4	3	4	1	12	3	15	15	15
Ubon/Yasothorn	5	8	15	4	32	12	44	7	6
Nakhon Phanom	7	6	8	4	25	10	35	10	9
Khon Kaen	7	10	11	9	37	1	38	6	7
Loei	8	2	1	11	24	4	28	12	12
Chaiyaphum	9	8	2	6	25	13	38	10	7
Buri Ram	10	15	5	12	42	11	53	5	5
Kalasin	11	5	7	4	27	5	32	8	10
Maha Sarakham	12	14	13	9	48	7	55	3	4
Surin	13	11	10	14	48	14	62	3	3
Roi Et	14	12	14	15	55	9	64	1	2
SiSa Ket	15	13	12	14	54	15	69	2	1

Ranking from highest (1) to lowest (15) among the 15 Northeast provinces for Columns 1,2,3, and 6.
Ranking from lowest (1) to highest (15) among the 15 Northeast provinces for Column 4.

Column 5 = unweighted sum of Columns 1,2,3 and 4.
Column 7 = unweighted sum of Columns 5 and 6.

Per capita income refer to 1979; Income growth rate for 1970-76, Paddy yield and Paddy risk to 1963-77. These figures are taken from a report prepared for NERAD project by University of Wisconsin & RTG team.

Active users of contraception is based on a computer print out from the Ministry of Health, RTG.

* Ranking of Provinces shown in Column (8) is based on values shown in Column (5) and ranking shown in Column (9) is based on values shown in column (7).

performance in the province as one of the selection criteria. Column (6) shows the ranking of provinces according to percent active users of family planning methods. Provinces are ranked from highest percent users (1) to lowest percent users (15). Thus, the low performance provinces are given higher ranks. Column (7) shows the revised Indicator Sum, which is equal to the unweighted sum of column (5) and column (6). The last two columns compare the ranking of provinces on the bases of two indicators: Column (8) shows ranks of provinces without including family planning performance among criteria of selection and column (9) shows ranks of provinces after including family planning performance as one of the selection criteria. The first priority with the highest score is indicated by 1 and the last priority with the lowest score is indicated by 15. With minor variations, the two rankings are quite close. The first five provinces with highest scores on both the original and the revised indicators are the same. This shows that in this particular case, inclusion of family planning performance as one of the criteria of selecting provinces would not have made any difference. But that is good to know.

The extent to which inclusion of family planning performance among the criteria for selecting geographic areas for development projects would change the final selection is an empirical question. The results would depend upon the correlation between family planning performance and other criteria of selection and upon the relative weights assigned to family planning performance. In the above example, family planning performance was one of the five criteria, and all the five were given equal weights. But since

four of them were economic criteria, in fact family planning was given less weight.

Similarly, depending upon the availability of information, some indicator of family planning usership can also be included among the criteria for selecting districts and other smaller administrative units from the selected provinces.

This methodology can be expanded to include other demographic criteria for selecting geographic areas, for example, in- or out-migration rates, and infant or child mortality.

B. Add delivery of services and information about family planning methods in geographic areas selected for a development project, perhaps, not as an integral component of the selected development project but simultaneously as a part of the expanded population project.

While recognizing the problems of integrating different project components, it is suggested that services and information about family planning methods be delivered and strengthened in geographic areas selected for development projects. There may still be some issues in coordination of different implementing agencies which might preclude this step. But it will be consistent with one of the priority items in the Expanded Population Planning Project which indicate that priority will be given to "low performance areas."

FERTILITY IMPACT STATEMENT

Quantification of the potential fertility effect of a development project in advance is an exercise in projecting broad changes. A simple methodology to estimate potential fertility changes is illustrated in Table 3. It uses some hypothetical data and some information from the social soundness and economic analyses included in the project paper on Northeast Small Scale Irrigation (NESSI) Project. For this illustration, annual household income is used as the stratification variable.

The potential fertility effect of project inputs/outputs would depend upon three factors:

a. Percent distribution of population in the project area by annual household income prior to the project implementation. This distribution can be estimated from the baseline survey. It is shown in column (2) and is derived from the percent distribution of households in the NESSI project area shown in column (1).

b. Income elasticities of birth rates. These are shown in column(6). The income elasticity of birth rate is equal to the percentage change in the average birth rate divided by the percent change in the average household income between successively higher income groups. Thus the income elasticity of birth rate measures the percent change in the birth rate associated with one percent change in the average household income. The estimation of these elasticities require information about the birth rates and the average household income for each income group.

