

ヴェトナム国
食品工業研究所強化計画（仮称）
短期調査報告書

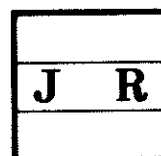
平成 12 年 12 月

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国 際 協 力 事 業 団



序 文

ヴェトナム社会主義共和国政府は、食品工業の近代化と農村の所得向上を目的として、食品工業の研究開発に係る人材育成の強化を図るプロジェクト方式技術協力を、我が国に要請してきました。国際協力事業団はこれを受けて、平成12年10月17日から11月3日まで、財団法人食品産業センター情報・技術協力部長 山崎恵氏を総括調査員とする短期調査員5名を、現地に派遣しました。

同調査チームは、プロジェクトの平成13年度協力開始に向け、先方実施体制や協力要請範囲の確認及び基本計画案の作成などについて、ヴェトナム社会主義共和国政府関係者と協議及び調査を行いました。

本報告書は、同調査員チームによる協議結果等を取りまとめたものであり、今後、本プロジェクト実施の検討にあたり、広く活用されることを願うものです。

終わりに、この調査にご協力とご支援を頂いた内外の関係各位に対し、心から感謝の意を表します。

平成12年12月

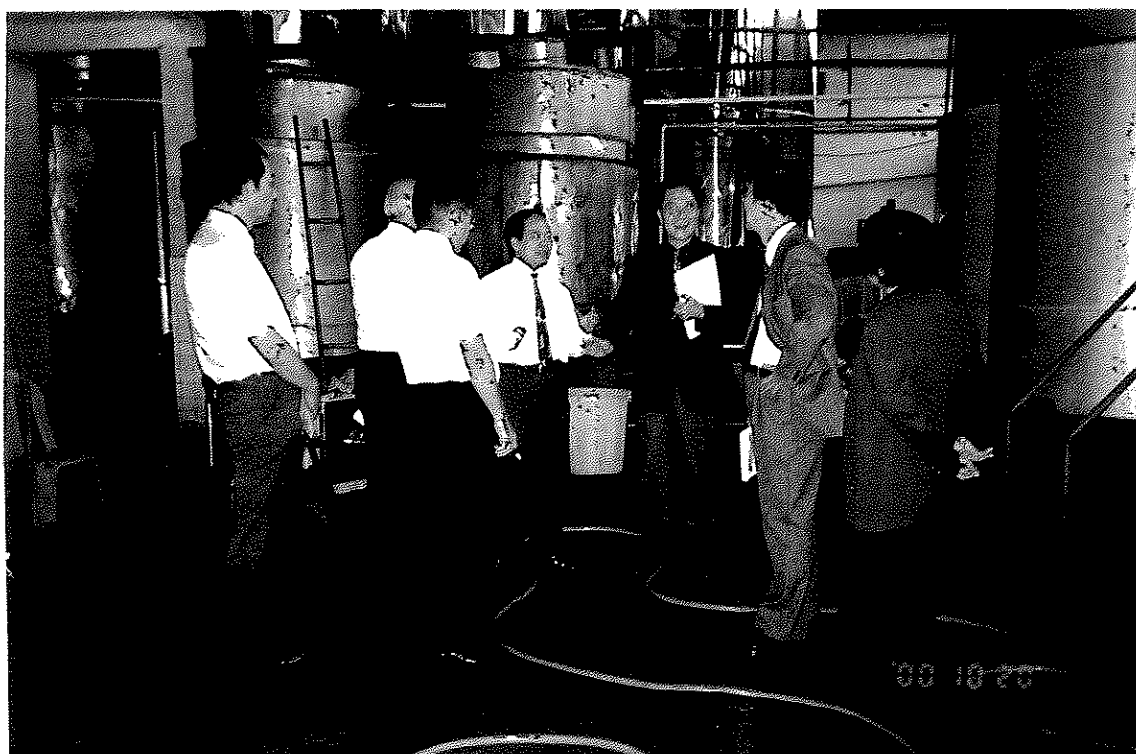
国際協力事業団
農業開発協力部
部長 鮫 島 信 行



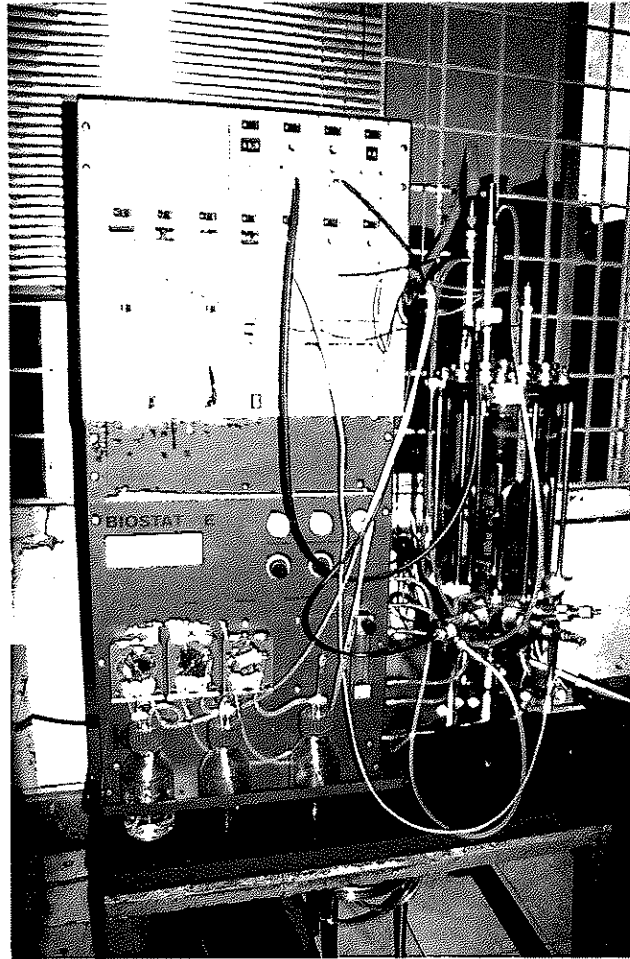
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研究室での聞き取り（微生物部門）



パイロットプラントの視察



10 年以上前の旧式のアミノ酸分析器



糖製造工場の視察



地図

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1. 短期調査員の派遣

1-1 調査員派遣の経緯と目的

開発途上国では、適切な食品加工により、食品の広域流通性、保存性を高め、その付加価値を向上することにより、農産物原料生産地の立場から脱却するとともに、国民の食生活の向上、食品産業の発展をめざしている。しかし、途上国では、食品加工産業は零細規模がほとんどであり、一般的に外資を除き、食品加工の基本となる品質管理や保存技術が未熟であり、その技術向上が不可欠となっている。

ヴェトナムは、社会主義体制を維持しながらも市場経済移行を進めつつあるが、特に農村部の貧困削減を最重要課題として、就業人口の7割を占める農業を重視し、農業生産の安定的増大、農産物の多様化による経営基盤の安定とならんで、食品加工の振興に努めている。

こうした背景から同国政府は1998年8月、中小企業を主とする同国の食品産業の近代化と農村の所得向上を図るため、研究開発に係る人材育成の強化が必要であるとして、ハノイの食品工業研究所(Food Industries Research Institute: F I R I)への技術協力を我が国に要請してきた。

これを受けて国際協力事業団は1999年12月、基礎調査団を派遣して、要請の背景及び実施可能性を調査・確認した。

今般は基礎調査結果を踏まえ、平成13年度からの協力開始に向けて、先方実施体制や協力要請分野の範囲の確認及び基本計画案の作成を目的とする、短期調査を実施した。

本短期調査の調査事項は、以下のとおりである。

- (1) 要請の背景、内容の確認
- (2) 先方実施体制の確認(実施機関、関連機関、予算、人員、施設)
- (3) 協力要請分野の範囲(協力対象分野の現状と問題点)の把握、内容の絞り込みと、基本計画(マスタープラン)案の作成のための資料収集
- (4) 基本計画(マスタープラン)案の作成

1－2 調査員の構成

- (1) 総括／食品加工：山崎 恵 財団法人食品産業センター情報・技術協力部長
(Dr. Megumi Yamazaki, Director, Information Service & Technical Cooperation Division,
Japan Food Industry Center)
- (2) 食品保全／分析・検査：浅沼 健太 オミックインターナショナルリミテッド 専門次長
(Dr. Kenta Asanuma, Deputy Manager, Omic International Ltd.)
- (3) 協力計画：飯田 次郎 JICA農業開発協力部畜産園芸課課長代理
(Mr. Jiro Iida, Deputy Director, Livestock & Horticulture Division, Agricultural
Development Cooperation Department, JICA)
- (4) 加工食品開発：山内 貞次 (株)日本開発サービス調査部 技術士
(Mr. Teiji Yamauchi, Professional Engineer, Consulting Division, Japan Development
Services Co., Ltd.)
- (5) 通訳：ヴァスアン・ズオン (財)日本国際協力センター研修監理員
(Mr. Vu Xuan Duong, Training Coordinator, Training Coordination Department, JICE)

1-3 調査日程

調査期間：2000年(平成12年)10月17日～11月3日

日順	月日	曜日	移動及び業務	場所
1	10/17	火	成田→(香港)ハノイ、団員内の打合せ(基本計画、日程等)	ハノイ
2	10/18	水	9:00 日本大使館表敬 10:30 JICA事務所打合せ 13:30 計画投資省・対外経済関係局 14:30 工業省表敬 16:00 JETRO事務所訪問	ハノイ
3	10/19	木	9:00 食品工業研究所(FIRI)表敬、概要聞き取り 13:00 研修施設の視察、聞き取り	ハノイ
4	10/20	金	9:00 テストプラントの視察、聞き取り 13:00 FIRI聞き取り調査①(酵素活用、食品分析管理、飲料部門)	ハノイ
5	10/21	土	7:00 食品加工業者(酒造会社、国営グルコース生産会社)の視察、普及指導体制調査	Pho Tho省
6	10/22	日	団内打合せ、日本語現地報告書の作成	ハノイ
7	10/23	月	9:00 FIRI聞き取り調査②(微生物学、でんぷん、バイオテクノロジー、食品技術・栄養部門) 13:00 予算に係る聞き取り、ミニッツ確認	ハノイ
8	10/24	火	7:30 農家サイドニーズ調査のための国営農場、起業家訪問	Ninh Bing及びThanh Hoa省
9	10/25	水	(午前) ミニッツ原案作成 13:00 FIRIとのミニッツ案協議	ハノイ
10	10/26	木	(午前) ミニッツ作成 13:00 追加調査事項協議、機材購入計画協議	ハノイ
11	10/27	金	11:00 ミニッツ署名・交換 14:00 日本大使館報告 16:30 JICA事務所報告	ハノイ
12	10/28	土	10:00 ハノイ→成田(官ベース) 10:00 コンサルタント団員：加工食品事情聞き取り(西友ストア)	ハノイ
13	10/29	日	レポート作成	ハノイ
14	10/30	月	10:00 規格の確認(ヴィエトナム標準度量衡品質センター) 14:00 豆乳工場視察	ハノイ近郊
15	10/31	火	9:00 菓子工場(HAIHA-KOTOBUKI)視察 14:00 FIRIでの追加調査(人員配置、微生物保存等)	ハノイ
16	11/1	水	9:00 西友ストア社長訪問、FIRIでの追加調査(研究実績等) 14:00 工業省戦略計画研究所聞き取り	ハノイ
17	11/2	木	9:00 FIRIでの追加調査(研修実績等) 14:00 大使館、JICA事務所報告	ハノイ
18	11/3	金	ハノイ→東京	

1 - 4 主要面談者

(1) 計畫投資省 (Ministry of Planning and Investment)

Dr. Ho Quang Minh Deputy Director General, Foreign Economic Relations
Department

Mr. Nguyen Xuan Tien Expert

(2) 工業省 (Ministry of Industry)

Mr. Phan Trong Tiem Deputy Director General, International Cooperation
Department

(3) 食品工業研究所 (Food Industries Research Institute: F I R I)

Dr. Ngo Tien Hien Director

Dr. Vu Thi Dao Deputy Director

Mr. Duong Dinh Thanh Deputy Director

Ms. Tran Thi Chau Head of Research Planning and International
Cooperation Dep.

Dr. Nguyen Thi Hoai Tram Head of Enzyme

Dr. Pham Van Thanh Head of Quality Control

Dr. Giang The Binh Head of Beverage Department

Dr. Truong Thi Hoa Head of Food Technology and Nutrition Department

Dr. Nguyen Thi Minh Hanh Head of Starch Department

Dr. Nguyen Thi Du Head of Biotechnology Department

Dr. Le Duc Manh Head of Environment

Dr. Phan To Nga Head of Protein Technology

Mr. Ho Suong Head of Bioproduct

Dr. Phan Thi Suu Head of Essence and Spice Technology

(4) 民間食品加工企業

Mr. Nguyen The Yen Director, Dong Xuan Alcohol Co.

Mr. Truong Quoc Chinh Director, Haiha Candy Co.

Mr. Vu Dac Khang Vice Director, Dong Giao 食品輸出入公社

Mr. Le Dinh Chien Director, MD Co.Ltd.

Mr. Nguyen Yen Duy Linh President, DAPCAU

Mr. Tetsuya Suzuki	President, HAIHA-KOTOBUKI
Mr. Nguyen Thi Yen	Director of Planning, HAIHA-KOTOBUKI
Mr. Nguyen Thi Tran	Director of Technology, HAIHA-KOTOBUKI

(5) 日本大使館

井村 久行	一等書記官
宮川 賢治	二等書記官

(6) J I C A事務所

金丸 守正	所長
井代 純	企画調査員

(7) 日本貿易振興会ハノイ事務所

池部 亮	所長
折山 光俊	通産省通商政策局経済協力部経済協力課 経済協力専門職

2. 要 約

本短期調査員チームは、2000年10月17日から11月3日までの日程でベトナムを訪問し、同国の食品工業研究所(F I R I)強化計画に係る短期調査を行った。その結果、平成13年度内のプロジェクト開始に向けて、先方実施体制や協力分野を確認するとともに、協力基本計画案を策定し、合意事項をミニッツ(付属資料1.)に取りまとめて署名を取り交わした。

調査によると、これまでのF I R Iは、開発から技術移転まで幅広く対応してきたが、新規性、独創性の高い研究よりも、所管省の指示による国営企業向け技術の実用化、特に、小規模化と製造時間を短縮する既存技術の焼き直しが主だった。しかし、こうした対応では、食生活高度化に伴う「品質」重視の流れに対処することが困難となろう。

このため今後は、真の「研究所」となるべく、国民的財産の掘り起こし、すなわち、ベトナムの微生物及び有用酵素の探索から製品評価まで、一貫した体系を習得させ、広く応用が可能な「基礎能力」を着実に身につけることが、将来にとって重要となる。ベトナムの主要な研究者は旧ソ連、東欧で博士号を取得した者も多く、微生物、酵素分野で一定度の経験を有していることから、地道な活動により自信を身につければ、各種の転換技術を応用し、研究を発展させることが可能になると判断される。

本短期調査で確認されたプロジェクトの概要は、以下のとおりである。

(1) 名称

「食品工業研究所強化計画(仮称)」

(2) 基本計画

1) 上位目標

農村の余剰農産物などに適切な加工を施すことにより、食品の安全性、栄養性、嗜好性といった品質とともに保存性を高め、農産物の付加価値を高める。これにより、農家の所得向上を図るとともに、技術力の不十分な零細規模の食品加工企業において、品質の高い加工食品の生産を可能とする。

2) プロジェクト目標

食品工業研究所(F I R I)において、食品加工技術の基礎となる微生物応用技術、酵素利用技術及び発酵工学に係る応用技術並びに成分分析評価といった品質管理能力を高めることにより、食品の研究開発とともに、食品加工企業に対する技術指導能力を高める。

3) 成果

- a. F I R I の研究者が食品加工技術の微生物、酵素及び発酵工学に係る基礎及び応用技術を習得する。
- b. F I R I の研究者が食品の成分分析評価に係る基礎及び応用技術を習得する。
- c. F I R I の研究者の食品加工の適切な素材開発及び技術指導能力が向上する。

4) 活動

- a. 微生物、酵素及び発酵に係る技術を F I R I 研究者に移転する。
- b. 食品の素材及び最終製品に係る成分分析評価技術を F I R I の研究者に移転する。
- c. 微生物などの技術、品質管理技術を習得ののち、F I R I は食品加工の適切な素材開発を行う。
- d. F I R I は中小企業に、研修や技術指導を行い、プロジェクトが開発した適正な技術や知見を普及する。

(3) 日本側の協力

長期専門家 4 名 (チーフアドバイザー、業務調整、微生物、転換技術／分析) のほか、必要に応じて短期専門家を派遣するとともに、年間 4 名程度のカウンターパート日本研修を受け入れる。また、技術移転に必要な資機材を供与する。

3. 要請の背景

(1) 背景

1) 背景

ヴェトナムの主要産業である農業は、就業人口の7割、国内総生産の3割を占めるが、農村は所得水準が低く、市場経済化移行のなかで、都市との格差は拡大傾向にある。そこで、農産加工による高付加価値食品の生産を通じて、農村雇用と農業所得の増大を図ることが求められている。したがって、食品加工に係る研究開発能力を高め、農村などにおける中小規模の加工企業への技術移転強化が望まれている。

2) 要請の内容

以上を背景にして1998年8月、ヴェトナム政府は、中小企業を中心とした食品産業の近代化を図るため、機材、情報、技術水準、人材育成に係る強化が必要であるとして、食品工業研究所(FIRI)への技術協力を要請した。活動としては、品質管理の向上、食品加工保全技術の研究開発、関係者の研修・情報提供、国家規格の設定、食品に係る調査、マネジメント業務などである。

(2) 基礎調査結果の概要

1999年12月13日から21日まで、要請の背景及び実施可能性を調査するため、基礎調査団が派遣された。プロ技をはじめとする技術協力において、農産加工分野の実績は少ないので、現状と問題点に係る情報収集を主眼とした(これまでの実績は付属資料6. 参照)。

調査結果総括は以下のとおり。

行政機関は農産物の加工適性、企業の技術水準、市場ニーズの把握が不十分なため、具体的な分野の絞り込みは、今後の課題として残された。外資との合併事業の増大は、ヴェトナム国内の資源の活用や技術向上の停滞をもたらす懸念があるため、それを防ぐためには、FIRIの技術開発能力の向上が不可欠である。そこで、品質管理のための検査技術を中心とする基礎分析能力の向上とともに、食品加工から分析評価、衛生管理にわたるモデルシステムを構築すべく、FIRIへの支援を行うことが有効と考えられる。

(3) 横山個別専門家報告書

1999年4月から9月までキリンビール(株)所属の横山洋個別専門家が、FIRIに派遣された。同専門家報告によるとFIRIは、1997年に100万ドルで施設の新築、1999年に特別予算により機器補充が行われた。パイロット生産を行うFIRIは、ほかの研究機関と比べ、事業

実績もあり、政策上重要視されているが、設備や情報の不足から、研究開発レベルは伸び悩んでいる。そこで、今後、F I R I への協力にあたっては、これまで重視され、実績もある微生物応用技術、酵素応用技術を強化することが最も効果的と考えられる。また、対象食品の「どの成分」を「どのように」、「何に」変化させるかという、基本を把握するための協力も必要である。

4. 調査結果

4-1 国家開発計画との整合性

2001年から20年間の社会経済開発計画のほか、2001年3月の共産党大会で、5か年計画が策定される予定であり、現在、ドラフトが提示されているが、貧困層の撲滅といった抽象的な表現であり、詳細は各省に委ねられる。

食品の需要の動向や将来方向を見極めたうえで、生産者育成、流通改善、消費者保護、規格の設定など、食品工業に関連した施策を関連省庁と連携して実施していくことが重要と認識しており、融資制度などは実施中とのこと。

4-2 農業、食品加工業の概要

(1) 主要農産物の生産・消費の概況(付属資料7. 参照)

米を輸出(インドネシア、フィリピン、中東、南アフリカなど)しているが、近年は、米から、付加価値の高い花卉栽培(キク、バラ、カーネーション)への転換が行われているとのこと。また、ロンガン、バナナ、ライチなど、伝統的果実の品種改良も推進されている。

1) 米

米は1999年には、約3200万t生産された。ヴェトナムは世界で2～3位を争う米輸出国で、生産量の10数%が輸出にまわされる(1998年の米生産量2914万t、輸出量380万t)。次に、ビール醸造用としてモルトの代わりに最高40%も使用。1万tが、ビーフン、うどん、煎餅などに使用。酒造用(ビール以外)として、0.8～1.6%ぐらいを消費。残りを食糧用米として使用。収量も、4.1t/haまで上がり、耕作面積は764万8000ha。

2) トウモロコシ

トウモロコシは、1999年の生産高が175万2000tで、その用途は、無加工調理用15～20%、飼料用60～65%、加工用15～20%であり、輸出はない。収量は、2.6t/haであり、作付面積は68万6900ha。

(2) 食品加工業(付属資料10.)