The average birth rate for the Northeast region around 1979 is estimated to be about 35 per 1,000 population. The birth rates by household

Table 3 : Illustrative example to show the effect of differential income growth rates on birth rates (Hypothetical data)

Annual Household income (Baht)	1/ Households % (1)	Population % (2)	2/ Birth Rate (3)	(4)	Average House-hold Income (5)	Income 3/ Elasticity (6)	Average growth rate in average household income 4/ (7)	(8)	(9)	Estimated percent change in birth rate (10)=(2)x(6)x(7)	(11)=(2)x(6)x(8)	(12)=(2)x(6) x (9)
0 - 1,000	5	7	35	45	500	-.088	300	30	660	-1.85	-1.85	-4.06
1,000 - 3,000	18	24	35	40	1500	-.056	200	30	220	-2.69	-.40	-2.96
3,000 - 5,000	16	18	35	38	4000	-.173	50	30	80	-1.56	-.93	-2.96
5,000 - 8,000	18	17	35	35	6500	-.299	40	30	50	-2.03	-1.52	-2.54
8,000 - 15,000	21	18	35	30	11000	-.333	30	30	30	-1.80	-1.80	-1.80
15,000 - 30,000	15	12	35	25	20000	-.160	20	30	16	-.38	-.58	-.31
30,000 -260,000	6	4	35	22	60000	+.150	15	30	6	+.09	+.18	+.06
Total	100	100	35	35	11000		30	30	30	-10.22	-5.18	-14.10

1. % households by income are taken from the Project Paper on Northeast Small Scale Irrigation Household income includes off-farm income and gross crop sales.

2. Average birth rate in Northeast around 1979 is estimated to be about 35 per 1,000, birth rate by income groups are assumed.

3. Income elasticities in Column (6) show percent change in birth rate associated with % change in average household income between two successive income groups. These elasticities are estimated from Column (4) and Column (5). Income elasticity for the first group = $\frac{(40-45)/42.5}{(1500-500)/1000}$ = -.088. Other elasticities are estimated similarly. The income elasticity for the highest income group is assumed to be +.150.

4. Net farm income has been estimated to increase from 1.1% in Puttha-Uttayan to 105.8% in Huai Kaeng command area yielding in an unweighted average for seven water tank command areas to 36.6% from 18,586 Bhat to 25,385 Bhat. This includes the price for Paddy etc. used for household consumption.

income were not available. Income specific birth rates shown in columns (3) and (4) are hypothetical. If, average birth rates by income class follows a pattern shown in column (3), then changes in household income is unlikely to have any effect on birth rates in the future. Otherwise, income elasticities of birth rates can be estimated. This is done from the birth rates shown in column (4) and average household income shown in column (5). The household income elasticities can be negative, positive, or zero. The elasticity for the highest income group is assumed to be positive. That is, at the highest income level any further increase in the average household income is assumed to be associated with an increase in the birth rate rather than a decrease in the birth rate as is the case for other income groups. The information required to estimate these income elasticities can be obtained from baseline surveys usually undertaken as part of each project.

c. Average projected growth rate in household income attributable to project inputs/outputs. The economic analysis currently included in the NESSI project paper provides an estimate of projected (anticipated) growth rate in household income at the aggregate level for the average farm household. Similar information will be required separately for each of the income groups included in the analysis. Three patterns assumed for the anticipated growth rates are shown in columns (7), (8), and (9).

The average growth rate in all three cases is assumed to be 30%. This is quite close to the 36.6% estimated for the NESSI project by subtracting the net farm income without the project from the anticipated net farm income with the project. The average growth rate for the seven water tank command areas in the NESSI project varied between 1% to 106%. The

unweighted average for all the seven command areas came out to be 36.6%. Income-specific growth rates shown in column (7) are completely arbitrary. Column (8) assumes an equal growth rate in all income classes. Column (9) assumes an equal increase in all classes in absolute Bahts. Thus, it is assumed that the net income of each household increases by 3,300 bahts (= .30 x 11,000) irrespective of the income level prior to the project. This pattern assumes a much higher growth rate for low income households.

Estimated percent changes in birth rates are shown in columns (10), (11), and (12). These changes correspond to the anticipated effects of project inputs on differential patterns of growth rates in household incomes shown in columns (7), (8), (9), respectively. In all three cases there is a projected decline in the birth rate but the magnitude of this decline varies between 5% to 14%.

Thus, if it is anticipated that as a result of a particular development project the percent increase in income of each household would be equal (i.e., the income distribution would become more skewed), the anticipated effect on the birth rate is likely to be minimum. On the other hand, if all households are assumed to benefit equally in terms of absolute number of bahts (i.e., the income distribution improves considerably), the estimated decline in the birth rate is likely to be maximum. And the third case lies between these two extremes.

Average family size instead of birth rates and average per capita household income instead of total household income can also be used to estimate income elasticies. (Refer to Todaro, 1977, for a discussion of dif-

ferences between these measures and of the general welfare implications of different growth patterns in income distribtion.)*

In sum, the magnitude of the potential effect on the birth rate would depend upon: (a) the distribution of population by household income prior to the project, (b) income-specific birth rates, and (c) anticipated changes in household income as a result of project implementation in the area. This technique to project anticipated changes in the average birth rate does not include the effect of changes in income-specific birth rates during the project periods. These changes could take place due to changes in factors other than household income and may or may not be attributable to the project per se. The accuracy of anticipated (assumed) changes in income-specific growth rates and their potential effects on changes in birth rates can be measured through impact studies.

Any other stratification variable such as education, employment, and general economic status can also be used. In these cases, the calculations would be closer to those shown in the appendix tables for Taiwan. The selection of social, economic, or cultural factors that are believed to influence fertility behavior in Thailand is the most important component of the fertility impact statements. The actual projection technique and the data requirements are quite simple.

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* Todaro, Michael P. "Development Policy and Population Growth: A Framework for Planners." Population and Development Review, 3 (1-2): p. 23-43. 1977.

FERTILITY IMPACT STUDIES

The purpose of these studies is to measure actual changes in fertility levels attributable to the selected development project. These studies can be done for completed projects, on-going projects, and new projects. These are treated separately.

For completed projects, by definition, the measurement of fertility change would be based on a retrospective assessment. For the on-going projects, the assessment of fertility change could be based on a combination of retrospective and prospective techniques. The new projects provide an opportunity to set up prospective studies. Experimental design -- natural or planned -- or statistical control can be used to isolate changes attributable to the project inputs.

Completed and On-going Projects

The main problem with such projects might be the lack of availability of baseline information about fertility levels, differentials, and patterns for the geographic area covered by the project. This will limit the scope of the study. One alternative is natural experiments which involves identification of control areas in which such developmental inputs were not provided but which were similar to the selected areas in all other respects. Another alternative is to use information about key determinants of fertility change from other available sources provided information about the effect of project inputs on such non-demographic factors as household income can be estimated from the project area. Computations shown in

Table 3 or in the appendix can be used if the following type of information can be obtained from baseline surveys and/or other sources:

(1) the distribution of population in the project area by some stratification variable, such as household income;

(2) income-specific birth rates prior to project implementation; and

(3) changes in distribution of population by household income attributable to inputs provided through the selected project.

New Projects

New projects provide an opportunity for setting up prospective studies to measure the effects of project inputs/outputs on demographic and non-demographic factors.

Ideally, to assess the fertility, other demographic, or non- demographic effects of project inputs/outputs, one would like to set up an experimental design similar to those used in agriculture to study the effect of a treatment on yield per hectare. Individual couples or small homogeneous geographic units (communities) can be used as units to set up an experimental design. Since, inputs provided through development projects are organized at an aggregate geographic level, communities might be preferable to the individual couples for setting up an experimental design.

Let us denote communities in which developmental inputs (treatment) are provided as "experiments." One would then like to identify "controls" for these communities. The experimental and control communities have to be matched on other factors, such as population size, distance from

the nearest urban or market center, presence or absence of primary school, health facilities, and family planning services. These two sets of communities, then, have to be followed prospectively.

Deficiencies of experimental designs as they are applied in social science research must also be recognized. For example, the children are not equivalent to yield and the couples are not equivalent to plots. That is, the problems associated with the measurement of inputs and outputs and the control of the external factors in experimental designs in the field of agriculture are quite different than the problems associated in an experimental design in the fertility-related social science research. For example, owing to other confounding factors not included in the original list of variables used for matching one may not be able to estimate the fertility effects of the specific developmental inputs at the end of the experimental design. The use of experimental design may be ideal but the use of statistical controls may be more feasible. The strategy suggested below is based on the utilization of statistical controls.