ヴェトナムの食品加工業では、企業数の85%が従業員数50名以下であり、中小規模の企業がその大半を占める(ミニッツの基本計画に示されているとおり、本プロジェクトでは、技術アクセスの困難な中小規模の企業を対象とする)。なお、外資総数は56社との回答があったが、詳細は明確にできなかった。

5. プロジェクト実施体制(付属資料2. 3. 参照)

質問票に対する回答が迅速であるなど、プロ技実施機関の中でも有数の優良機関とのJICA事務所の認識がある。

5-1 実施機関の概要

食品工業研究所(FIRI)は、食品加工の新技術開発、研修指導、国内産物から栄養価の高い高付加価値食品の開発を目的として、1967年に設立され、現在は、工業省下の直轄機関である。

(1) 人員(付属資料4.)

14の技術部門と、ホーチミン支所があり、総数183名。研究者全体は、146名。大卒以上は、全体で116名、博士号取得者14名。新卒者は10名雇用(国家予算でなく、自己収入にて対応)。各研究室には、博士号を有する室長の下、1～2名程度の博士号取得者と修士、大卒の研究者がおり、十分なカウンターパートが配置されているといえる。

(2) ホーチミン支所

ホーチミン支所は、12名。予算配分は3割。予算、人事、研究課題は、本部の承認を受けて実施。年2回所長と支所長が相互に出張をするほか、セミナーなど開催の際は本部へ招へいしている。テストプラントは2つ。活動内容は、ハノイ本部の各研究室とほぼ同じ。基本的には、地方支所の位置付けで、ハノイのカウンターパートが、技術移転を行う態勢となっている。

(3) 予算(付属資料5.)

財源は、計画投資省、工業省、科学技術環境省からの配分及び自己収入からなる。計画投資省からは、施設や機材整備などの特別予算(省の直轄研究所に措置されるもの)、科学技術環境省からは、科学技術及び環境分野の契約課題に基づく予算措置がある。1999年実績で100億ドン(約7600万円。2000年10月20日現在の基本レートは100円=13164.7ドン。出所東京三菱銀行)。2000年度予算は、300億ドン(約2億3000万円)であり、他機関と比較し、かなり優遇されている。財源の内訳は、計画投資省30%、工業省26%、科学技術環境省7%、自己収入37%である。

(4) 機材、施設

分析に必要な機器は不十分であるが、新規購入も含めれば、より活発な活動が可能。既存の研究部門は、類似の活動を競合して行っており、整理の必要がある。基礎・応用の分野を

明確にし、共通する分野の基礎レベルの強化が必要。その一環として、共通機器室設置の検討も必要である。

5階建ての研究棟は3年前に新築。また、新規機材を1999年と2000年の2カ年にわたり整備した。6年前よりビール製造プラントを独自に設計し、運転中。プラントは2棟あり、寄付金により設置。ただし、目的は研究であり、生産販売を目的としない。

5-2 工業省

工業省がFIRIの監督機関である。研究は、工業省との1年契約(更なる成果が期待される場合は1年ごとに延長)であり、課題設定は、委員会で討議。評価は、外部委員会があり、科学性、実用性の観点から実施する。成果が期待できない場合は、軌道修正(なお、工業省では、ほかに工科短期大学プロジェクトを実施中であり、電力専門学校を計画)。

5-3 研究者育成

長年、行政の指示により、行政的なニーズを満足させるための短期業務を行ってきたことや、予算的な問題などもあり、独創性を発揮する場が欠落していた。独創的な技術の開発なしにはヴィエトナムの将来はない。研究の研究たるゆえんは、独創性であり、そのためには、研究者の独創性を伸ばすインセンティブを与えることが重要である。各研究室内で、博士号取得者が、若手を指導する体制や、所内の検討会が実施されているので、一応のシステムは存在するものと判断される。1999年に食品工業科学協会が発足(FIRI所長は、同会副会長:不定期の会報あり)し、徐々にその機運が高まっている。

5-4 関連機関

連携協力機関としては、科学技術環境省(工業省とともにFIRIの目標設定を指示)がある。農業農村開発省、ポストハーベスト技術研究所は、業務上、直接的な関係はなく、連携協力機関として、ミニッツに特記しなかった。

また、食品衛生分野では、食品の品質、衛生、安全性向上のため、1999年に保健省に新しい局(食品行政局)が設置され、プロ技の要請も提出された。そこでは食品の品質、衛生、安全性基準の設定、技術手法、認証、検査、罰則、啓蒙、工場検査、食品検査など、監視機構を業務とする。要請書では、検査施設の設置により、食品検査、分析、食中毒情報管理の研修の実施などを活動項目としている。

FIRIで行う分析は、原料の素材評価、製品の品質評価など、保存、加工及び開発上必須のもので、食品衛生の分析とは性質が異なり、重複しない。

5-5 その他

- (1) 調査員の質問に対する回答は迅速であるが、必ずしも的確な回答といえない場合もあった。このようなケースにおいては、メニューを示して先方に選ばせる方法が望ましいとの日本政府の他関係機関からの指摘があった。対工業省関係で、職員、有料の研修の内容などの自己収入の内訳、省からの契約に基づく研究課題の実施状況など、運用上の実施が予想される分野については、明言を避ける傾向が観察されたが、これは今後の信頼関係の構築により対応し得るものと思料する。
- (2) ヴィエトナムの特徴は、個人でなく、組織で動くことといわれ、組織間のライバル意識は強いとされる。今回、他省庁や機関所管の事項について、聞き取りや資料収集は行わなかった。FIRI所長は、チェコ・スロバキアで博士号を取得し、以前、酒造会社の社長をしていたことなどもあり、業界関係者との連携もあるので、この面での協力は期待できるものと思われた。

6. 協力分野の現状及び問題点

6-1 微生物応用技術、酵素利用技術及び発酵工学

(1) 微生物の保存状況

食品工業研究所(F I R I)は現在、性質の分かっている約300種、不明100種の微生物を保存しているとのことで、その実態を調査した。

微生物保存法は世界各国で工夫されており、現在12の方法が目的に応じて実施されている。大きく分けると、①経代培養保存法、②代謝速度を低下させる保存法、③凍結保存法及び④乾燥による保存法がある。F I R Iでの実施方法は、以下のとおり。

1) 酵母については、前記②の方法のうちの1つである流動パラフィン重層法を採用し、寒天斜面培養に流動パラフィンを重層して保存する。標準試験管に保存された菌は、4～6℃で保存。

2) カビについては、小型試験管にて「Sand Culture」により保存。これは前記の④の方法で、清浄な海砂をアルカリ、酸、水で交互によく洗い、試験管またはアンプルに2～3 cmの深さに入れ、乾熱滅菌する。これに菌の培養液を1 mlを添加してよく混ぜ、真空デシケーター中にて乾燥し、乾燥後、常圧にて火炎熔封し保存するものである。F I R Iでは綿栓でやっていた。

3) 細菌については、前記④の方法の1つである凍結乾燥法で行っていた。この方法が一番良い方法であり、3年の保存が可能。ただし、しかるべき装置が必要であるが、F I R Iのものは現在故障中。今後を考慮し、至急に対策を講ずべきものと思われる。

このほかに放線菌を前記①の方法である継代培養保存法で保存している。比較的簡単な方法ではあるが、長期保存には向かない。

F I R Iでは、F I R Iが行っている方法が最善との意識であったが、菌種に合った保存法が検討されるべきである(保存方法についての文献を手交)。また、最初に挙げた③の方法の1つで比較的簡便にできる液体窒素を用いる方法は、簡単な装置でできるので、保護剤などを検討して使用すべきものである。

(2) F I R I 研究実績(発表分、国外・海外)

これまでの主要な研究成果の内容(実際のペーパー)をプロジェクト実施前の状況として確認するために調査したところ、博士論文リスト(海外分、国内分または今取り組んでいる分)

は、実績が14点、執筆中のものが13点であった(付属資料8.)。

6-2 加工食品の品質評価技術

(1) 食品成分分析・評価

1) プロジェクトの効果

- ・食品保全技術：F I R Iの実績は実質的には皆無。したがって、食品保全技術によってもたらされるロスの減少、品質保持、安全面の確保等、経済効果を、技術移転過程を通して実感させることにより、F I R Iにより開発された技術の伝搬を促進させ、ヴェトナムの国民を食中毒などの被害から守り、また、食品の寿命を延長させることにより同国経済の発展に寄与するものと思料する。

なお、保存料の添加については、中国からの密輸品には有害保存料が使用されているケースもあり、監視されているとのこと。また、事故例として、うどんによる中毒例が報告されている。

- ・成分分析評価：陳腐化した1990年代初頭のI S O基準と、それ以下の発令当時の越国内技術水準に基づいたT C V N (TIÊU CHUẨN VIỆT NAM : VIETONAM STANDARD) によって実施されており、国際水準とはほど遠い。したがって、これを現在の国際水準に引き上げることにより、品質を国際水準まで保証することが必要である。

2) 自立発展性の見込み、技術的意義

競争原理を経験せずに過ごしてきたカウンターパートの技術水準は、十分なものとはいえない。しかし、カウンターパートの基礎的な能力は、水準的には問題ないものと考えられるので、技術移転過程を通じて世界における競争原理経済の自覚により自立発展は可能と思料する。

3) 技術普及活動

到達目標に到った技術は、私立大学の農産加工学科の講義及び実習に組み込むことで容易に伝搬可能であり、また、適時セミナーなどを開催したり、参加発表を通じて技術普及を図ることも有効である。

(2) 施設機材に係る留意事項(食品成分分析・評価)

F I R Iは規格検査を対象とした技術協力には何ら問題のない機関と判断された。しかし、実施にあたっては以下の事項に留意する必要性がある。

1) 施設

施設面積(実験室)の広さは、ほぼ満足できる。現在不足していると思われる機材施設は次のとおりである。

- ・ドラフトチャンバー (Fume Hood) : 抽出などの操作により発生する有害有機溶媒由来ガス並びに有毒ガスなどの排除には現有施設では不十分である。したがって壁面全体を占める程度の備品を設置する必要がある。なお、当該備品は特注品として現地調達可能である。
- ・微生物実験室の改造 : 当該研究所の施設はコンベンショナルな構造であり、微生物実験を行うには雑菌汚染の機会に常に曝露されているので、パーティションと HEPA filter による準無菌 (Semi-Biohazard) 仕様に改造する必要がある。また、抽出、分析時のコンタミネーションを防止するために、機具、機材の洗浄・乾燥コーナーを整備する必要がある。
- ・分析の精度を保つために、分析機器には定電圧設備 (stabilizer) の設置が望ましい (現在 AC single 213 ~ 216V で常に変動している)。
- ・試料持ち込み後、抽出操作を開始するまでの一時保管用に大型冷蔵庫 (現地で市販されている飲食店用飲料水用ショーケースなどが適当) 及び内容量 300 l 以上の -40℃ の deep freezer が必要。

2) 機器類

J A S 規格に準じた規格検査を実施するのに不足する機器類は次のとおり。

- ・ガスクロマトグラフ (Gas Chromatograph) : 全く導入されていないので、電子捕獲イオン化検出器 (ECD)、水素炎イオン化検出器 (FID) 及び熱伝導度検出器 (TCD) 検出器付きのものが必要 (本邦製なら島津、USA 製ならヒューレットパッカード製が望ましい)。
- ・高速液体クロマトグラフ (HPLC) : 現在稼働可能なものは島津製 LA-SA 型のかなり老朽化した型が 1 台あるのみ。検出器には赤外検出器 (IR)、蛍光検出器 (FP)、紫外・可視分光検出器 (UV-V) が装着しているので、新規に購入する場合はフォトダイオードアレー型 (PDA) 検出器、グラジェント装置、カラム恒温槽付きが望ましい。
- ・薄層クロマトグラフ (TLC) : 全くないので TLC 一式を導入すべきである。
- ・DNA 鑑定用蛍光デンシトメータ : 現在電気泳動槽並びに酵素適的核酸増幅法 (PCR) は保有しているのでデンシトメーターを付け加えれば DNA 鑑定は実施可能となる。この場合、低速遠心器、ディスプレイチューブなどもそろえなければならない。
- ・低温恒温培養槽 (冷凍器付きインキュベータ) は最低でも 2 台は必要。

- ・免疫酵素法 (E L I S A) 用プレートリーダー及びダイリユーター：カビ毒及び残留抗生物質等の検出には必要。
- ・凍結乾燥機：早急に修理 (真空ポンプ及び冷凍機) が必要。
- ・缶内圧計：缶詰協会式 1 台は必要。
- ・試薬：試薬類は一部を除いてすべて輸入による (中国製、日本製、米国製など)。
- ・標準品：一切ない。外交ルートで Codex 委員会、W H O、F A O より供与を受けるのも一法であろう。
- ・標準基準品：分銅、篩、温度計、比重計などの基準検定付きのものはない。本邦の J I S 規格で校正記録証明書付きのものが必要。
- ・コンピューター：現在数台あるが、Virus 対策がとられていないので、同対策が必要。なお、接続はモデムで行っており、専用 line 契約などを行えば専門家の資料入手、通信費の削減につながる。
- ・参考図書：未整備であり、使用に耐え得るものはない。C D - R O M などで要整備。
- ・その他：標準操作手順書 (S . O . P .)、記録簿などの system が不十分であり、その構築が必要。

6-3 中小規模の企業を対象とする技術普及活動

講習会は、2 コース、10 日間、企業や科学技術省の地方局職員 100 名を対象に実施。経費は、原則無料 (国やドナーの補助)。製品紹介セミナーであり、企業の要望があれば、技術指導の有償契約を行う。企業からの寄付金あり。また、技術指導実績としては、ビール企業 71、飲料 9、アルコール 7、インスタントコーヒー 1、植物油 10、乳児食 7、グルコース 6、ペットフード 1 など (付属資料 9.)。さらに、3 私立大学において、F I R I 在籍 研究員が、環境学、食品学などの講義を一部担当 (ドンド大学など)。修士や博士課程の学生の受け入れも行う。

これら活動は、研究成果の普及として重要であり、プロジェクトにおいても強化する。

F I R I 研修実績は以下のとおり。

- ・「National Workshop of Application of Enzyme in Food Processing」
1998 年 12 月 7 ～ 9 日 講師：6 名 受講者 63 名
- ・「Flavour Workshop in Vietnam」
1999 年 4 月 19 日 ～ 24 日 講師：7 名 受講者 40 名
- ・「食品工学における発酵技術と酵素の応用」
1999 年 12 月 講師：7 名 受講者：65 名
- ・「National Biotechnology Conference, Hanoi 1999」
1999 年 12 月 9 ～ 10 日 共同発表会

・「食料と食品加工企業に対する新しい技術紹介及び技術情報提供方法」

2000年5月22～24日 講師 受講者42名

7. 協力計画の絞り込み

以上の調査結果に基づき、調査員側の基本計画案(当初案は付属資料 12.)につき、先方と協議のうえ、基本方針を確認したうえで、ミニッツに取りまとめ、署名を取り交わした。

(1) プロジェクト目標

プロジェクト目標としては、食品工業研究所(F I R I)において、食品加工技術の基礎となる、微生物応用技術、酵素利用技術及び発酵工学に係る応用技術並びに成分分析評価といった品質管理能力を高めることにより、食品の素材開発とともに、食品加工企業に対する技術指導能力を高めることとする。

なお、F I R Iにおいては、保存関連課題への取り組みは行っていない。技術協力の要望事項として「保存技術」が入っていたが、技術協力対象としての絞り込みが必要であり、削除した。また、後述のように、当初想定していた廃水処理技術は除いた。また、加工食品の開発ではなく、適正な「素材」の開発とした。

(2) 成果、活動

微生物応用技術、酵素利用技術、発酵工学に係る応用技術は、先方優先順位が最も高い分野で、これまでの調査によっても、ベトナム国内の資源の活用や製品開発技術、品質管理のための検査技術を中心とする基礎分析能力の向上など、素材の評価、食品加工技術から品質評価まで一連のモデルシステムの構築が望まれていた。このためF I R Iにおいて、これまで重視され、実績もある微生物応用技術、酵素応用技術の基礎能力強化が最も効果的と考えられた。

そこで、微生物応用技術、酵素利用技術、発酵工学の基礎能力の充実に努め、プロジェクト前半において、微生物及び酵素関連基礎技術や品質管理技術を習得した後に、適正な「食品素材」の開発に当たる位置付けとした。なお、実際の製品開発などは、ベトナム側にて行うこととする。

8. 協力計画

基本計画を基に、以下の詳細計画を策定し、先方には、口頭で伝えた。

8-1 微生物及び酵素に関する基礎技術

(1) 活動項目

1) 微生物代謝産物などの解明

オリジナルな研究には、不可欠であり、これらの技能を身につけることは、今後、幅広い応用をもたらすものである。

- ・マイコトキシン産生(肝臓ガンなどの要因)

当面技術移転の対象とするマイコトキシンは、アフラトキシン、オクラトキシン、ゼアラレノンの3種類とし、マイコトキシンの分析法、マイコトキシン産生菌の分離同定法、マイコトキシン産生菌の分布調査を通じて技術移転を行う。

- ・生成酵素の種類とその活性
- ・有機酸、アミノ酸などの産生
- ・微生物の生理
- ・微生物の発酵中の動態

2) 有用微生物の同定

3) 有用菌の保存と管理

4) 生成酵素による各種農産物成分の高付加価値化物質への転換と転換物質の定性、定量

5) 酵素活性の強化

(2) 研修分野

1) マイコトキシンの分析(1名)

2) 微生物代謝産物の解明(1名)

3) 生成酵素の種類とその活性及び生成酵素による転換物質の定性、定量(1名)

4) 酵素活性の強化(1名)

(3) 機材、施設

培養器、かくはん器、高圧釜(オートクレーブ)、顕微鏡、空調機、ストッカー、ガスクロマトグラフ(FID及びECD各1台)、高速液体クロマトグラフ(PDA検出器、示差屈折検出器、蛍光検出器付き2台)、アミノ酸分析計、発酵プロセス自動計測装置、ストマッカー(乳化器)。