The selected development project is primarily used to identify geographic areas. Inputs provided through the project under consideration and through other projects are then monitored. Observed change in demographic and non-demographic factors can then be decomposed into components attributable to specific project inputs and components attributable to the external factors. This will require a baseline survey, monitoring of inputs, and a follow-up survey. Implementation of these surveys will be easier for those projects which contemplate evaluating the intended effects

on non-demographic factors such as yield, income, employment, etc. For these projects, one may simply have to add some questions about fertility, age at marriage, use of contraception, abortion, and breastfeeding.

Since many projects assisted by USAID/Thailand do include budgets and plans for research and evaluation, the following suggestions are included in this report. The Small Scale Hydro-Electric Adaptation Project is used as an illustration.

There are some indications that provision of electricity along with other developmental inputs in rural areas might be followed by a decline in the birth rate. Herrin (1979) has been studying these linkages in the Phillippines.* Twatchai and his colleagues will study the fertility effects of rural electrification in Thailand under the FID grant from A.I.D. to the Population Council. These efforts should be reviewed carefully if USAID/Thailand decides to select the Small Scale Hydro-Electric Adaptation Project for a Fertility Impact Study.

Features of the Small Scale Hydro-Electric Adaptation Project

- Will start in 1982 and will continue for four years.
- Will affect 37,000 people.
- Provision of electricity at reduced rates is expected to increase farm productivity, employment, and perhaps income

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* Herrin, Alejandro N. "Rural Electrification and Fertility Change in the Southern Philippines." Population and Development Review, 5 (1): 61:86, 1979.

(although income is not mentioned specifically as one of the outcomes).

- Will have six sub-projects: 2 large hydroelectric power generators and 4 small.
- Local User Cooperatives are planned in some areas which at their option are expected to invest earned revenues in small scale light industries thus generating employment in the non-agriculture sector as well.
- Recognizes equity issues such as that "it (electricity) may have less impact on substitution for fuel wood or liquid fuels... (might be) used principally by the upper income groups for lighting and other appliances."
- "The availability of lighting and electricity should contribute to a sense of security and should facilitate education both at home and in the villages and provide potential for better health care and preventive sanitary protection."
- Planned studies include: baseline survey, feasibility study, mid-term evaluation, and final rural energy study.

The planned research and evaluation studies are quite likely to concentrate upon issues related to implantation and operation of the hydroelectric hardware. But if the scope of these studies includes economic and social soundness components then consideration might be given to including items shown in Tables 4 and 5.

As we mentioned earlier, three types of studies would be required:

- Baseline information
- Monitoring of Project inputs/outputs and other external factors
- Follow-up information at the end of the project.

Table 4 includes some items for monitoring project inputs/outputs and external factors. Table 5 includes items which might be useful in anticipating the economic and fertility impacts of a development project

under consideration. Items included in Tables 4 and 5 are illustrative and can be used as a check list. No effort is made here to quantify changes in non-demographic and demographic factors. A similar table is required for estimating the actual project impacts on these factors. These tables include items to address some of the following issues.

1. Does availability of electricity attract private and public expenditure in non-agriculture sector?
2. Who uses electricity and for what purpose? Is the use of electricity affected by differential pricing for agriculture, non-agriculture, and domestic use? Is the use affected by the membership in user cooperatives?
3. Does it increase land under irrigation? Does it change cropping patterns, crop mix, and cropping intensity?
4. How does it change employment opportunities in the agriculture and the non-agricultural sectors separately for males, females, and children.

To be useful in anticipating the fertility impact or in estimating the actual fertility impact, information would be required:

- By geographic site
- By sex
- By age
- By size of land holding
- By income

Since this project and many other projects in Thailand include several geographic sites (6 in this case), a comparison of fertility changes

among these sites can provide useful information about the differential fertility effects of electrification under varying conditions.

Three development projects assisted by USAID/Thailand will be implemented in the Northeast region. These are the Northeast Rainfed Agriculture Development, the Northeast Small Scale Irrigation Project, and the Small Scale Hydro-electric Adaptation Project. It might be useful to consider and develop a comparative fertility impact study involving geographic areas covered by these three projects.