※分析機器類は、共通機器分析室に設置。

(4) 情報整備の強化

必要図書、文献の充実強化。

8-2 品質評価

加工食品の規格、成分分析、科学的な評価の向上を図る。

(1) 成分評価

1) 我が国の J A S 規格検査に相当する基礎分析能力の育成

加工食品素材の品質評価に必要な項目の学習と分析法の習得。

J A S 規格制定品目は、100 品目（飲食料品目 74 品目）あり、飲食料品目 74 品目中 27 品目がベトナムでも適用可能と考えられる。そこで、以下の 27 品目に対して同国に見合った規格試験について、技術指導を行う（目標 27 品目）。

食酢、乾燥スープ、食用生成加工油脂、食料植物油脂、ぶどう糖、異性化液糖及び砂糖混合異性化液糖、果糖、ジャム類、果実飲料、炭酸飲料、豆乳類、果実缶詰及び果実瓶詰、種類別農産物缶詰以外の農産物缶詰、野菜缶詰及び野菜瓶詰、畜産物缶詰及び畜産物瓶詰、調理食品缶詰及び調理食品瓶詰、水産物缶詰及び水産物瓶詰、水産物野菜煮缶詰及び水産物調理缶詰、特殊缶詰、農産物瓶詰、レトルトパウチ食品、調理冷凍食品、魚肉ハム、魚肉ソーセージ、煮干魚類及び煮干魚類粉末、即席めん類、醤油。

そのほか国内事情により優先的に規格策定が急がれるものについて、適時、規格試験法・規格試験の指導を行う。

以上の品目について規格試験法の技術移転が終了したならば、順次国内に流通している加工食品に関して、同様の指導・援助を行う。

2) 官能検査

市場調査なども含む国民の嗜好調査（国家委員会による評価以外に、消費者による評価が製品開発上重要であり、官能評価法の習得が必要）。

※製造規範 (Products practice and its accredit) について

- ・ 危害分析重要管理点方式 (H A C C P) 技法による総合的衛生管理システムの導入と認証能力のあるスタッフの養成

高度な Chemical Hazard 施設と多額のランニングコストが予想される DNA 鑑定、ダイオキシン分析及び残留農薬分析技術は、対象としない（ベトナム側にて、これを実施するに十分な、高度に訓練された人材・Chemical Hazard system を完備し

た施設並びに運営するに足る local cost の手当て可能なことが前提条件)。

- ・ G L P に準じた研究所運営管理技法の移転に留意する。

(2) 研修

- 1) 知的所有権調査及びその取得と転換物を利用した製品化技術(1名)
- 2) 官能検査技術及び製品の格付け(1名)

(3) 施設、機材

官能検査室、第1段階で必要な機材に加えて、ミネラル分析装置(原子吸光)。

8-3 微生物及び酵素を利用した生物資源の高付加価値化転換技術

基礎技術を習得のあとに、具体的に生物資源の高付加価値化転換技術の習得が対象となるが、基本的にベトナム側が主体的に対象生物資源、対象転換物質を決定し、自ら開発するものとする。技術協力の位置付けは一般的な方法について指導を行うものとする。

(1) 対象生物資源

- ・ 各種農産物：米、果実など

対象生物資源、農産物についてはあえて特定化しない。

(2) 各種農産物中成分の転換

1) 技術

微生物酵素を利用した技術。

2) 転換

医薬品、食品品質改良剤、補助剤など、広い用途が望める物質への転換。

3) 転換に要する技術

微生物及び有用酵素の検索、有用酵素の生産、酵素の固定化と転換物質の生産、転換成分の分析。

(3) 研修

- 1) 微生物及び有用酵素の検索(国内)(1名)
- 2) 酵素の固定化技術と転換物質の生産(1名)

(4) 機材、施設

8-1(3)と同じ。

(5) 高付加価値化転換物質とその有効性、利用対象（マルトオリゴサッカライドの利用）

農産物を原料とした高付加価値物質として、各種のものがあるが、マルトオリゴサッカライドもその一例である。その有効性、利用対象は以下のようなものである。

- ・有効性（期待される効果）：褐変、着色の防止、つや出し、日もちの向上、こく付け
- ・利用対象：粉末化基材、滋養食（幼児、高齢者、病人など）、臨床検査用試薬（G 5。病体診断用）

9. ニーズ調査結果

食品工業研究所(FIRI)の技術レベルの向上により、国内産加工食品の品質レベルが向上するとともに、国内産の農産物の高付加価値化が期待できる。また、安全な微生物の利用は、国民の健康保持の観点から、必須のものであり、それが約束される。予測される効果の指標及び裨益対象についての分析は、以下のとおり。

9-1 プロジェクトのニーズ

次期5カ年計画で掲げられる年7%の経済成長率の達成には、民間投資が不可欠だが、そのための施策マインド、技術、制度(融資など)は容易ではない。土地を担保にしようとしても、登記簿がなく、私的所有権も未確立である。企業法が制定される方向にあるが、依然、技術の課題が残り、その解決に本プロジェクトは有効である。

9-2 食生活の変化

これまで、市場の概念のない中央計画経済に慣れ、商品は限られ、選択の余地はなかったが、現在は、食材が多様化し、従来の食材に加え、畜産物、果実及び各種加工食品などの需要が伸び、品質、栄養、食味が重視されることが予想される。1人当たりの食料摂取量(全国)のうち、肉類は、1994年0.86kgから、1996年には0.91kgに上昇し、食生活の多様化が進んでいることが示される(しかし、都市部では、1996年1.28kg、農村部では、0.78kgであり、格差が大きい)。

9-3 対象生物資源

生物資源は、全国で広く栽培されている農産物などを想定しており、微生物、酵素により、転換ができれば、農村への裨益効果も高いものと思料される。

本プロジェクトは、生物資源の生産性向上を図るものではなく、生物資源を原料として、含有成分を微生物や酵素により、有用な物質に転換する手法を移転することを目標とする。

開発されるのは、原料ではなく、食品への安全かつ有効な素材としての添加剤であり、有用な用途はあるものの、国内の加工企業向けのものである。

プロジェクトが、ヴィエトナムの生物資源の生産振興に及ぼす寄与は、直接的なものではなく、間接的なものととどまる。生物資源の有用物質への転換は、既に開発された技術による転換ではなく、研究手法の指導を受けることにより自らが技術を開発し転換するものであり、時間を要するものである。

9-4 カロリー摂取量

(1) ヴィエトナム人のカロリー摂取量と必要カロリー数

主要産物からの摂取量に係る最近の統計によれば、ヴィエトナム人のカロリー摂取は依然として低く、一層の栄養摂取が必要である(表-1)。

表-1 カロリー摂取量比較

	1983-1985	1986-1988	1989-1991	1993-1995	Required 1995
ヴィエトナム	2,259	2,240	2,226	2,414	2,157
オーストラリア	3,030	3,054	3,079	3,024	2,277
日本	2,817	2,872	2,899	2,878	2,155
ニュージーランド	3,151	3,326	3,370	3,370	2,206

出典: Selected Indicators of Food and Agriculture Development in Asia-Pacific Region, 1986~1996

FAO

ヴィエトナムのカロリー摂取量は、先進国の日本、オーストラリア、ニュージーランドなどに比べ、対オーストラリアで約25%、対日本で約20%、対ニュージーランドで約39%低い。ただし、南中アジアのなかでは中庸を保つ。

(2) 主要産物からのカロリー摂取量

表-2 主要産物からのカロリー摂取量

	cereal	root	pulses	tree nuts	oil crops	fruits	veg.	sweetner	veg. oil	ani. fat
ヴィエトナム	1,758	140	23	0	26	70	31	79	48	23
オーストラリア	700	95	37	20	35	113	57	488	249	104
日本	1,159	92	21	8	133	54	76	299	279	43
ニュージーランド	786	101	50	7	51	151	73	533	254	266

出典: Selected Indicators of Food and Agriculture Development in Asia-Pacific Region, 1986~1996

FAO

穀物からの摂取量が多い。対日本34%、対オーストラリア60%、対ニュージーランド55%増である。oil cropsからの摂取量は非常に少ない。対日本比20%、対オーストラリア比・対ニュージーランド比50%しかとっていない。野菜からの摂取量は、対日本、対オーストラリア及び対ニュージーランドそれぞれに対し約50%減。甘味料からの摂取量は、極端に少ない。日本の27%、オーストラリアの16%、ニュージーランドの15%となっている。また、アルコールからの摂取量はそれぞれの国の7%しかとっていない。

植物油からの摂取量は、それぞれの国の17%しかとっていない。動物脂肪からの摂取量は、日本の53%、オーストラリアの21%、ニュージーランドの8%しかとっていない。また、表にはないが、動物質からの摂取量はベトナム218、オーストラリア1,067、日本589、ニュージーランド1,184となっており、ベトナムは日本の57%、オーストラリアの20%、ニュージーランドの18%となっている。

9-5 ヴィエトナムの罹病率及び死亡率

ベトナム人の罹病率及び死亡率について1993年から1998年までの保健省の統計を基に以下のとおり分析した。

結核の高罹患率は栄養不足や医療の遅れが考えられる。一方、成人病の増加(ガン、心臓病、脳硬塞)は、食生活との関連が推測される。肝臓ガンが最多との回答もあったが、統計上は示されていない(原因として、アフラトキシン、A型肝炎、残留農薬が考えられる)。これら、国民の食生活の変化などの情報に基づき、具体的な食品加工振興施策を作成することが重要である。

(1) 罹病率

ベトナム人の罹病率でもっとも特徴的なことは、1995～1998年の4年間で第1位ないし第2位に下痢及び胃腸炎があげられていることである。その次にあげられているのが、呼吸系伝染病など(肺炎、急性気管支炎、肺結核)である。マラリヤは、1998年は7位になっているが、1997年第9位、1996年第5位、1995年第2位、1997年第1位で、依然並びこっている。デング熱は、1998年第4位に現れ、1995年第7位、1994年第7位と3年間10位以内に入っており、今後の推移に注目すべきである。本質的高血圧症も、1998年第6位、1996年第6位、1995年第1位、1994年第9位となっている。交通事故も、1998年、1997年以外は1996年第7位、1994年第8位となっている。

(2) 死亡率

- 1) 死亡率で最も高いのは脳内出血で、1998年第1位、1997年第2位、1996年第5位であり、1995年以前は10位以内に入っていないのに、最近の急進は注目に値する。これは、油やタンパク質摂取不足による細胞膜の脆弱性に起因しているものと考えられる。
- 2) 次に注目したいのは、肺炎・肺結核であり、1998年第2位、第3位、1997年第4位、第5位、1996年第2位、第3位、1995年第3位、第4位、1994年第4位、第5位、1993年第2位、第4位となっており、例年多くの死亡者を出している。
- 3) 胎児、新生児関係では、1998年第4位、1997年第10位以下、1996年第6位、1995年第1

位、1994年第1位、1993年第1位となっており、1997年を以外は高位に位置し、特に1993～1995年はトップ。

4) 本質的高血圧症、急性心筋梗塞は、1998年には第5位、第6位、1997年は10位以下だが、1996年第7位、第8位、1995年第6位(心筋梗塞なし)、1994年第9位(心筋梗塞なし)、1993年第8位(心筋梗塞なし)。

5) ウイルス性脳炎は、低位ではあるが、1998年第9位、1997年第7位、1996年第9位、1995年第8位、1994年第8位、1993年第9位と毎年現れている。

6) マラリヤ、デング熱については、1998年第7位でデング熱が初めて現れ、マラリヤは1995年第9位、1994年第6位、1993年第6位となっており、マラリヤによる死亡率は、1996年以降10位以内に入っていないが、デング熱が、1998年に初めて現れた。

7) 交通事故死は、1993、1994、1995及び1996年にそれぞれ3位、3位、7位、6位となって現れているが、1997年、1998年には10位以下になっている。

実数として、罹病率第1位で約30万人(人口10万人当たり500人)、死亡率では、1998年第1位で約1,500人(人口10万人当たり約2.0人)となっている。

10. 協力実施にあたっての留意事項

(1) 企業の動向

今回の調査で、国営企業でもドイツから新規に設備を購入して缶詰生産を行っている例や、また、近隣のタイを視察して独自に技術を習得し、品質の高い生産に努める個人起業家などの動きが確認できた。今後、これら企業は、激化する競争に生き残るため、品質を向上するしかなく、食品工業研究所(F I R I)は、模範となるべく品質重視を示さなければ、立ち遅れることになる。したがって、プロジェクトで品質を踏まえた技術開発、そのための分析と高付加価値化転換物質の開発を行うことは時宜にかなったものといえる。

(2) 小売業の意向

ハノイの西友ストアで、現地の加工食品の概況について聞き取りをした。ヴィエトナムの経済成長率は着実に向上している。生活にゆとりのできた富裕層も増えているが、安全・安心を望む富裕層に生産が応えていない。品質管理が必要とのことであった。

(3) 高付加価値化転換物質

国民に資する食品加工学の研究として、微生物から製品開発まで一環した体系を習得させる技術移転の1つの事例として取り上げるものであり、それを通じて、世界の研究動向を含む、総合的な能力の向上が可能となるとの位置付けである。必ずしも容易ではないが、人材育成の観点からも極めて意義の高い対象と認識する。

(4) テストプラント

テストプラントの規格水準は十分でなく、品質的にも劣ることから、生活水準の向上と企業活動の活発化により品質が重視され、早晚機能しなくなることが予想される。そうすると、自己収入財源としての維持は困難となるが、いずれにしても日本側は関与しないこととする。

(5) 廃水処理

環境保全意識が高まるなかで、食品産業から排出される廃水対策は大きな課題であるが、J E T R Oが協力を実施中であり、協力対象外とする。

経済産業省(旧通産省)は、グリーンエイドプランにて、アジア7か国で1998年からエネルギー環境問題に対応。海外貿易開発協会(J O D C)、海外技術者研修協会(A O T S)などのツールを活用して、政策対話や工場に対する技術指導を実施中である。ヴィエトナムでは、科学技術省を窓口、F I R Iとヴィエトナムの醸造研究所を通じて、企業の指導を検討中。産

業公害防止が目的であるが、ヴィエトナムでは、生産工程のロスが大きく、工程の改善が課題。そこで、本プロジェクトでは、廃水処理は除き、経済産業省（旧通産省）との重複は避けることとする。なお、JETRO側より、専門家が派遣された場合には、情報交換などの協力依頼があった。

(6) 特許

知的所有権については、ヴィエトナムには特許庁があり、特許法も制定されている（関連のJICAプロ技も実施中）。FIRIでは、米の酵素など、認証された発明はあるが、特許権は未取得とのこと。今後、着実な技術移転の成果として、世界的にも重要な微生物が発見されることも予測されることから、関連法規の遵守とともに、権利帰属については双方で決定すべきことなど、その対応について提言にて触れた。

11. 日本側の協力内容

11-1 機材供与(付属資料 13. 参照)

据付け技師の派遣や、操作研修について要望があった(また、機材の保証について、詳細を確認したい意向あり)。また、試薬は高価であることから、日本側負担が要望された。本プロジェクトでは、基礎研究が主体となることから、必要な試薬は、先方の自助努力を促しつつも、日本側が一定度負担することも求められるものと考えられる。

11-2 ローカルコスト負担

- (1) 両国政府が1998年に締結した技術協力協定では、専門家の通勤にかかわる便宜は、予算が許す限りベトナム側が措置することになっている。現在、食品工業研究所(FIRI)には、国連工業開発期間(UNIDO)供与のミニバンと普通乗用車が各1台あるが、既に10年経過し、老朽化している。しかし、新たに通勤時の車両のアレンジは困難と回答があった。また、ミニッツにて、運営に係る経費は、FIRI負担とされていることについて、十分な予算の確保には懸念があるとの発言があった。

これについては、ベトナムの他のプロジェクトの事例を参考に対応するが、日本のODA予算も限られていることから、技術協定の原則に従うことに留意してほしい旨返答した。

- (2) 日本側の負担額についての情報

ベトナム側の予算要求のため、支援額の概数でも把握したいとの要望があり、先方に5億4,500万円として連絡済み(プロジェクトコストの公開は決裁済み)。

11-3 専門家派遣及び研修員受入れ

- (1) 専門家派遣

長期専門家は、チーフアドバイザー、業務調整に加えて、微生物、転換技術/分析の4名。短期専門家は4名/年とする。分野の特性に応じて、食品総合研究所(OB含む)または(財)食品産業センターを通じてのリクルートが想定される。特に、本プロジェクトの成否を握る1つとしては、基礎的な研究能力強化のため、食品総合研究所の関与が不可欠と考えられる。短期では、食品総合研究所や、ほかの関連機関の現役研究者などを派遣することを想定している。

なお、本邦の民間企業からの技術者派遣にあたっては、公募方式によるとともに、知的所有権の帰属については、専門家派遣契約書にて対応を整理する予定である。

(2) 研修員受入れ

研修員受入れは、4名／年とし、食品総合研究所ほかの関連機関を受入先とする。

12. 今後の予定

本調査結果につき、関係機関に報告し、了承を得たのち、専門家の人選作業を開始する。それを踏まえ、平成13年度の第2四半期をめどに実施協議調査団を派遣(6～8月を想定。比較的小規模、短期間)する。また、ミニッツでも、討議議事録(Record of Discussions: R/D)締結前に実施計画(PO)、プロジェクト・デザイン・マトリックス(PDM)を作成する旨明記しており、先方も意欲的であることから、実施協議調査前に、ワークショップを行うことも検討したい。

プロジェクト開始は、第3四半期を目途とするも、専門家リクルート次第では、前倒し(9月ごろ)の可能性もある。

13. 研究概要

13-1 研究室概要

いずれも施設、試薬、情報の不足が問題点として先方から指摘された。

(1) 品質管理

研究員 10 名(うち、博士号 1 名)。内外の要望に応じて分析を行う。輸出入検査(ビナコントロール)や鑑識にも協力。液体クロマトグラフ 1 台のみ。糖、有機酸の分析を実施。タンパク質などの成分分析は未実施。2000 年 12 月までにアメリカ製のガスクロマトグラフを購入予定(4 万 5,000 ドル)。ビタミン分析は、ハノイ工科大などに委託(20～25 万ドン＝1,500～1,900 円相当)。アミノ酸分析のため、原子吸光分析も必要。残留農薬分析は不可。今後は、迅速な分析や、偽和食品の分析を行いたい意向。ヴェトナムの食品規格の策定について、科学技術省にも協力(かつてはソ連の規格「ГОСТ」に基づく)。糖、タンパク質、油、有機酸などの成分分析を主とする。必要な機材は、添加物分析と残留農薬分析機器。不明な事項は、大学、専門の分析機関などに照会。

(2) 環境

BOD、COD を測定。測定キットはハノイで現地調達が可能。

(3) 砂糖、シロップ

でんぷんの分解により製造された糖の定性、定量。

(4) 香料、香辛料

ビサの実(赤)からの天然色素を抽出。ビタミンなどの成分分析は未実施(生理機能性を有する可能性あり)。他にはガルデニアの実、黒胡椒などから色素を抽出。

(5) バイオテクノロジー

研究員 8 名(うち、博士号 1 名、博士課程 1 名が日本に留学中、修士 1 名、大卒 5 名)。デンマークから酵素を購入し、ナンプラーの速醸を行う(品質的には天然法のものに劣る)。ジュースのにごりをペクチナーゼで分解し、透明にする研究(膜を使い、繊維飲料とする方法あり)を実施。果物は収穫期が短く、廃棄分が多い。豚レバーを使った高タンパク食品(原料は、全国で 2 万 3,000 t)を製造。豚皮からゼラチンを製造。

(6) 飲料技術

研究員 10 名 (うち、博士号 1 名、修士 3 名、大卒 6 名)。ビール、酒、飲料を対象。ビールは、小規模企業のプロセス改善を目的。アルコール濃度の低い、女性向けのビールを開発中。ワインの熟成期間の短縮も課題。輸入モルトの代りに国内産の農産物を使い、低価格化を検討。ワイン (梅、イチゴ、パイナップル、米、ライチ、マンゴー) の消費は、生活レベルの向上とともに、年配者の消費も伸びる。サトウキビの搾粕からのアルコールや酪酸の製造も考慮中 (これらは、既に行われているもので、研究とはいえない)。

(7) マイクロバイオロジー

研究員 22 名 (うち、博士号 3 名、修士 5 名、大卒 10 名、技士 2 名)。酵母入手は、保存菌種を用いる (代謝性などの試験実施せず)。今後は、野生菌の収集、スクリーニング、同定、保存のための施設が必要。菌の保存は、装置の故障のため現在は使用不可 (電圧変動による故障)。顕微鏡による形状分析。ナンプラーや漬け物用の菌を有料で配布。博士、修士課程の学生を受入れ中。

(8) 食品技術、栄養

研究員 14 名 (うち、博士号 1 名、留学中 3 名、修士 1 名、大卒 9 名)。飲料の品質改善、正油の生産など。クレハの支援によるソーセージの生産 (室温で 3 か月保管可能)。

(9) 酵素

8 名の研究員 (うち、2 名博士号、1 名修士。新卒 2 名を新規雇用予定)。健康食品を開発。バクテリオファージ対策、乳製品開発などへの取り組みを検討。松食い虫問題を課題として取り組み中。室長は北海道大学で研修し、その指導教官から雑誌の提供などの支援を受ける。

(10) プロテイン技術

チーズを色素により染色。

(11) 油料

試薬は一部現地調達化。油の有効成分 (ビタミン E など) の分析は不可。

(12) でんぷん

6 名の研究員 (うち、1 名博士号、博士課程留学中 2 名、技士 3 名)。グルコースイメラーゼの研究をしているが、既に確立された技術であり、研究の必要性は低いとの認識。

(13) 図書室

旧ソ連の古い図書のみで、圧倒的に情報不足。書籍費が2,000ドル／年に過ぎず、不足。FOOD SCIENCE など、主要な英文雑誌の定期購読が必要。

13-2 日系企業との共同研究

キリンビールにより研修を実施(本邦他)。日本女子大から山岳地の子供の栄養プロジェクトの委託を受ける(1万3,000ドル)。クレハの支援によりソーセージの製造(ヴェトナム人の口に合わせるため、食味テストを実施)。

13-3 テストプラント概要

危害分析重要管理点方式(HACCP)対応の観点からは、むしろ事例として、研修のモデルとして、どうすればよいか実践を通じて指導することが期待される。日本の零細企業でも、HACCP対応は、コスト高となり困難だが、今後中長期的には不可欠であり、徐々に、しかし着実に心掛けるべきものである。

(1) ビールプラント：原料の4割は米であり、残りはモルト。ホップはドイツ産を使用。企業からの要望があれば、契約を締結して、技術移転。

(2) 乳児食：トウモロコシ、米、大豆より製造。フランスからの学生がアフリカ支援のために研修に来たことがある。

(3) ワイン：梅、リンゴ、イチゴなど(アルコール分12%)。冬はビールは好まれず、需要増が見込まれる。

(4) うどん、豆腐：うどん製造機は、在ロシアのヴェトナム人の要望により、2台売却済。

(5) ジュース加工：1990年にUNIDOにより、圧縮などの機材が供与される。梅、バナナ、マンゴージュースなどの技術を契約済み。豆乳加工もあり。

14. 企業視察

今後、プロジェクトの裨益対象となり得る企業を視察し、現状認識、改善の方向を確認した。

(1) DOALCO

ハノイから130km離れた酒造工場。食品工業研究所(FIRI)が提供した酵母を利用して、焼酎を35年前から、ビールをドイツからの技術導入により10年前から製造中。従業員は450名、ビール工場に100名、焼酎、アルコール、ジュース工場に250名、そのほか100名は事務職員である。シェアは、5割を占め、国営企業のシェア2割を超える。原料はキャッサバであり、農家から、チップを1,200ドン/kgで購入している。

(2) HAIHA 国営食品会社

菓子、グルコース生産工場。1994年から韓国企業との合併で、グルタミンモノナトリウム塩を国内向けに生産している。国内シェアは15%を占め、第1位(1万3,000t)。従業員数600名。課題は、自動設備がないこと。グルタミン酸は、韓国より輸入。2001年より発酵装置を導入予定。グルコースの生産工程は、FIRIが設計、開発した。

(3) VietTri 社

ビール、酒、砂糖の工場。廃水処理施設は、機能せず、11月から3名がJETROにて本邦研修の予定。

(4) 豆乳工場

FIRIの技術指導工場であるDAP CAU食品加工工場(Bac Ninh省、Bac Ninh町)を訪問、視察した。

- ・ 主要製品：豆乳(5000本/日、1本200cc、年間36万本)
- ・ 沿革：1959年農業機械メーカーとして出発。1988年ドイモイが始まって売れ行きが悪くなり、1993年から1999年まで代替品を作っていたが1999年生産中止。そのとき省知事からの紹介でFIRIの豆乳生産の技術を導入、生産販売。
- ・ 豆乳の生産は2000年5月に開始し、順調。このほか、Vacuum Fryingの菓子、よう素入り調味料、よう素入り食塩の生産を計画中。
- ・ よう素入り食品は、山岳地帯の子供たちの栄養分不足を補うものとして保健省からの依頼、年間1,000t出す予定。FIRIの指導で行うとのこと。
- ・ 豆乳の加工法：大豆を7時間水浸漬、皮むき機で剥皮、粉碎器にて粉碎、遠心分離機で粕除去、豆乳から油分などを除去(ろ過器)、殺菌(一次、70℃20分)、貯蔵タンクへ導入、

小分け密栓、殺菌(高圧120℃、30分)、保管(3か月可能)、販売。廃棄物は、皮と不溶物で35kg、飼料用としている。

- ・ 敷地：全体1万9,000m²：現在使用5,000m²将来増設
- ・ 販路：Bac Ninh省のほか、周辺6省へ販売。担当6名。大企業では、2,000万ℓ／年の生産規模のものもあるが、紙パック入りで高価。その点この会社はビンを使用し、回収し再使用。安価。冬期は売れ行きが鈍り、は境期用のものとしてF I R Iの指導で前述の製品を検討中。
- ・ 組織：2001年には株式会社組織にする予定とのこと。社長 Nguyen Yen Duy Linh

(5) H A I H A - K O T O B U K I (合併事業) 訪問報告

- ・ 対応者：社長鈴木鉄也氏、計画担当 Nguyen Thi Yen、技術担当 Nguyen Thi Tran
- ・ 設立：1992年ベトナムに出てきて12月許可。発売開始は1993年7月。
- ・ 出資：日本側71、ベトナム29。400億ドン(日本からの最初のJ.V)
- ・ 従業員：250名。ピーク時300名。日本人は鈴木社長のみ。
- ・ 敷地：隣の国営企業と併せ3万m²のうち、5,000m²使用。国営企業は、1,800名でほとんどキャンデー(20t／日)を手作りでやっている。これに対しこの企業は機械作り。
- ・ 製品：キャンデー、スナック、チューインガム、クッキー、チョコレート、洋菓子(ケーキ)。ほとんど国内用だが、1%以下はモンゴル、ロシアにも輸出。
- ・ 販路：ベトナム全国。ハノイ直営店6店、F. C 2店。ハイファン2店すべて専門店。近くハノイ、ハイファンにそれぞれ1店喫茶店兼業店を開く。このほかに代理店全国にあり。車(8t車2台、4.5t車1台、ワゴン車2台、冷蔵車1台)で直接全国の150の代理店に配送。この代理店は元来あったものを引き継いだもので、代理店づくりからやっていたら大変だったと思うとのこと。今は配送機能が逆に求められてきている時代。なお、南には別会社の南 KOTOBUKI (Vina Bico との合併) があり競合関係。
- ・ 趣向：日本人と味覚が違う。鈴木氏がつくり、ベトナム人が評価し種々検討したうえでレシピをつくり、出荷。
- ・ 売上：1月30億ドン。年間450億ドン(約2,300万円相当)。4～8月が落ちる時期で20～25億ドン。10～3月が多い、ときには50億ドン。
- ・ 原料：グルコース(液体)はベトナムとシンガポールから購入。砂糖はベトナム、タイ、韓国など。チューインガムは、無着色で高濃度のグルコースが必要で、シンガポール製。日本の規格に合うものを使っているが、1つだけ日本の規格に合わないものが入っていて、日本には輸出できない。
- ・ 新たな試み：キャンデー主体だが、シュガーレスも取り込む。ドイツから輸入した

「ISOMALTO」を糖源として虫歯予防、ダイエット効果をねらいとして3年先5年先を見込んで売っている。売上は微々たるもの。

- ・原料と売値：グルコースは、白度も悪く色がついているが、他社でも使って売値で競争しようとしており、品質で競争できない。しかし将来は変わると予測。「最初は、少し良い素材を使って良い味を出し、しかも同一価格で売っていくと、お客も分かってくれる」。他社は、すぐ外国からノウハウを入れて立ち向かってくる。
- ・工場見学：洋菓子工場(クリスマスケーキ)、スナック工場では米にタピオカを混ぜ、水分調整。餅状にすり、切ってパームオイルで揚げる(200℃)。スナックのもう1つは、トウモロコシに圧力をかけて放圧。チューインガム工場は(原料を50℃で1日寝かす。グルコース、砂糖香料を入れ練り込んで、温度調節し、エクスクルーダーで厚さを調整してからカット包装。包装室は湿度40%、16℃にしている。ドイツ製の自動機械。あとは手包装(雇用確保のため、自動機械はあるが使わない)。クッキー工場は連続式装置(日本製の機械)。ISOMALTO工場は、160℃まで温度を上げて作っている、棒付きキャンデー。チョコレート工場は300kgの原料仕込みタンクから始まる。ベトナムでは高級品でテトなどで食べる。ペロペロキャンデー工場はモンゴル輸出用で大多忙。キャンデー工場は35年前の機械を使って苦勞している。輸出は1%以下。Vina Controlからそのつど証明を取りつける。
- ・規格・基準：保健省で登録が必要だが、フォームが決まってないので、日本の食品衛生法をもとに自社で作ったフォームで申請。色素については、例外的に扱う。ベトナムでは、途上にあり、内部で食品衛生教育を行う。
- ・砂糖：信用のおけるものは韓国産。日本のものは高く買えない。タイ国産は溶かすと必ず異物が出る。ベトナム産も同様。
- ・賞味期間：ベトナム人にはあまりなじみがないが、KOTOBUKIは保証期間をつけている。
- ・排水基準：厳しすぎる。設備投資をして廃水処理施設を置くよりは罰金で逃げている方が得であるという考え方。政府の規制値が厳しすぎて企業がそれに見合う設備投資ができない状況。
- ・コメント：澱粉を処理して作った機能性のオリゴ糖を作って活用。今は輸入しているが、これからは研究を続けベトナムでの生産を検討する。

15. 農場視察

(1) Doang Giao 食品輸出入公社

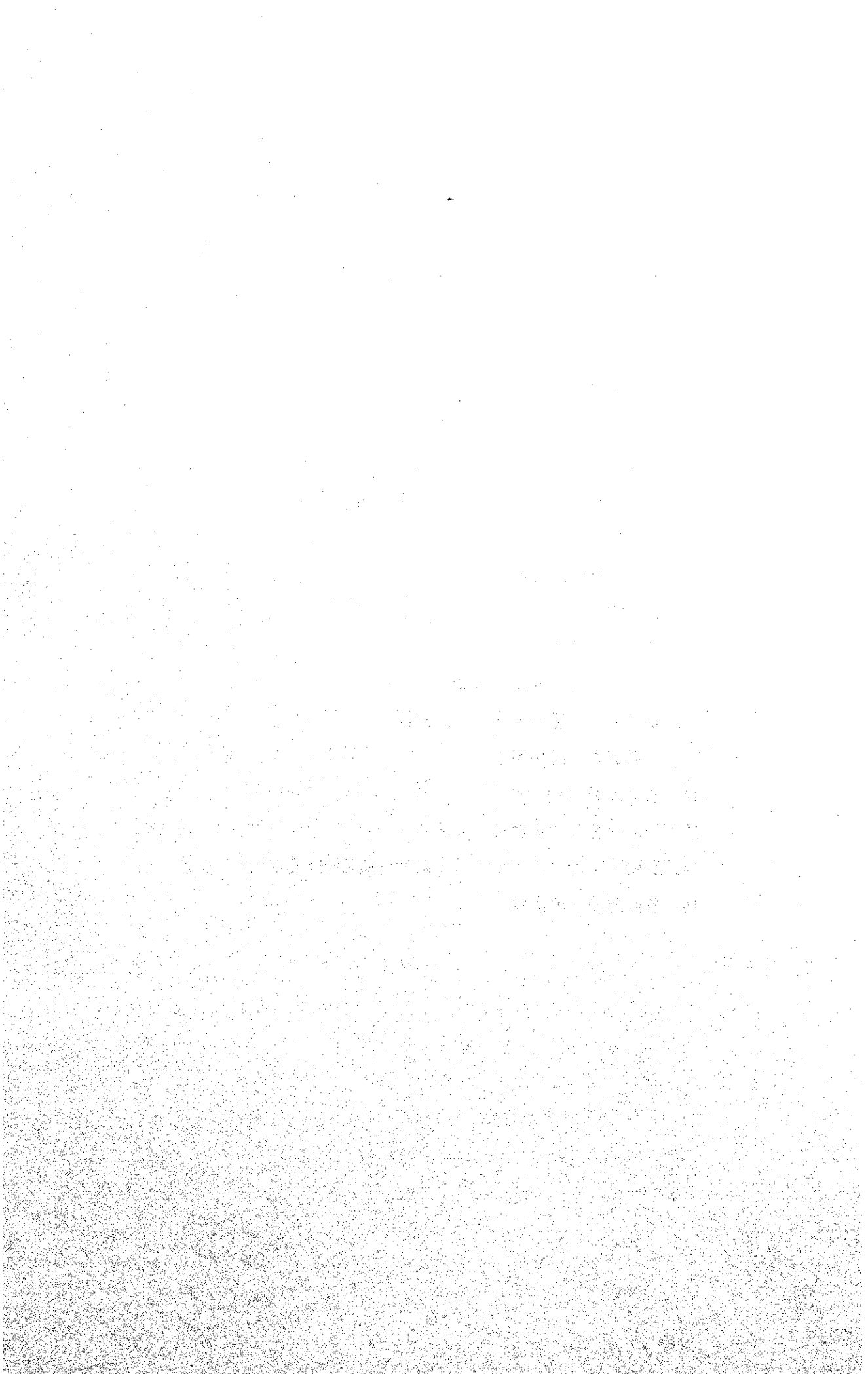
1955年設立。農業省所管の野菜・果実輸出公社の子会社中、生産が2番目に多い。2,500haの所有地を3～5ha各農家に配分し、各農家が所有、管理する。国营農場の職員は1,200名で、月給は50万ドン(約3,800円相当)。1975年以前は、コーヒーを栽培したが、その後、パイナップルの冷凍、缶詰生産を開始した。1978年にパイナップル加工工場、1990年に缶詰工場を設置。将来は果汁生産を計画中。トウモロコシ、ライチ、キュウリなどの缶詰も生産する。パイナップル缶詰は、2,000t/年の生産であり、ロシア、ドイツ、イタリアに輸出。課題は、ジュースのにごりが生ずることで、食品工業研究所(F I R I)に対応を依頼中。パイナップルの品種は2種で、品質は問題ない。栽培上の課題(開花調節、病虫害防除)は技術開発普及部門が対応。輸出検査を実施している。添加物は使用せず。2000年7月より、国の融資により、新規に缶詰工場を拡充し、11月より操業予定。1農家を訪問、粗収入1億ドン/年(10haを所有し、労働者を雇用。夫は医者、息子はホーチミンに勤務する者2名と、ハノイの大学生)。収益の7%を土地管理者に支払う。

(2) ニョックマム生産工場

かつて軍人だったが、傷病して退役。年金は受け取れるが、ハノイの大学卒業後、ニョックマムの製造を習得し、3年前に事業を開始した。現在、40名の従業員、農場(4.7ha)には25名。はげ山の浸食防止と農村失業対策を目的として、パイナップルを栽培しており、自己資金で農産物契約栽培と果実ジュースの加工を計画中。パイナップルは300ドン/個。ニョックマムの品質は優れ、売れ行きは良い。ハム製造についてF I R Iの指導を受ける。タイ、ラオスにニョックマムを少量輸出。発酵期間は1年、3年間保管。

付 属 資 料

1. ミニッツ
2. 工業省組織図
3. 食品工業研究所(F I R I)組織図
4. 食品工業研究所(F I R I)人員配置表
5. 予算措置
6. 当該分野の技術協力実績
7. 農産物統計
8. 博士論文リスト
9. F I R Iの技術指導実績
10. 規模別、業種別食品加工企業数
11. 短期調査・調査事項
12. 基本計画(当初案)
13. 先方が要望する機材リスト
14. 質問票に対するヴィエトナム側の回答(1)及び(2)
15. 各部門の活動実績



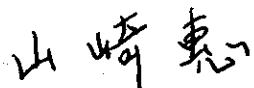
MINUTES OF UNDERSTANDING
BETWEEN THE JAPANESE PREPARATORY STUDY TEAM
AND THE AUTHORITIES CONCERNED
OF THE GOVERNMENT OF THE SOCIALIST REPUBLIC OF VIET NAM
FOR THE TECHNICAL COOPERATION PROJECT FOR STRENGTHENING
THE FOOD INDUSTRIES RESEARCH INSTITUTE
IN THE SOCIALIST REPUBLIC OF VIET NAM

In response to a request from the Government of the Socialist Republic of Viet Nam for the Technical Cooperation Project for Strengthening The Food Industries Research Institute (hereinafter referred to as "the Project"), the Government of Japan sent a preparatory study team (hereinafter referred to as "the Team"), headed by Dr Megumi Yamazaki, to Vietnam from October 17 to November 3, 2000. The Team was sent through the Japan International Cooperation Agency (hereinafter referred to as "JICA") in order to clarify the background of the request and to identify the actual status of the project and underlying problems.

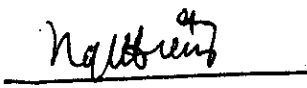
During its stay in the Socialist Republic of Viet Nam, the Team conducted a field survey and had a series of discussions with the authorities concerned of the Government of the Socialist Republic of Viet Nam.

As a result, the Team and the authorities concerned of the Government of the Socialist Republic of Viet Nam agreed to report to their respective governments the matters referred to in the document attached hereto.

Ha Noi, October 27, 2000


Dr Megumi Yamazaki
Leader
Preparatory Study Team
JICA


Dr Tran Minh Huan
Director General
International Cooperation Department
Ministry of Industry


Dr Ngo Tien Hien
Director
The Food Industries
Research Institute
Ministry of Industry


Dr Duong Duc Ung
Director General
Foreign Economic Relations
Department
Ministry of Planning and
Investment


Dr Le Quoc Khanh
Vice Minister
Ministry of Industry

THE ATTACHED DOCUMENT

1 MASTER PLAN OF THE PROJECT

After a series of discussions, both sides have agreed on the Master Plan of the Project which is shown in ANNEX 1. However, the content of the Master Plan will be further discussed and may be amended on the occasion of the Implementation Study.