Table 4 : Illustrative List of Indicators of Infrastructure; Social and Other Services : Their Availability and Use

Input/Output	Availability			Use Prior to Project By				Anticipated increase in Use after the Project				Actual increase			
	Prior to Project	Project	Outside Project	Farmers Small	Medium	Large	Non-Farmers	Farmers Small	Medium	Large	Non-Farmers	Farmers Small	Medium	Large	Non-Farmers
. Source and availability of Electricity															
• Use of electricity															
Agriculture															
Non-agriculture															
Domestic															
• Price to the consumer															
Agriculture use				x	x	x	x	x	x	x	x				
Non-agriculture use				x	x	x	x	x	x	x	x				
Domestic use				x	x	x	x	x	x	x	x				
• Transportation & Communication															
Road to market															
Public transport															
• Other Irrigation Facilities															
Water Tanks															
Rain fed only															
Small/large dams															
• Credit facilities															
• Social Services															
School															
Health Clinic															
Family planning clinic															
Portable drinking water															
Sewerage															
• Cooperatives															

[x]Not applicable. Information about price can be obtained at the aggregate household level.

Table 5 : Illustrative List of Output Indicators and Anticipated Changes Attributable to the Project

Output	Anticipated Changes (Absolute or Percent)																					Actual changes in a similar table
	Aggregate Geographic		Household	Landless			Small			Medium			Large			Children			Adult			Old		
				M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
Economic																									
Agriculture																									
Production				x	x		x	x		x	x		x	x		x	x	x	x	x	x	x	x	x	
Employment																									
Income																									
Non-Agriculture																									
Employment																									
Income																									
Exogeneous																									
Price				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Cost of Living				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Consumption				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Social																									
Education																									
Formal																									
Informal																									
Communication																									
Health																									
Demographic																									
Migration																									
Mortality																									
Fertility				x		x	x		x	x		x	x	x	x	x		x	x		x	x	x	x	
Marriage						x			x			x			x	x	x	x		x	x	x	x	x	
Breastfeeding				x		x	x		x	x		x	x		x	x	x	x	x		x	x	x	x	x	
Use of contraception																x	x	x				x	x	x	

x = indicate not applicable

Change = + for increase
- for decrease

APPENDIX I: EDUCATION AND FERTILITY CHANGE IN TAIWAN DURING 1966-74

The purpose of this appendix is to show the relative contribution of changes in education distribution of women to the observed fertility decline in Taiwan during 1966-74. The data for this appendix are taken from Freedman et al (1977)*.

Estimates of education-specific total fertility rates and education composition of women in the child-bearing period, age 15-44 years, for 1966 and 1974 are shown in Table I.1 The results presented in this table indicate that total fertility in Taiwan declined by 37 percent from 4675 in 1966 to 2935 per 1000 women in 1974. The percent decline in education-specific total fertility rates among women with less or no education is much higher than the corresponding fertility decline among women with nigher education. For example, among literate women (less than primary school education), the total fertility rate declined by about 36 percent in comparison to a decline of 16 percent among women with at least senior high school education. This means that the decline in the overall total fertility rate would have been less than the observed 37 percent if the percent decline in the fertility of women with less than primary education was of the same order as the corresponding decline in the fertility of women with at least senior high school education. The decline in the overall total fertility (37 percent) was higher than the decline in

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* Freedman, Ronald, et al. "Trends in Fertility and in the Effects of Education on Fertility in Taiwan, 1961-74." Studies in Family Planning. Vol. 8, No. 1. The Population Council, New York, January 1977.

fertility in each of the five education groups because during this period the education distribution of women became more favorable to lower fertility; for example, the percent of women with at least junior high school education increased from about 14 percent in 1966 to 29 percent in 1974.

The relative contribution of changes in education distribution is shown in Table I.2. Freedman et al. (1977) have shown that 23 percent of the decline in crude birth rate during 1966-74 was attributable to education. Calculations presented in Table I.2 also show that about 25 percent of the decline in total fertility rate in Taiwan during 1966-74 can be attributed to changes in the education distribution of women in the childbearing period: 15-44 years of age. The remaining 75 percent of the decline in overall fertility was due to changes in education-specific fertility rates. This means that if education-specific fertility did not decline, the overall fertility of Taiwanese women would have declined only by 9 percent instead of the observed decline of 37 percent.