2 TITLE OF THE PROJECT

As is mentioned in the cover page, the title of the Project will be "The Project for Strengthening the Food Industries Research Institute". However, the title may be changed in the course of future discussions before signing of the Record of Discussions (hereinafter referred to as the "R/D").

3 MEASURES TO BE TAKEN BY BOTH GOVERNMENTS

The Project should be carried out in accordance with the provisions of the Agreement on Technical Cooperation between the Government of Japan and the Government of the Socialist Republic of Viet Nam, signed in Ha Noi on October 20th, 1998. When the Project is realized, the necessary measures listed in ANNEX 2 would be taken by each government.

4 MANAGEMENT OF THE PROJECT

For smooth and effective implementation of the Project, both sides have agreed to appoint the agencies and position as follows, and the organizational chart of the Project is shown in ANNEX 3.

4.1 Responsible Agency

The Ministry of Industry (hereinafter referred to as the "MOI") will supervise the Project and will bear overall responsibility for providing funds, coordination, monitoring and evaluation of the Project to guarantee project implementation. The Vice Minister of the MOI will be appointed as the Project Director.

4.2 Implementing Agency

(1) The Food Industries Research Institute (hereinafter referred to as the "FIRI") will be in charge of executing the Project and will have general responsibility for administration and execution of the Project. The organization of the FIRI is as shown in ANNEX 4.

(2) The Director of the FIRI will be appointed as the Project Manager, who will be responsible for managerial and technical issues of the Project. Depending on necessity, the Deputy Director of the FIRI, who will be appointed as the Project Sub-

Manager, may act for the Project Manager.

4.3 The Japanese Chief Advisor will advise the Project Director, the Project Manager and the Project Sub-Manager on any matters pertaining to the Project.

4.4 The Japanese experts will provide necessary guidance and advice to Vietnamese counterparts and concerned personnel on technical matters pertaining to the Project.

4.5 For the effective and successful implementation of the Project, a Joint Coordinating Committee, whose function and composition are described in ANNEX 5, will be established.

5 JUSTIFICATION

Based on the study, it is understood that technical cooperation in the sector will be very effective and efficient, and also that the FIRI is a suitable organization to implement the Project.

5.1 Issues related to Agriculture and the Food Processing Industry

70% of the population in Vietnam live in rural areas and the agricultural sector occupies 30% of the total GDP. On the other hand, rural areas have lagged behind urban areas in economic development.

Therefore, the Vietnamese government is supporting the agricultural sector and plans to promote the food processing industry in addition to increasing the productivity and diversity of agricultural products.

The food processing industry adds higher value to food products and is expected to promote rural employment and more income generation in rural areas. However, the industry is mainly comprised of small-and medium-scale enterprises that do not have appropriate skills in terms of processing and quality control.

Therefore, the FIRI is expected to play an important role in developing appropriate methods in food processing and in giving technical guidance to small-and medium-scale industries.

5.2 ISSUES RELATED TO PROJECT MANAGEMENT

The FIRI was established in 1967 and is affiliated with the Ministry of Industry. Total expenditure in 1998 was about 60 (sixty) million yen. The FIRI generates half of its budget through profits in consultancy and the sale of its own products.

The FIRI comprises 1 (one) sub-institute and 14 (fourteen) research units with 183 research employees. The FIRI has conducted scientific and technological

activities, trial production projects and transfer of technology in the field of food processing. As the main building of the FIRI was newly constructed in 1997 and new equipment was provided in 1999 and 2000, the FIRI can be described as the most capable organization in the field of food processing technology in Vietnam.

6 ISSUES TO BE FURTHER DISCUSSED

There should be further study and discussions to formulate the Project in more detail. Both sides agreed to conduct the following items before implementing the Project:

- (1) to design a detailed activity plan and formulate a draft of the Annual Work Plan.
- (2) to map out the Project Design Matrix.

7 SUGGESTIONS AND COMMENTS

With regard to intellectual property rights, the Team suggested that the FIRI and JICA shall comply with the laws and regulations in force in Vietnam as well as international agreements. Also, prior to the exploitation of processes, products or materials accrued from the activities of the Project, the FIRI and JICA will jointly define the ownership of intellectual property rights of the outputs of the Project.

ANNEX 1

THE MASTER PLAN OF THE PROJECT

1 Objectives

1.1 Overall Goal

To improve the quality of foods in such areas as safety, nutrition and taste, and to add a higher value to farm products through use of appropriate processing technology. This is expected to contribute to the upgrade of farmers' income as well as to the development of the food processing industry through processing of higher quality foods.

1.2 Purpose of the Project

To improve food processing methods (such as microbiology, fermentation and enzyme) as well as quality control methods (such as analysis and assessment) in order to produce foods of higher quality safely and hygienically. Also, to upgrade the capacity of FIRI personnel to conduct research and development in food processing and to give technical guidance to food processing industries.

2 Outputs and Activities of the Project

2.1 Outputs of the Project

- (1) FIRI personnel will obtain basic and applied skills in microbiology, fermentation and enzyme.
- (2) FIRI personnel will obtain basic and applied skills in food analysis and assessment.
- (3) FIRI personnel will have increased capacity to develop appropriate materials for food processing and to give technical guidance to food processing industries.

2.2 Activities of the Projects

- (1) Skills in microbiology, fermentation, enzyme are transferred to FIRI personnel.
- (2) Skills in analyzing and assessing the composition of the materials and final products are transferred to FIRI personnel.
- (3) Based on the skills acquired, the FIRI will develop appropriate materials for food processing.
- (4) The FIRI will give more effective training and technical guidance to small- and medium-scale enterprises in order to transfer the appropriate skills and knowledge of food processing and quality control, which the Project has developed at the FIRI.

3 Site of Project activities

FIRI Central Office, Ha Noi, Socialist Republic of Viet Nam.

4 Term of Cooperation

The Project will last for five (5) years from the date to be defined in the R/D.

ANNEX 2

MEASURES TO BE TAKEN BY BOTH GOVERNMENTS

1 Measures to be taken by the Government of Japan

1.1 Dispatch of Japanese Experts

(1) Long-term experts including a Chief Advisor and a Coordinator will be dispatched in accordance with the project activities that will be discussed at a later date.

(2) Short-term experts may be dispatched, when necessity arises, for the smooth implementation of the Project.

1.2 Acceptance of counterpart personnel to the Japanese experts for training in Japan

Acceptance of counterpart personnel for training in Japan shall be arranged during the cooperation period.

1.3 Provision of Machinery and Equipment

Necessary machinery, equipment and other materials (hereinafter referred to as "the Equipment") for the Project will be provided according to the budget.

2 Measures to be taken by the Government of the Socialist Republic of Viet Nam

2.1 Provision of land, buildings and facilities

(1) Land, buildings and facilities necessary for the Project.

(2) Rooms and space necessary for installation and storage of the equipment.

(3) Office space and necessary facilities for Japanese experts.

(4) Electricity, water supply and necessary telecommunication facilities including telephone, facsimile and E-mail services.

(5) Other facilities mutually agreed upon, if necessary.

2.2 Assignment of counterpart personnel

A sufficient number of full-time counterpart personnel having advanced university degrees (at least two for each Japanese expert) and an appropriate number of part-time counterpart personnel will be assigned to the Project. The counterparts are expected to have a good command of English in order to carry out the Project activities effectively.

In addition, the Vietnamese counterparts who have received training in Japan as mentioned 1.2 above will be continuously assigned to the FIRI to ensure the sustainability of Project activities.

2.3 Assignment of administrative and technical staff

A sufficient number of administrative and technical staff members will be assigned for the smooth implementation of the Project.

2.4 Budget allocation

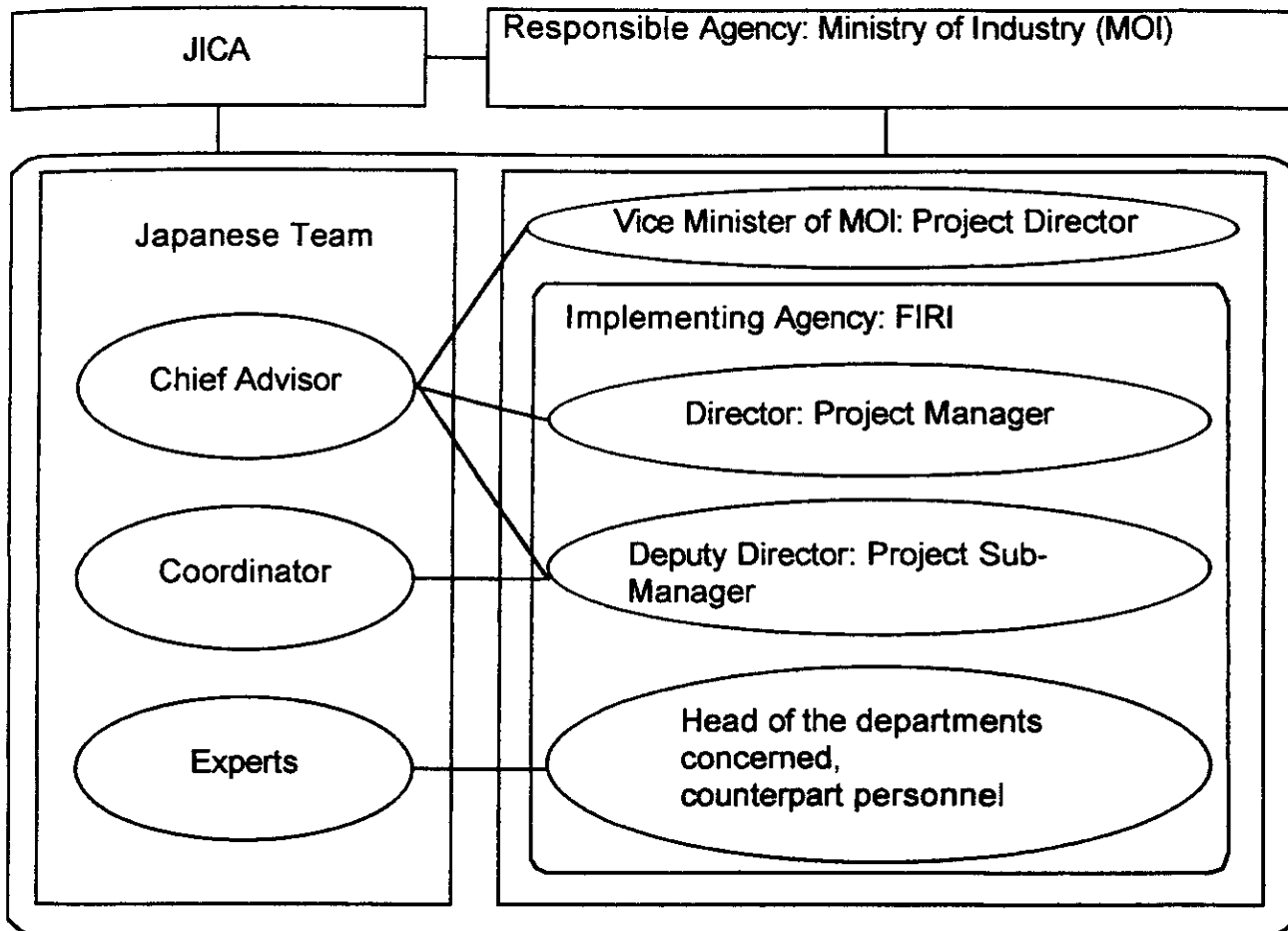
The Vietnamese side will secure the budget for the following items and is expected to take necessary measures to ensure the self-reliant operation of the Project during and after the period of Japanese technical cooperation.

- (1) Expenses necessary for domestic transportation of the Equipment provided through JICA under the Project within the Socialist Republic of Viet Nam, as well as for installation, operation and maintenance.
- (2) Expenses necessary for customs, duties, internal taxes and other charges imposed on the Equipment provided through JICA under the Project in the Socialist Republic of Viet Nam.
- (3) Supply or replacement of machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the Project, other than the Equipment provided through JICA under the Project.
- (4) All running expenses necessary for the Project

2.5 Coordination with related institutions

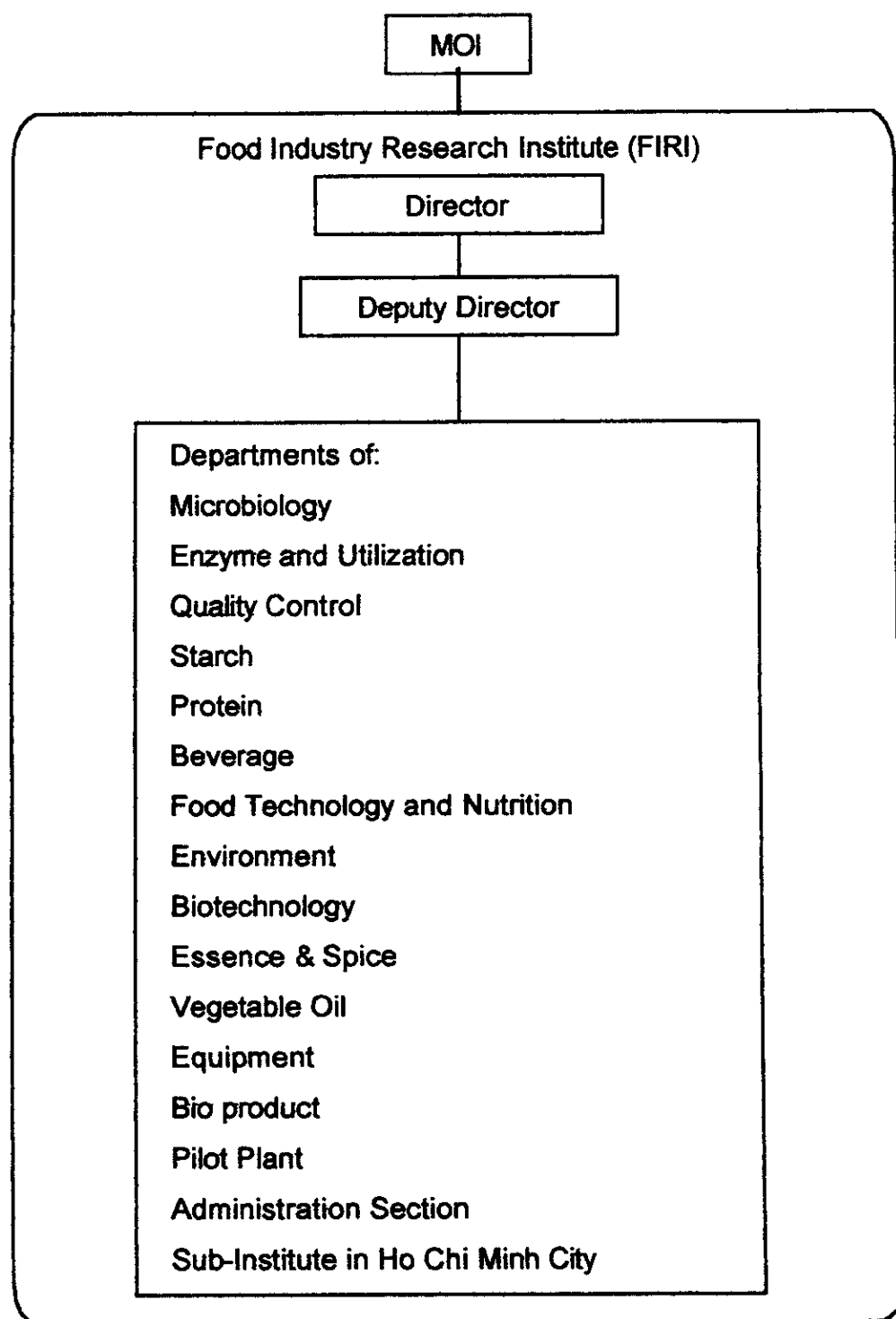
Cooperation and coordination with related organizations such as the Ministry of Science, Technology and Environment will be maintained for smooth operation of the Project.

ANNEX 3
ORGANIZATIONAL CHART OF THE PROJECT



ANNEX 4

ORGANIZATIONAL CHART OF THE FIRI



ANNEX 5

JOINT COORDINATING COMMITTEE

1 Function

The Joint Coordinating Committee will meet at least once a year and whenever the necessity arises. Its functions are:

- (1) to approve the Annual Work Plan under the framework of the Project
- (2) to review achievement of the Annual Work Plan and overall progress of the Project

2 Composition of the Committee

(1) Chairperson: Vice Minister, MOI as the Project Director

(2) General secretaries:

A) Japanese Chief Adviser

B) Director of the FIRI as the Project Manager

(3) Members:

A) Vietnamese side

a) Representative, Foreign Economic Relations Department, Ministry of Planning and Investment

b) Representative, Department of International Cooperation, MOI

c) Vice-Director of the FIRI as the Project Sub-Manager

d) Head, Department of Research Planning and International Cooperation, FIRI

e) Head of the Departments concerned of the FIRI

B) Japanese side

a) Experts assigned to the Project

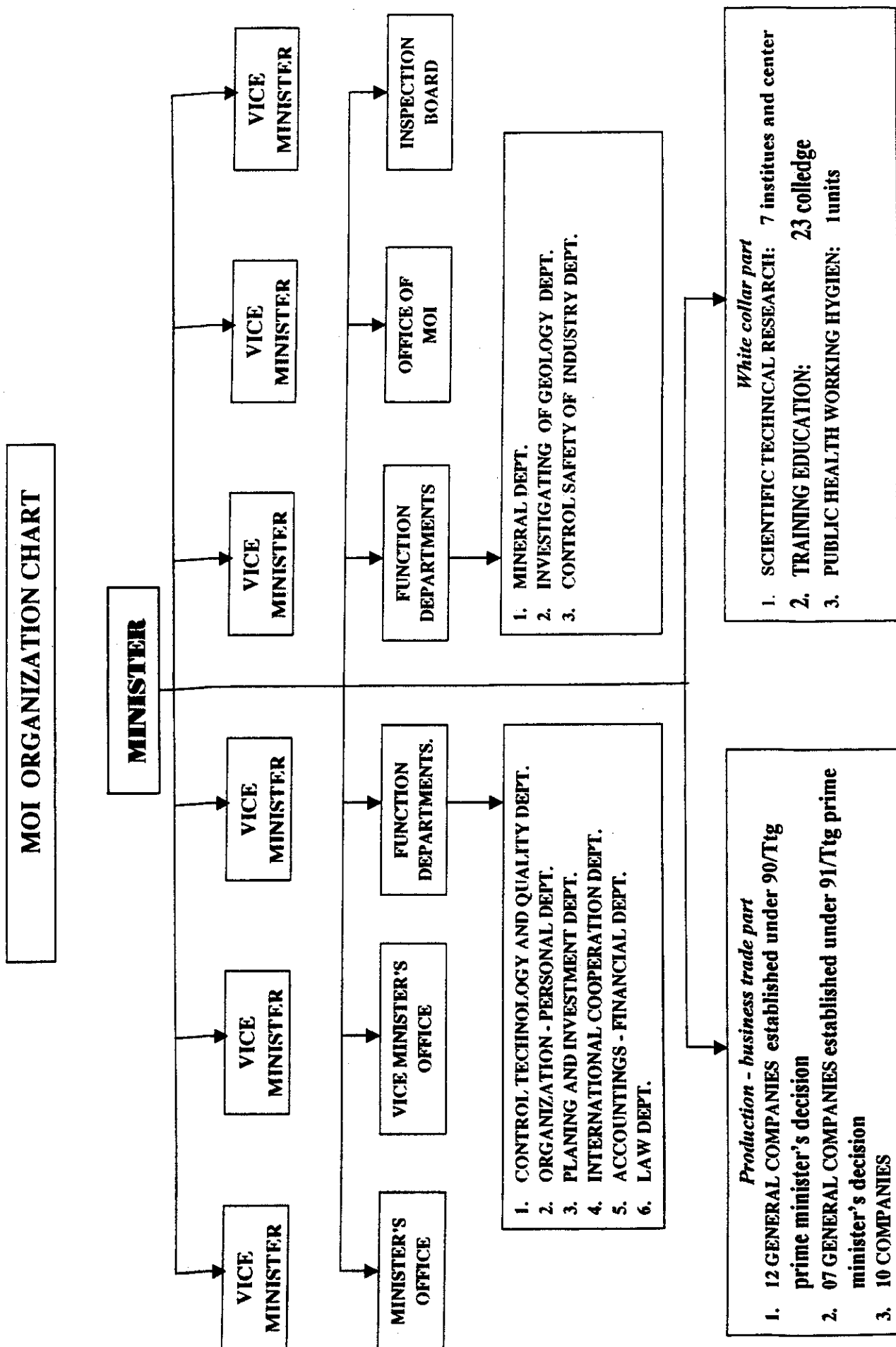
b) Personnel concerned dispatched by JICA, if necessary

c) Representative from the JICA Vietnam Office

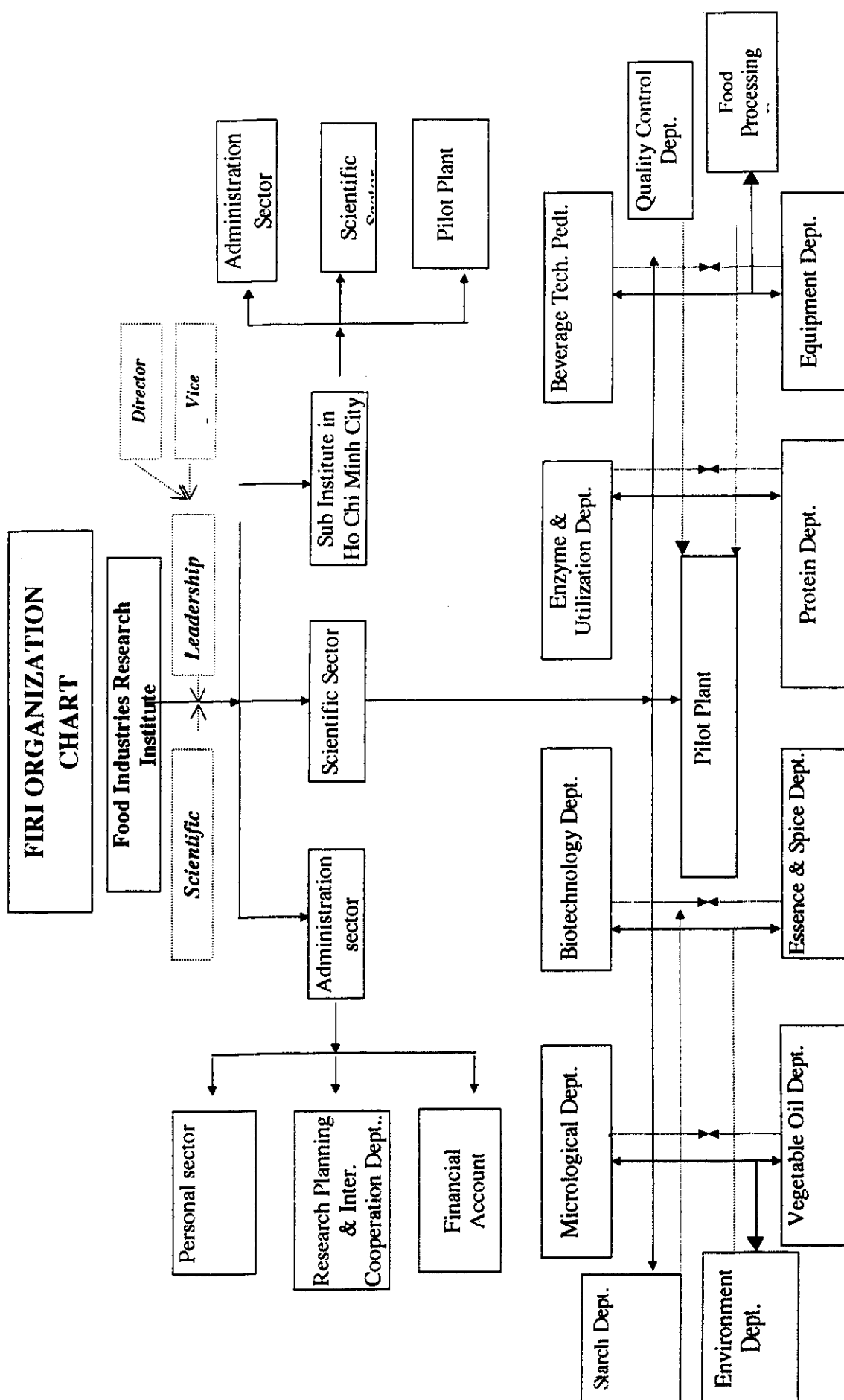
Notes:

1 Officials of the Embassy of Japan may attend Joint Coordinating Committee meetings as observers.

2 Persons who are nominated by the Chairperson may attend Joint Coordinating Committee meetings as observers.



3. 食品工業研究所 (F I R I) 組織圖



4. 食品工業研究所 (F I R I) 人員配置表

FIRI人員配置表

研究室名	博士	修士 (院生中)	修士	大学卒	短大卒	技術員	その他	計
Microbiology	3		6	8	2	2	1	22
Enzyme & Utili	2		1	4	1			8
Quality Control	1			4	2			7
Starch	1		1	4				6
Protein	1			3				4
Beverage	1		2	7	1			11
Food& Nutrition	1		3	9	1			14
Environment	1		3	2				6
Biotechnology	1		2	3	1			7
Essence & Spice	1		1	3	1			6
Vegetable Oil	1		1	3				5
Equipment		(2)		3	2	2	1	8
Bioproduct				5				5
Pilot Plant				1	13	11		25
Administration			2	6				8
人事・行政			1	2	2	3	1	9
Account				1	3			4
通信				2				2
Car						3		3
警備室				1	1		9	11
ホーチミン支所			1	7	2	2		12
合 計	14	0	24	78	32	23	12	183

(人)

5. 予算措置

2.3. FIRI fund within 5 years

(Million VND)

	1995	1996	1997	1998	1999	2000
From the Government						
Themes	1.667	2.574	3.603	3.675	3.420	3.340
Project investment	0.824	1.098	2.500	3.000	3.000	<u>10.000</u>
B. FIRI						
Technology transfer and production in a pilot	3.338	5.739	2.524	3.424	3.745	4.000
Total	5.829	9.411	8.627	10.099	10.165	<u>30.107</u>

(FIRI's budget %)

Nº	Source	1995	1996	1997	1998	1999	Preliminary 2000
1.							
2.	MPI	14,1	11,7	29,0	29,7	29,5	----
3.	MOI	26,9	21,5	30,2	26,1	26,4	15,1
4.	MOSTE	1,7	4,8	11,5	10,3	7,3	33,3
5.	FIRI	57,3	62,0	29,3	33,9	36,8	13,3

6. 当該分野の技術協力実績

1 インドネシア・ボゴール農科大学農産物加工計画（プロ技）

●プロジェクト期間：1977.10～1979.10（R/D）、1979.10～1981.10（F/U）

●日本側投入：長期専門家 12 名、短期専門家 26 名、機材 4.1 億円、研修員受け入れ 25 名

●プロジェクト活動成果：

パイロットプラントの設置運営

既存の実験室・研究の設備および機能の改善

農産物加工品の品質管理等に関する実験・実習プログラムの改善およびその実施

学部職員、学生ならびに技術・職業学校の農産加工にたずさわっている教職員の訓練

2 ペルー水産加工センター計画（プロ技）

●プロジェクト期間：1975.4～1982.4（R/D）

●日本側投入：長期専門家 20 名、短期専門家 10 名、機材 1600 万円、研修員受け入れ 32 名

●プロジェクト活動成果：

水産技術研究所の研究者を対象にし既存製品の改良、製造技術の改善、水産物の鮮度保持、冷蔵、高次薫製品製造の技術を移転。

3 フィリピン食品開発センター設立計画（無償資金協力）

●実施期間：1987.9～1989.3

●供与額：20.47 億円

●内容：民間企業への食品加工技術（品質分析、商品開発）の移転を行うための食品開発センターの設立にかかる、研修・分析棟、商品試験棟、宿泊棟、品質検査資機材、車両の供与

4 越国個別専門家派遣

●派遣期間：1999.4.1～1999.9.29

●分野：食品加工

●工業省食品工業研究所（FIRI）に配属

以上

7. 農産物統計

A. CULTIVATION: (Whole country)

1- Paddy:

	1996	1997	1998	Prel. 1999
Area (thousand. ha)	7003.8	7099.7	7362.7	7648.1
Gross output (thousand tons)	26936.7	27523.9	29145.5	31393.8
Yield (quintal/ha)	37.7	38.8	39.6	41.0

2- Maize:

	1996	1997	1998	Prel. 1999
Area (thousand. ha)	615.2	662.9	649.7	686.9
Gross output (thousand tons)	1536.7	1650.6	1612.0	1751.9
Yield (quintal/ha)	25.0	24.9	24.8	25.5

3- Sweet potatoes:

	1996	1997	1998	Prel. 1999
Area (thousand. ha)	302.7	267.2	253.5	269.0
Gross output (thousand tons)	1697.0	1691.0	1526.1	1745.3
Yield (quintal/ha)	56.1	63.3	60.2	64.9

4- Cassava:

	1996	1997	1998	Prel. 1999
Area (thousand. ha)	275.6	254.4	235.5	226.8
Gross output (thousand tons)	2067.3	2403.4	1773.4	1806.9
Yield (quintal/ha)	75.0	94.5	75.3	79.7

5- Soybean:

	1996	1997	1998	Prel. 1999
Area (thousand. ha)	110.3	106.4	129.4	129.2
Gross output (thousand tons)	113.8	113.0	146.7	144.7
Yield (quintal/ha)	10.3	10.6	11.3	11.2

6- Peanut:

	1996	1997	1998	Prel. 1999
Area (thousand. ha)	262.8	253.5	269.4	248.2
Gross output (thousand tons)	357.7	351.3	386.0	318.7
Yield (quintal/ha)	13.6	13.9	14.3	12.8

7- Sugar cane:

	1996	1997	1998	Prel. 1999
Area (thousand. ha)	237.0	257.0	283.0	350.8
Gross output (thousand tons)	11430.3	11920.9	13843.5	17840.0
Yield (quintal/ha)	479.8	463.8	489.2	508.6

B. LIVESTOCK:

Livestock population (Whole country)

<u>Kinds</u>	<u>Amount (thousand heads)</u>			
	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>Prel 1999</u>
Buffaloes	2953.9	2943.6	2951.4	2955.7
Cattle	3800.0	3904.8	3987.3	4063.6
Pigs	16921.7	17635.9	18132.4	18885.8
Horses	125.8	119.8	122.8	149.5
Goats, sheep	512.8	515.0	514.3	470.7
Poultry (<i>million heads</i>)	151.4	160.6	166.4	179.3

C. SEA PRODUCTS: (Whole country)

1- Sea products:

	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>Prel 1999</u>
Area of water surface (ha)	498,687.7	504,137.0	524,500.9	535,000.0
Gross output (tons)	1,701,002	1,730,432	1,782,001	1,881,800

2- Gross output of some sea products (tons):

	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>Prel. 1999</u>
Breeding shrimp	49,479	49,298	54,853	58,996
Breeding fish	255,959	279,323	285,626	305,717
Exploited sea fish	808,226	835,318	856,710	920,500

**D. AREA-YIELD-GROSS OUTPUT OF SOME MAIN FRUIT TREE BY REGION
IN 1995**

(Area: 1000 ha; Yield: quintal/ha; Gross output: thousand tons)

N°	Kinds	Area, yield, gross output	Whole country	By regions						
				(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Total	Area	211.53	-	-	-	-	-	-	-
		Gross output	2042.29	-	-	-	-	-	-	-
2	Orange, mandarin	Area	59.52	7.82	3.86	6.15	0.48	0.44	0.53	40.58
		Yield	105	62	70	49	62	54	105.5	130
		Gross output	379.4	24.87	23.9	23.24	2.25	0.36	3.47	304.31
3	Banana	Area	91.75	8.73	15.6	10.95	9.91	22	10	34.36
		Yield	159.1	163	184	87.3	132	407	344	11.9
		Gross output	1282.2	124.8	269.7	90.5	128.2	20.8	324.9	323.18
4	Pineapple	Area	24.04	1.7	1.1	4.04	1.4	0.4	0.4	15.5
		Yield	76.8	4.37	14.5	4.8	6.4	9.2	92	8.4
		Gross output	184.75	7.46	16.1	19.45	8.65	1.06	1.16	130.87
5	Mango	Area	21.1	2.1	0	0.37	2.84	0.37	2.65	12.74
		Yield	93	-	-	120	94	47	153	89
		Gross output	152.5	428	-	0.16	24.07	1.04	21.97	101.4
6	Apricot	Area	4.14	4.14	-	-	-	-	-	-
		Yield	57	57	-	-	-	-	-	-
		Gross output	5.14	5.14	-	-	-	-	-	-
7	Plum	Area	2.55	2.55	-	-	-	-	-	-
		Yield	87	87	-	-	-	-	-	-
		Gross output	11.15	11.15	-	-	-	-	-	-
8	Longan	Area	1.96	0.76	1.32	-	-	-	-	-
		Yield	120	-	-	-	-	-	-	-
		Gross output	14.3	3.4	7.15	-	-	-	-	-
9	Litchi	Area	6.47	3.6	2.88	-	-	-	-	-
		Yield	40	-	-	-	-	-	-	-
		Gross output	12.85	6.7	6.15	-	-	-	-	-

(1): Mountainous district and midland

(3): The forth region

(5): Tay Nguyen

(7): Cuu Long river's delta

(2): Hong river's delta

(4): Middle sea - coast

(6): South-east area

E. THE MAIN REGIONS PLANNED ARRANGE PLANT FRUIT TREE

Nº	Regions	Areas in present condition	Areas in 2010	Kinds of main fruits-trees
1	Mountainous district and midland			
	Regions plant temperate zone fruits: BacHa, Sapa (LaoCai), MocChau (SonLa), HaGiang, and LangSon.	8,200	40,000	Apricot, plum, peach, pear, apple
	Regions plant special fruit-tree CaoLoc-LocBinh-BacSon (LangSon)	6,000	15,000	Persimmon, peach, mandarin
	Regions plant orange, mandarin: LucYen, YenBai	8,300	50,000	Orange, mandarin
	Regions plant litchi, longan, pineapple: DongTrieu(QuangNinh)	14,400	60,000	Litchi, longan, pineapple
	Regions plant banana, pineapple: PhuTho-YenBai	3,500	35,000	Pomelo, orange, mandarin
	Regions plant special pomelo DoanHung(PhuTho)-YenSon-YenBinh(YenBai)	1,800	5,000	Apricot, plum, peach, pear, mango, longan, litchi, ...
	Regions plant fruit-tree along national highway N°6	23,000	40,000	
2	Hong river's delta			
	Regions plant pineapple, banana: PhuTho, LapThanh, TamDuong (Vinh Phuc)	2,200	15,000	
	Regions plant fruit-tree along highway N°21A HaTay	300	2,000	Litchi, longan, apricot, persimmon, custard-apple
	Regions plant litchi, longan, pineapple: HaiDuong, Hung Yen	9,600	40,000	Litchi, longan, pineapple
	Regions plant banana along Hong river	14,600	15,000	Banana
	Suburbs of Hanoi	300	2,000	Citrus, sapodilla, apple, banana
	Dong Giao (Ninh Binh)	2,000	4,000	Pineapple
3	The former forth region			
	HaTrung (Thanh Hoa)	1,700	2,000	Pineapple
	QuyHop (NghiaDan-NgheAn)	3,900	8,000	Orange, pineapple
	HuongKhe, HuongSon, KyAnh (HaTinh), -TuyenHoa (QuangBinh)	3,500	25,000	Pomelo PhucTrach, orange, pineapple
	Huong Thuy, Huong Tra (ThuaThienHue)	150	1,000	Pomelo, sapodilla.

8. 博士論文リスト

FIRIメンバーの博士論文リスト

No	Name	Title of thesis	period	place	note
1	Ngo Tien Hien:	Study on translation sysytem by Bacteriophage in Staphylococcusaureus 817 for resistance toanti-biotics	70-75	Czechoslova kia	Microbiology
2	Vu Thi Dao:	Research on refining technology of cottonseed oil	81-84	USSR	Oil &Oilseed
3	GiangThe Ninh:	Study on glutamic acid fermentation based on reducing sugars hydrolysed from cassava starch and sugar-cane molasses by Corynebacterium etc.	92-96	Hanoi University	Beverage
4	Le Duc Manh:	Study on amylase from Bac.subtilis in solid state and application in beer processing.	92-96	Hanoi national University	Biochemistry & Environment
5	Phan Thi Suu:	Steam distillation and optimum of clove oil	85-89	Plovdiv- Bulgaria	Aroma & spice
6	Truong Thi Hoa:	Hybridization of wine yeast Saccharomyces cerevise	86-89	Bratislava :Slovakia	Foodtech.& Nutrition
7	Nguyen Thi Du:	Submerged fermentation to produce vinegar from broken rice	84-88	Plovdiv- Bulgaria	Biotechnology
8	Phan To Nga:	Optimization of cultivation conditon for biosynthesis Cellulase and sub-activities of fungi Penicillum strain	84-87	Humboldt University Germany	Protein
9	Thi Minh Hanh:	Co-immobilization of glucoamylase and Glucoisomerase enzymes and immubilization of Strp.robeus on husk	85-89	Kiev- Ukraine	Starch
10	Pham van Thanh:	Study on microbial control methods for microbiological-amylase preparation	86-90	Kiev- Ukraine	Quality Control
11	Thi Hoai Tram:	Study on enzyme utilization and technological methods to enhance protein hydrolyzing ability from maize and rice used in beer	88-92	Kiev- Ukraine	Enzyme
12	Do Thi Giang:	Study on amylase production from the bacteria Bac.subtilis by submerge cultivation at industrial scale and its utilization in Food	84-87	Hanoi University	Enzyme

No	Name	Title of thesis	period	place	note
13	Vu Nguyen Thanh:	The destiny of yeast in the relations with animals in soil	91-93	Moscow, Russia	Microbiol ogy
14	NguyenLaAnh:	Study on production technology and utilization of polygalacturonase from the yeast strains	91-95	Moscow, Russia	Microbiol ogy