The relative contribution of changes in education distribution of women would depend upon the magnitudes of education-specific fertility rates. This point is illustrated by calculations shown in Tables I.3 and I.4. The estimated distributions of women by education for four different cohorts are shown in Table I.3. Women who were 45-49 years of age in 1966 are the survivors of those who were 15-19 years of age in 1936. Since mortality in Taiwan has been quite low, the education distribution of women 45-49 years of age in 1966 would be quite similar to the education distribution of the same women who were 15-19 years of age 30 years earlier in 1936. Similarly, other education distributions shown in Table I.3 are estimated from the education distributions observed in 1966 and 1974. These

distributions shown in columns (3) to (6) indicate changes in education composition of women who entered their childbearing period around 1936, 1944, 1966, and 1974. During this period of about 40 years, the education distribution of cohorts of women 15-19 years of age changed significantly. About 62 percent of those who entered their child-bearing period around 1936 were illiterate in comparison to only 2 percent among those who entered their child-bearing period in 1974. Improvements in the education attainment, nevertheless, have been quite gradual.

Total fertility rates for each of the four cohorts of women who entered their child-bearing period around 1936, 1944, 1966, and 1974 are estimated under two assumptions of education-specific fertility rates of 1966 and of 1974. These comparisons are shown in Table I.4. It can be seen that the relative contribution of the same change in education distribution of women to decline in fertility depends upon the magnitude of education-specific fertility rates. If these four cohorts are exposed to the 1966 education-specific fertility schedule, the overall fertility of the entire cohort would decline by 23 percent from 5047 to 3867 due to changes in education distribution. Under the assumption of 1974 fertility schedule, the corresponding decline attributable to changes in education distribution would be only 16 percent from 3524 to 2949.

Table I.1: Total Fertility Rate Per 1,000 Women and Distribution of Women by Women's Education During 1966-74, Taiwan

Education	Total Fertility Rate Per 1,000 Women			Distribution of Women 15-44 Years		
	1966	1974	% decline 1966-74	1966	1974	change
	(1)	(2)	(3)	(4)	(5)	(6)
Illiterate	5445	3740	31.3	28.3	15.1	13.2
Literate	5105	3280	35.7	14.0	12.6	1.4
Primary	4595	3445	25.0	43.5	43.5	0
Junior high	3025	2440	19.3	8.6	16.3	-7.7
Senior high +	2605	2200	15.5	5.7	12.6	-6.9
Total	4675	2935	37.2	100.1	100.1	

Table I.2: Estimated Total Fertility Rate Per 1,000 Women and Decomposition of Change During 1966-74

	Education-Specific Fertility	Education Distribution	Estimated Total Fertility
1.	1966	1966	4663*
2.	1966	1974	4286
3.	1974	1974	3152*
4. Change in Total Fertility During 1966-74:		Absolute	Percent
a. Total: 1-3		1511	100
b. Due to change in education distribution: 1-2		377	25
c. Due to change in education specific fertility: 2-3		1134	75

* Slightly different than those shown in Table I.1, which are based on education and age specific fertility and composition of women.

Table I.3: Estimated Distribution of Women 15-19 Years by Education Attainment and Estimated Education Specific Total Fertility Rate in Taiwan

Education	Total Fertility Rate		Estimated Distribution of Women 15-19 Years				Estimated Fertility Rate with 1936 Distribution and 1966/74 Fertility	
	1966	1974	1936	1944	1966	1974		
	(1)	(2)	(3)	(4)	(5)	(6)	(1)x(3)	(2)x(3)
Illiterate	5445	3740	62.0	45.9	8.2	2.3	3376	2319
Literate	5105	3280	11.7	13.5	11.4	5.5	597	384
Primary	4595	3445	18.9	30.1	62.7	45.0	868	651
Junior high	3025	2440	3.0	5.1	14.5	39.0	91	73
Senior high +	2605	2200	4.4	5.4	3.2	8.2	115	97
Total	4675	2935	100.0	100.1	100.1	100.0	5047	3524

Table I.4: Estimated Total Fertility Rate Per 1,000 Women Under Different Assumptions About Education Specific Fertility Rates and Education Distribution of Women 15-19 Years, Taiwan

Education-Specific Fertility	Education Distribution 15-19 Years	Estimated Total Fertility		
		Absolute	Relative	
1966	1936	5047	100	
1966	1944	4866	96	
1966	1966	4432	88	
1966	1974	3867	77	
1974	1936	3524	70	100
1974	1944	3440	68	98
1974	1966	3265	65	93
1974	1974	2949	58	84