博士課程で勉強中の論文名

N	Name	Title of thesis	period	place	note
1	Nguyen Viet Anh:	Graduate school of Bioresources	99-02	Mie University	Biotech.
2	Ly Ngoc Tram:	Research into galingale essential oil exploitation	00-03	Gifu University	Aromas & spice
3	BuiQuangThuat:	Synthesis of some optical active constituents from Ricinus oil	95-01	Lodz, Poland	Food tech. & Nutrition
4	Do Tuyet Mai:	Study on fruit and vegetable preservation by biosubtarices	98-02	Republic of Slovakia	
5	Nguyen Van Dao:	Research on biosynthesis of thermostable amylase	97-01	Seoul, Korea	Food tech. & Nutrition
6	Vu Xuan Dung:	Study on synthesis protease from Bac.subtilis and applying in beer	98-01	FIRI, Hanoi	
7	PhamThiThu Trang:	Study on Biological characteristics of Bac.sphaericus and Bac. thuringiensis strains to obtain crystal protein preparations for controlling disease transmitting mosquito larve	98-02	Hanoi National University	Enzyme
8	Phan Thi Khanh Hoa:	Study on Nisin biosynthesis from Streptococcus laches	99-02	Hanoi Univ. of Technology	
9	TrinhThiKim Van:	Biosynthesis of enzyme-fructosil transferase from Asp.niger ,using in fructooligosaccharide product	99-02	FIRI, Hanoi	Food tech & Nutrition
10	Nguyen Thu Ha:	Study on high gravity brewing for beer fermentation	99-03	FIRI, Hanoi	Food tech & Nutrition
11	Truong Huong Lan:	Research on some technological solutions to improve beer flavour	00-03	FIRI, Hanoi	Food tech & Nutrition
12	LeViet Nga:	Imprvement quality of the yeast strains and their utilization for fermentation technology of flow-alcohol fruit juices	99-01	FIRI,	Microbiol ogy
13	Nguyen Van Chung:	Research into technology of pepper oleoresin preparation in Vietnam	95-00	Hanoi Univ. of Technology	Aromas & spice

Technology transfer by FIRI

No.	Product	Area	Number of enterprises	No.	Product	Area	Number of enterprises
1	Beer	Ha Noi	18	5	Vegetable oil	Ha son binh	1
		Hai phong	11			Ha noi	1
		Hai lung	8			Ha bac	1
		Hai duong	2			Ha tinh	1
		Thanh hoa	3			Hai phong	1
		Ha son Binh	1			Ha giang	1
		Quang ninh	3			Ho Chi Minh City	2
		Da nang	1			Son la	1
		Vinh phu	2			Tien giang	1
		Ha nam ninh	4				
2	Beverage	Son la	1	6	Baby food	Yen bai	1
		Quang tri	1			Thai binh	1
		Thai binh	2			Hai duong	1
		Ha tay	9			Lai chau	1
		Ha giang	1			Quang trb	1
		Thai nguyen	1			Dac lac	1
		Tuyen quang	2			Lang son	1
		Hue	1				
		Thanh hoa	1	7	Glucose	Ha tay	2
		Ha bac	1			Ha noi	1
3	Alcohol	Ha tay	2			Quang ngai	1
		Hai phong	2			Nam Dinh	1
		Ha noi	1			Thanh hoa	1
		Tuyen quang	1				
		Son la	1				
		Ha bac	1			Hoa binh	1
		Ha tay	1			Nghe an	2
		Hai duong	2				
		Thanh hoa	1			Can tho	1
		Thai binh	1			Soc trang	1
4	Instant coffee	Bac giang	1	11	Soy cheese		
		Bien hoa	1			Ha noi	3
						Lang son	1

10. 規模別、業種別食品加工企業数

NUMBER OF FOOD AND FOOD STUFF ENTERPRISE BY LABOUR SCALE
(Update to 1/7/1995)

N°	Scale	Number	Number of labourer
1	1	92	92
2	2-3	384	982
3	4-5	558	2,517
4	6-10	993	7,692
5	11-20	738	10,731
6	21-50	550	17,357
7	51-100	204	14,444
8	101-200	173	24,471
9	201-500	150	47,825
10	501-1,52000	47	30,655
11	1,001-2000	19	24,969
12	Higher 2,000	1	2,460
	Total	3,909	184,195

THE NUMBER OF SOME KIND FOOD PROCESSING ENTERPRISES

N°	Kinds of food industry enterprise	Quantity
1.	BEER	68
2.	SOFT DRINK	34
3.	WINE & ALCOHOLIC DRINKS	18
4.	CONFECTIONERY	32
5.	FRUIT & VEGETABLE	48
6.	SUGAR	35

11. 短期調査・調査事項

1 要請の背景、内容の確認

- 国家開発計画との整合性
- 農業の現状、食品工業の現状
- 食品加工技術の指導、普及体制
- 農家サイド、食品加工中小企業サイド及び最終消費者のニーズ調査

2 先方実施体制の確認

- 実施機関の組織、運営管理、関連機関の支援体制
- 予算措置、カウンターパート、人員の配置
- カウンターパートの技術レベル
- 建物施設の計画
- 現有資機材、現地調達の可能性

3 協力要請分野の範囲、基本計画（マスタープラン）案の作成のための資料収集

- 各活動項目の現状と問題点、内容の絞り込み
- 関連資料、データの収集
- 対象作物、技術内容、水準の検討

4 基本計画（マスタープラン）案の作成

- 上位目標、プロジェクト目標、プロジェクト成果、プロジェクト活動の設定
- プロジェクトの日本側投入（専門家派遣分野、研修員受入分野、機材供与のプライオリティーリスト、施設整備）

5 実施に当たっての留意事項

6 その他（専門家生活環境等）

12. 基本計画(当初案)

1 上位目標

農村の余剰農産物等に適切な加工を施すことにより、食品の安全性、栄養性、嗜好性といった品質とともに、保存性を高め、農産物の付加価値を高めることにより、農家の所得向上を図るとともに、農村地域の技術力の不十分な零細規模の食品加工企業において、品質の高い加工食品の生産を可能とする。

※食品は生体成分から成るので不安定であるが、加工保蔵技術により品質を制御することは、食生活向上に不可欠である。

※ベトナムの食文化は、コメを主食とし、味付けは、ニョックマムという魚しょうを主とすることから、味覚は日本人に近く、技術移転に際して効果的と考えられる。

2 プロジェクト目標

食品工業研究所において、食品加工技術の基礎となる、微生物応用技術、酵素利用技術及び発酵工学に係る応用技術並びに食品保全及び成分分析評価といった品質管理能力を高めることにより、実用的な加工食品開発とともに、食品加工企業に対する技術指導能力を高める。

3 成果

- (1) 食品加工技術の基礎となる、微生物応用技術、酵素利用技術及び発酵工学に係る応用技術が向上する。
- (2) 食品保全技術及び成分分析評価能力が向上する。
- (3) 実用的な加工食品開発及び技術指導能力が向上する。

3.1 微生物応用技術、酵素利用技術及び発酵工学に係る応用技術の向上

(1) 考え方

食品加工技術の基礎となる、微生物応用技術、酵素利用技術、発酵工学に係る応用技術分野は、先方優先順位が最も高い分野である。

具体的には、伝統的発酵食品、有機酸発酵、醸造、菌株保存等、基礎となる技術を習得する

ことを主眼とする。本調査にて、対象技術、レベルにつき、より詳細を確認する。なお、先方の要望分野は以下のとおり。

●微生物応用技術：サトウキビ精製の副産物から有用物質を形成（糖蜜から、アルコール、乳酸、酵母等を産出）。

●発酵工学：伝統的発酵食品の品質改善（魚しょう、醤油、発酵豆腐、発酵肉、漬物等）、アルコール醸造技術の向上（中小ビール製造業対象）、廃水処理技術。

●酵素利用技術：キャッサバでんぷんから糖を生成（グルコース糖やフラクトース糖）、大豆、魚、肉等から高タンパク質や機能性食品を生成、濃縮果汁の品質向上（ペクチンの分解）、果実からの発酵食品の開発。

※酒、醤油、味噌、納豆、チーズ、一部の漬物、酢、みりん等は、発酵作用による加工食品であり、いずれも原料よりも、保存性、食味、滋養性（ビタミン、無機質、必須アミノ酸を豊富に含む）、健康的機能（制ガン作用物質を含む等）が高い。

3.2 食品保全技術及び成分分析評価能力の向上

いかなる加工食品においても必須となる品質管理のための基礎技術の強化を主眼とする。

（1）食品保全技術

水分除去、浸透圧の利用（塩蔵、糖蔵）、pH 調節、酸素の除去、低温貯蔵、包装、殺菌、添加物利用等、食品の変質を制御する保蔵技術を強化する。

（2）成分分析評価

HACCP、世界食品規格（CODEX）等も視野に、食品の衛生、安全性を保持する品質管理機能の強化を図るため、その基本となる成分分析評価能力を向上させる。

（3）環境汚染技術

環境保全意識が高まる中で、食品産業から排出される廃水対策は大きな課題であることから、微生物を利用した廃水処理対策技術の向上を図る。

3.3 実用的な加工食品開発及び技術指導能力の向上

（1）実際の製品開発にあたっての調査の必要性

応用技術、品質管理能力を修得の後、プロジェクト後半から、実用的な加工食品開発に取り

組むこととする。したがって、プロジェクト前半は、対象農産物や対象技術の特定、製品開発ニーズ把握のため、市場ニーズ等に係る調査を行う（短期専門家やローカルコンサルタント活用を想定）。

※食品産業には、原料生産、原料流通（国内調達と輸入あり）、原料処理加工（加工の程度により1次～3次まで）、食品流通、最終消費の5段階がある。本プロジェクトは、第3段階に対する協力であるが、前段（原料流通）や、最終消費段階に係る調査が、製品開発には不可欠である。

※調査には、余剰農産物の調査（生産量等の各種統計）、食品加工業の現状調査（企業数、生産量）、市場調査（原料、加工食品）、開発すべき製品の加工適性調査、食文化調査等がある。

※人の食料摂取には限界があり、風土に順応した可食物の摂取により食料消費体系は基本的に保守的であることから、食品産業の市場は安定性が高い一方、広がりには限界がある成熟市場とされ、新規参入は困難とされる。

※食品選択は、知識（健康、栄養、生活様式適応、年齢層）や所得に左右される。食味、食慣習、健康寄与度、経済性の他、包装や宣伝によっても、消費性向や購買意欲は影響を受ける。また、主食、副食、嗜好物といった食品によっても飽きに差は生ずる。したがって、加工食品の市場における寿命は概して短命であり、少量多品種が著しい。また、新製品開発の競争は激烈である。したがって、製品開発には十分な調査が必要である。

（2）原料の選定

原料としては、国内で生産されるものであり、農村への裨益効果が高く、農家の生産意欲の向上につながり、品質が均一で安定供給しうるものであることが求められる。そこで、食品としては、安全性、栄養性の高いものが求められる。

※食品産業は、国民への栄養補給という社会的意義を有し、健康志向が高まっていることから、今後は、食品の安全性への配慮が不可欠である。

※ヴィエトナムの農業生産は、家族を生産単位とし、余剰農産物の自由販売が認められたことにより、輸出も可能となった（主要な輸出先はロシア東部）。米は、タイ、アメリカに次ぐ世界3位の輸出国であり、農業生産量の9割を占める。他は、トウモロコシ、大麦（ビール原料）、小麦（パンや菓子）、キャッサバ（デンプン、麺類）等がある。

※野菜、豆類は、主として自家消費又は家畜の飼料。商業的野菜生産は、大都市近郊でなされる。野

菜生産には、輸入農薬の1/2を消費するといわれる。

※野菜、果実においては、生鮮、加工いずれの場合でも、品質の高度化、均質化が求められる（乾燥野菜を製造する日系企業は、現地作物の品質が一様ではないことが、企業にとってネックであるため、日本から種子を輸入し、契約栽培にて対応する例あり）ので、要件を満たす理想的な原料の確保は、容易ではないことが予想される。

※ベトナム戦争中に、米軍が散布した枯葉剤の影響は、南部のカンボディア国境地帯やメコン等に限定されていると言われる。

（3）加工技術の内容と技術水準の設定

プロジェクト前半にて、修得した加工保全技術に基づき、その内容と水準を設定する。

※加工には、第一次（原料から著しい変化のないもの）、第二次（パンやソース等、一次食品のさらなる加工）、第三次（冷凍食品、レトルト食品、菓子、嗜好飲料等、さらに加工度を増した食品の製造）がある。

※製品化に当たっては、製造に用いる機械、びんや缶等の包装機材、流通業等、関連技術や産業の発展も求められる。

（4）中小規模の企業を対象とする技術普及活動の強化

FIRIにて開発された技術は、受益者負担により研究所にて有料の研修がなされる他、巡回指導もハノイ周辺を中心に行われてきたが、プロジェクトにおいても、関連技術に係る、研究者や中小企業の技術者への普及活動を一層強化することとする。その際は、当該業界との連携も念頭におく。

※FIRIは、81年以降、指導した企業数は125社に達する。

※ヴェトナムでは、中央政府管轄の大規模公社と、それ以外の中小企業（10人未満の事業所数シェアは98%、従業者数シェアは62%）に大別でき、FIRIは後者を対象とした技術移転活動を行い、企業との有償契約により、ビール醸造、でんぷん加工、魚しょう、食物油脂、ベビーフード等の成功事例がある。

※保存性の観点から、食品加工業は、強い地域性を有し、中小規模生産が通常であるが、他産業に見られる下請けの構造は希薄といわれる。

※食品業界は、原料の需給、価格情報や、共同購入、規格設定、品質管理、技術改善、流通消費調査、消費拡大宣伝等を行う。業界との連携は、技術普及に有効と考えられる。

4 専門家依頼先

専門家については、分野の特性に応じて、食品総合研究所（OB含む）又は食品産業センターを通じてのリクルートが想定される。特に、本プロジェクトの成否を握る1つとしては、本邦の民間企業の関与が考えられる。そこで、企業からの技術者派遣にあたっては、国立大学における民間連携や他の特殊法人等の事例を参考に、公募方式等、その対応を整理することとしたい。なお、環境汚染対策技術や市場ニーズ等に係る調査は、短期専門家を想定。

5 実施体制

（1）関連機関

責任機関は工業省（1995年設立）とし、実施機関は食品産業研究所とする。連携機関としては、科学技術環境省（95年までの所官庁。引き続き支援機関として位置付け）、農業農村開発省（野菜、茶、砂糖を所管）、ポストハーベスト技術研究所等がある。

科学技術環境省は、工業省とともにFIRIの目標設定を指示する。関連機関は、研究対象について、科学技術環境省の指導のもと、FIRIとの重複を避けるべく調整している。

※公社管轄の機関として、ポストハーベスト技術研究所の他、茶業研究所、野菜果樹研究所、タバコ経済技術研究所、醸造研究所があるが、食品加工分野は、食品産業研究所に統合の方向にある。

※ポストハーベスト技術研究所は、2000年6月に農業農村開発省・北食料公社所管から、農業農村開発省の直轄となった。同研究所は、一次加工が中心であるが、FIRIよりも施設、機材の水準が劣るので、技術協力の受け皿としては不十分であると、基礎調査団は判断。対象とはしないこととする。

（2）食品産業研究所

食品産業研究所は、食品加工の新技术の開発、中小企業や若手研究者等に対する研修指導、国内産物から栄養価の高い高付加価値食品の開発を目的として、1967年に設立され、15研究部門（スパイス香料、微生物学、食品技術・栄養、酵素活用、飲料、油脂、バイオテクノロジー、生物処理、タンパク質、食品分析管理、加工機械他）から構成され、ホーチミンに支

所を持つ。

全要員数約260名中、研究員数は183名であり、そのうち大卒以上は128名（うち博士号取得者17名）である。

年間予算（98年）は、約6千万円であり、うち5割が自社製品の販売による自己収入である。

※1988～91年まで、UNIDOにより総額1.3億円の援助を受け、国内産原料を用いた応用微生物分野を中心に、応用研究、産業界への技術指導、技術者の研修、パイロットプラントの整備、マニュアル育成を実施した。キリンビールや協和発酵は専門家を派遣した。

※過去5年間のFIRIの課題は、国内資源の活用、伝統的な微生物技術の近代化、栄養補給のため、特に幼児、高齢者、病人を対象とする自然食品の開発、国民の新しい嗜好の開発による農産物利用の増大、果実、野菜の保存性を高めることによる農村への利益還元等である。

以上

13. 先方が要望する機材リスト

2.6. Equipment in use

<i>The name of equipment</i>	<i>Department</i>	<i>Supplier</i>
Analytical balance	Food analysis and control	FIRI
HPLC system		UNIDO
Spectrophotometer H-200		FIRI
Fluorescence spectrophotometer F-200		Ditto
Furnace		Ditto
Shaker incubator CH4103	Biotechnology	UNIDO
Micro Kjeldal		Ditto
Microscope		Ditto
Centrifuge		FIRI
Microscope and photo, video system NIKON	Microbiology	Ditto
BOD v μ COD analyser		Ditto
HACCH-DREL/2010 deep freezer - 85°C		UNIDO
Centrifuge		Ditto
Laminar air flow		Ditto
Rotary vacuum evaporator BUCCHI R144/A	Spices and aroma	FIRI
Centrifuge ALC 4217	Enzyme	Ditto
Incubator		UNIDO
Homogenizer	Oil and oilseed tech.	FIRI
Freeze dryer BETA-216	Food tech.	UNIDO
Fermenter Biostat E x 2		Ditto
Microscope		Ditto
Electrical steamer		FIRI
25 litter fermentation system		KIRIN BREWERY CO.
Spectrophotometer JANWAY 6300	Biological preparation	FIRI
Spectrophotometer	Beverage tech.	Ditto
Microscope		Ditto
Spray dryer APV	Engineering	UNIDO
Canning machine		Ditto
Butter separator		Ditto
Freeze room		FIRI
Vertical autoclave		Ditto
Universal grinding machine		Ditto
Wet grinding machine		UNIDO
Double water distiller		-nt-
Pilot plan (Beer)		
Pilot plan (Soft drink)		
Pilot plan (Enzyme)		
Pilot plan (Oil)		
Pilot plan (Baby food)		

機材リスト (機材供与要望分)

EQUIPMENT TO BE GRANTED BY JICA

N ^o	Equipment	Number
1.	HPLC	1 set
2.	Beer analyzer SCABA	1 set
3.	Atomic absorption anly.	1 set
4.	Pure water prod. equip.	2 set
5.	Fat rapid analyzer	1 set
6.	Crude fiber analyzer	1 set
1.	Atomic absorption anly.	1 set
2.	Centrifuge and cold centrifuge with high speed	1 set
3.	Refrigerated microcentrifuge	1 set
4.	Refrigerated ultra centrifuge	1 set
5.	High speed refrigerated centrifuge	
6.	Disc centrifuge	1 set
7.	Eppendorf centrifuge	
8.	Centrifugeuses et essoreuses industrielles	1 set
9.	Programmable Universal Centrifuge	1 set
10.	Microscope	2 set
11.	Evaporator	1 set
12.	Incubator with timer	3 set
13.	Incubator with CO2 control	2 set
14.	Incubator shaker with temp. Control Horizontal (1) and orbital (2)	3 set
15.	Viscosimeter- Canon B-98934-15, VT-03, Orion (Japan)	2 set
16.	Viscosimeter AVS 440 avec bain thermostablique 2 postes 150°C; 0.3-1000 cp	
17.	Vacuum dryer	1 set
18.	Drum dryer	1 set
19.	Cold dryer	1 set
20.	Spray dryer	2 set
21.	High-vacuum vapourization equipment	1 set
22.	Lyophilisator	1 set
23.	Fermentor starter - 3 liter	1 set
24.	Fermentor -5 liter	1 set
25.	Fermentor- 10 liter	1 set
26.	Continuous fermentor	1 set
27.	Refractometer-Leica-Abbe	1 set
28.	Thin Layer Chromatography	1 set
29.	Deep freezer	3 set
30.	Press machine for lab. scale	1 set
31.	Spectrophotometer	3 set
32.	ấm烘ng ngoại	1 set
33.	Gravity convention oven	1 set
34.	Water quality checker- U23 Horiba Japan	1 set
35.	Cell Counter - TOA, AF 100 Japan	1 set
36.	Gel strengthen measurer	1 set
37.	Desolved oxygen measurer	1 set
38.	VWRbrand Low Temperature/B.O.D Incubator Model 2005	1 set
39.	Eppendorf Pipetors, 2100 Series, Brinkmann	1 set
40.	GeneAmp. PCR system 9600	1 set
41.	ABI PRISM 377 DNA Sequencer	1 set
42.	Concentrating pan	1 set
43.	Sugar crystalizer	1 set

EQUIPMENT TO BE GRANTED BY JICA

Nº	Equipment	Number
44.	Laboratory mills	1 set
45.	Multiple steam baths	set
46.	Mixing powder machines	set
47.	Seitz enzinger noll (Sheet filter)	1 set
48.	Automated DNA sequencer	1 set
49.	Image documentation and analysis system (Model Image master VDS)	1 set
50.	Gel-protein spectrophotometer (Model UL trospec)	1 set
51.	Pipetman 1000, 5000 µl	
52.	Pipetman 100, 200 µl	
53.	Pipetman 10, 20 µl	
54.	Vacuum concentration DNA system	
55.	Low temp bath circulator	
56.	Others	

THE EQUIPMENT FOR PILOT PLANT

No.	Equipment	Number
1.	Twin screw Extruder	1 set
2.	Vacuum dryer	1 set
3.	Cold dryer	
4.	Drum Dryer	1 set
5.	Meat mill	1 set
6.	Mixer	1 set
7.	Press fill machine	1 set
8.	Cutter	1 set
9.	Packaging	1 set
10.	Retort sterilizer	1 set
11.	Ultra filter	1 set
12.	Enzyme clarification and purification	1 set
13.	Fermentor 50 liter with control management	
14.	Fermentor 500 liter with control management	
15.	Fermentor 1000 liter with control management	
16.	Fermentor 5000 liter with control management	
17.	Others	

14. 質問票に対するヴェトナム側の回答(1)及び(2)

質問票に対するヴェトナム側の回答(1)

越側回答の要約

1.日本側からの提案に対してのコメント

(1) 食物分析検査分野

- 1) 物質形成中の原料および研究開発活動によって完成した成果物の分析と定義に近代的な機材供与が必要。
- 2) 食品の安全と機材の効果的な活用のため、食品分析と評価に関する職員研修が必要

(2) 環境汚染分野

横山専門家の報告書の指摘の通り生物学的な污水处理技術が必要。

(3) 実用化技術分野

以下の3分野の技術に焦点を当てたい。

- 微生物技術
- 発酵技術
- 酵素技術

2.実施体制について

農業農村開発省は農産物の加工の管理を行う。工業省はたばこ、酒類、飲料、食品加工、乳製品の管理を行う。水産省はえびと魚類の生産管理を行う。

1996年10月24日制定により FIRI は工業省所管の6の機関の一つとなった。

政府は原料投資、基盤整備、研究室およびパイロットプラントの機材整備、研修などに優先順位を与える政策を決めた。

これら組織は公社の生産に寄与するために科学技術の研究と、科学技術を開発するための投資を公社から受ける任務がある。

(1) 食品加工に関係する組織

- 1) FIRI は工業省直轄の食品加工分野における特殊な科学技術組織である。
- 2) 食品加工の公社は以下の通りである。

- 3) 上記組織は効率的な活動を行うため、近い将来 FIRI に統合されることが各関係省庁の参加のもと検討されている。しかし、現在まで財政的な問題から実現には至っていない。

3.FIRI とポストハーベスト技術研究所との関係について

1967 年 7 月の FIRI の設立当初、ポストハーベスト技術研究所は FIRI の食品部であった。その後、1971 年 3 月に制定により食品保存の科学技術研究の役割を食品省の保存部門から FIRI に移管した。

研究と生産を連結するため、FIRI のいくつかの部門は研究センターや組織として切り離された。そのうちの 하나가ポストハーベスト技術研究所で、1981 年 4 月に設立された。

FIRI は工業省、ポストハーベスト技術研究所は MARD の所管である。

ポストハーベスト技術研究所の役割は以下の通りである。

- 1) 農産物の流通加工に関する基礎研究の実施
- 2) 農産物の品質管理と基準作り
- 3) 生産者への技術移転
- 4) 農産物加工に従事する関係者への研修や啓蒙。
- 5) 新技術導入のための海外協力の拡大。

4.FIRI の主な業績

過去 30 年に 274 の課題について、236 の中小企業に技術移転を行った。1981 年より現在までに、県レベルにおいて 48、省庁レベルにおいて 56、草の根レベルにおいて 40 課題を行った。

科学技術省の監督のもと、FIRI と他の機関との活動の重複は避けているが、情報も共有ができていないために既に実施された活動が繰り返し行われることもある。

他の機関との連携による活動は多い。例えば、ポストハーベスト技術研究所とはバナナ、マンゴー、ライチなどの保存技術の研究を行っている。また過去には食品産業の汚水処理技術について熱帯生物学研究所と共同研究を行った。

5.農産物の優先度

(1) 微生物技術分野

サトウキビ加工時の副産物（糖蜜を利用した、アルコール、乳酸、酵母菌の生産など）、バカスは食用茸栽培に活用される。

(2) 発酵技術分野

伝統的は発酵食品（魚醤、薫製、漬け物等）に応用。その原料は大豆、肉、魚、野菜等）

アルコール飲料：米と穀物、ビール生産においては中小企業への技術支援が必要。

(3) 污水处理分野

中小企業は予算や技術不足から污水处理には力を入れていないことから、政府の政策に応えるような研究活動が必要。

(4) 酵素技術分野

メイズ、サツマイモ、キャッサバが重要。1999 年の統計では、キャッサバは 180.7 トン生産されている。酵素技術を適用することにより、ブドウ糖などを生成し、医薬品、食品、飲料生産を行う。

大豆、魚、肉などからは酵素技術により高蛋白質食品を生産する。

果物加工においては酵素技術によりジュースや高濃度飲料を生産する。

(5) 発酵技術

サイダー、ワイン、シャンペーンなど。現在まで果物の加工品の割合は少ない。

6FIRI の重点地域について

北ヴェトナムが中心。南部のホーチミンに支所を置き、技術移転の拠点としている。

7.中小企業における技術移転の実績

農民の経済効率のために中小企業に技術移転をおこなっている。中小企業は技術向上を行い、地域における農産物の加工をして消費に貢献している。

また、微生物の開発にも力を入れている。（資料参照）

FOOD INDUSTRIES RESEARCH INSTITUTE

**REPLY THE QUESTION FROM JICA HQ ON PREPARATION
FOR THE STUDY MISSION ON PTTC FOR FIRI**

Hanoi, July 2000

REPLY THE QUESTIONS FROM JICA HQ ON PREPARATION FOR THE STUDY MISSION ON PTTC FOR FIRI

Question 1:

We agree with JICA HQ that for PTTC from FIRI to JICA should be focused on 3 fields as follow: food analysis test, environmental pollution measures and the technology for the practical use.

For food analysis test, we need the assistance in both sides:

- Being supported new and modern equipment for analysing and defining the composition of materials as well as final products produced in research and development activities.
- Received training staffs to carry out analysis and evaluation food products in order to get the safety and hygiene of food and efficiency using the supporting equipment.

Regarding to the environmental pollution measures, we would like to know more detail about the contents of this item. As indicated in Mr. Hiroshi Yokoyama's report, we need the help in the technology of biological treatment of wastewater from food industry.

For the technology for the practical use, we would like to consider in 3 main technologies as follow:

- Microbiology technology
- Fermentation technology
- Enzyme technology.

Question 2:

1. The system for implementation:

In order to answer this question, we would like to explain the situation in Vietnam at this stage.

1.1. The host Ministries controlling enterprises and scientific and technological organizations on agriculture, forestry and fishery in Vietnam (from 1992 up to now):

Ministries managing production, trade, scientific and technological activities, training, investment, co-operation among organizations under Ministries. In food industry, each Ministry manages certain fields, as follow:

- Ministry of Agriculture and Rural Development (MARD): Managing production on products of foodstuff, farm products, cattle, poultry, sugar cane, coffee, tea, rubber tree, cashew, cacao, oily tree, fruit and vegetable...
- Ministry of Industry (MOI): Managing production on tobacco, alcohol, beer, beverage, confectionery, food processing, milk industries.
- Ministry of Fishery (MOF): Managing production, exploitation, rearing shrimp, fish...

1.2. System of Corporation and Companies:

Based on owned scales, activities, investments, products, there are many Corporation under regulation of Ministries.

Ex.:

- North Foodstuff Corporation (MARD)
- Vietnam Sugarcane and Sugar Corporation (MARD)
- Vietnam Tea Corporation (MARD)
- Vietnam Vegetable and Fruit Corporation (MARD)
- Vietnam Coffee Corporation (MARD)
- Vietnam Alcohol, Beer and Beverage Corporation (MOI)
- Vietnam Tobacco Corporation (MOI)
- Vietnam Milk Corporation (MOI)
- Fishery Company Area No. 1 (MOF)
- Fishery Company Area No. 2 (MOF)
- State Sea Product Company (SEAPRODEX-MOF)

1.3. System of scientific and technological organizations

The Prime Minister of Government has issued the Decision No. 782-TTg on October 24, 1996 about organizing 41 National Institutes under Ministries and ministerial level bodies, in which Food Industries Research Institute is 1 of the 6 Institutes directly under regulation of MOI.

The Government has issued policies giving priority to investment on material, infrastructure, laboratory's and pilot plant's equipment, training personnel ... for Institutes under Ministries.

The Institutes under Corporations are receive tasks to research science and technology to serve production of Corporations and received investment from Corporations to develop science and technology.

Several scientific and technological organizations involve Food Processing:

- a) Food Industries Research Institute is the unique scientific and technological organization on Food processing technology directly under Ministry.
- b) The Institutes under Corporations on food processing:
 - Post-harvest Technology Institute (North Foodstuff Corporation)
 - Tea Research Institute (Vietnam Tea Corporation)
 - Vegetable and Fruit Research Institute (Vietnam Vegetable and Fruit Corporation)
 - Tobacco Economic and Technical Research Institute (Vietnam Tobacco Corporation)
 - Alcohol, Beer and Beverage Research Institute (Vietnam Alcohol, Beer and Beverage Corporation)
- As we have mentioned above, there are many organizations related to food processing under regulation of different Ministries and Corporations. Therefore, their activities still are dispersed and get low efficiency. There are many meeting on this matter and agreed on principle that all organization related in food processing will be merged into FIRI in the near future. The participants of these meeting are Governmental Organization Board, Heads of Ministries, Departments, Institutes of Ministry of Industry, Ministry of Science, Technology and Environment, Ministry of Finance, Ministry of Planning and Investment and Ministry of Agriculture and Rural Development. However, this merger can not be implemented at this moment because of lacking of finance support from the Government.

1.4. Relationship between Food Industries Research Institute (FIRI) and Post-harvest Technology Institute (PhTI)

a) History:

The original organization of Post-harvest Technology Institute is Foodstuff Department of Food Industries Research Institute, which is set up since establishment of FIRI based on the Decision No. 112/CP of the Primer Minister on July 21, 1967. After that, Ministry of Food and Foodstuff had issued the Decision No. 277/LTTP/QD dated March 4, 1971 to move the duty of scientific and technical research on preserving foodstuff from Preservation Department, Ministry of Food and Foodstuff to FIRI.

Due to demand of connecting research and production, some departments of FIRI had been separated and became Research Centers and Research Institute under Corporations. One of them is Post-harvest Technology Institute.

Post-harvest Technology Institute was established based on the Decree No. 168-CP of Governmental Council on April 23, 1981.

b) The difference of role between FIRI and PhTI:

- FIRI is belonged to Ministry of Industry, PhTI is belonged to North Foodstuff General Company, which is under Ministry of Agriculture and Rural Development.

The functions and tasks of PhTI as follows:

- 1> Carrying out basic and applied research for post-harvest in agriculture such as appropriate technologies and equipment for agro-products preserving, primary processing, processing, packaging, transportation, marketing...
- 2> Evaluating, controlling the quality of agro-products and setting up standards for agro-products.
- 3> Transferring new and appropriate post-harvest technologies to producers.
- 4> Organizing the education programs and training courses for scientists, technicians and others working in post-harvest stage of the agriculture.
- 5> Expanding and developing international co-operations to exchange technologies and to introduce new technologies and products to Vietnam.

The functions and tasks of FIRI as follows:

FIRI is an entity specializing in research and development scientific and technology, especially applying biotechnology in the food industry.

- 1> Studying scientific and technological development strategy and policy in food industry.
- 2> Carrying out implementation of programs, projects and themes on scientific and technological research in the field of genetic engineering, microbiology, fermentation technology, enzyme technology and food processing technology from agro-products.
- 3> Training workers, technical staff's tertiary and post - graduate.
- 4> Developing scientific and technological information activities, information network for food industry.
- 5> Establishing technological process, tacking part in formulating Industry and State standards, controlling food quality.
- 6> Developing co-operative relations on science and technology.
- 7> Designing, manufacturing, installing equipment and transferring technology in the field of biotechnology, food and beverage processing.

c) Main achievements of FIRI:

Under going 30 years of operating scientific and technological activities Institute received and successfully completed the study of 274 programs, themes and experimental production projects, transfer technology for 236 enterprises at small and medium scale.

From 1981 up to now, FIRI operates 144 themes in which 48 are at State level, 56 are ministerial level and the remainder 40 grassroots levels, transfer technology for 125 enterprises at small and medium scale.

FIRI and staffs have been awarded 1 second grade Labour Order, 2 third grade Labour order, 11 certificates of merit from Government, 69 certificates of Ministries, and 2 International Covalevskaja Prize.

d) There are not any overlap on activities between FIRI and other institutes because all plans for research activities are controlled and approved by MOSTE. However, during implementation, due to lacking of information, some Institutes may repeat some parts of the works, which other have already done before.

e) In general, the Institutes co-operate to carry out joint research, which are paid attention by them.

There are many joint research activities between FIRI and other Institutes.. We just give some examples for illustration.

Ex.:

- At present, we are co-operating with PhTI to research on preservation some kinds of fruits like: bananas, mango, litchi and etc.
- In the past, we have collaborated with Tropical Biotechnology Institute to research on wastewater treatment from food industry.

2. The object of farm products, technology, level:

2.2.1. The priority for the object of farm products:

The research and development tasks of FIRI are based on orientations of MOSTE and MOI. The strategy of these Ministries is related closely to agricultural policies of Vietnamese Government including MARD.

Now, Vietnamese Government focus on infrastructure of national economy and development of remote areas and rural, which are account for 70% population and pay an important role in the national economy. To solve this problem, it is paid attention into agricultural policies to increase agro-product productivity as well as buying products from farmers and improving food processing technology. On the other hand, the Government attaches special importance to policies developing science, technology and technique in order to implement efficiently the above policies.

Based on Governmental policies, FIRI carries out its tasks, one of them is research and developing technology of food processing to increase the value of agro-products and create variable products.

In order to implement the above objectives, FIRI need the support and technical co-operation from Japanese Government. At present, technological level of FIRI is still low with lacking of new and modern equipment as well as technical information. Therefore, FIRI by itself can not develop new technologies.

The main farm products, in which FIRI interested to process by applying microbiology, fermentation and enzyme technologies, as follow:

1> Applying microbiology technology:

- Research on production of some products from by-products of sugar cane production:
 - Nowadays, there are 35 sugar cane factories producing 147,000 tons of sugar/year (See Appendix 1 and 5). Molasses is by-product forming in sugar production. From molasses, we can produce many kinds of valuable products, ex.: Alcohol, lactic acid, yeast biomass and etc.
 - Sugar cane bagasse can be used as material for producing several kinds of edible mushroom.
 - Mud can be used as material for production of bio-fertilizer.

2> Applying fermentation technology:

- Applying fermentation technology to improve quality of traditional fermented food.

Fish sauce, soy sauce, soy cheese, fermented meat, vegetable pickle and etc. are traditional food of Vietnamese people. The materials of the above food are soybean, meat, fish, vegetable and etc (See Appendix 2). The need to improve quality of the above traditional fermented food is the task of FIRI.

- Alcoholic beverages:

Vietnamese agriculture develops unceasingly. The productivity of rice and cereal increase time by time. This is big resource of material for alcoholic beverage production to meet the demand of citizen.

For beer production, there are many small and medium enterprises located in different provinces in the whole country with low level of technologies as well as backward equipment. Their products can not reach high quality. Those enterprises need the help from FIRI to change technologies and improve quality of their products.

- Waste water treatment

At this moment, small and medium scale of food processing enterprises (included ones receiving technology transferred from FIRI) just pay

attention into production to provide products for customers. They have not enough budgets to invest for wastewater treatment system, which is one of reasons leading to water pollution. FIRI will research on this problem in order to meet the governmental policies.

3> Applying enzyme technology:

- Maize, sweet potato and cassava are big raw material resources in Vietnam. According to Statistical Year in 1999, the productivity of cassava in 1999 is 1,807,000 tons (See Appendix 2). We can produce many kinds of valuable product from cassava by applying enzyme technology: glucose syrup (using in confectionery), glucose powder (for food and pharmacy), fructose syrup (using in beverage industry) and etc.
- From soybean, fish, meat and other materials (See Appendix 2), applying special enzymes we can produce products with high protein content or functional foods.
- Fruit products: Vietnam has many kinds of tropical fruits with high productivity (See Appendix 2 and 3). From these materials, in order to obtain products like clear and concentrated fruit juice with high quality, we have to use certain enzymes to breakdown pectin and other components.
- Fermented products from fruits such as cider, wine, champagne and etc are high valuable products. At present, almost fruit products are using in fresh form, the processing rate of fruit is still small. FIRI will focus on this matter to help farmers to produce variable products.

2.2.2. *The statistics on SMEs regarding food industry* (See Appendix 4)

2.2.3. *The region which FIRI put strength on to transfer technology and the demand on food processing in rural level*

FIRI will put strength on to transfer technology to the North and Central of Vietnam. However, FIRI has sub-institute in Ho Chi Minh City, which will in charge in transfer technology to some parts in the South in Vietnam.
The demand on food processing in rural level (See Appendix 5)

2.2.4. The achievement on technology instruction toward SMEs by FIRI:

As the results, FIRI will transfer technologies to small and medium enterprises to bring economical efficiency to farmers. The small and medium enterprises are gradually improved their technologies, process and supply products for local consumption. On the other hand, they can develop and provide semi-finished products for larger enterprises in near future. FIRI willing to transfer technology to SMEs in the above mentioned fields (See 2.2.1.)

The contents of technology transferred by FIRI include mainly technological processes at medium level.

On the other hand, FIRI will pay attention into collecting micro-organisms and supporting new strains of micro-organisms with high productivities to industrial enterprises.

AMOUNT OF PRODUCTION OF AGRICULTURAL PRODUCTS IN VIETNAM

PROCESSED PRODUCTS

(Data from Statistical Yearbook 1999)

<i>Kinds</i>		<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel 1999</i>
Canned fruits (Ton)	<i>Total</i>	16,318	21,422	20,026	20,342
	<i>State</i>	12,445	14,195	15,779	15,990
	<i>Non state</i>	87	-	-	-
Vegetable oil (Ton)	<i>Total</i>	78,706	87,717	94,648	102,833
	<i>State</i>	30,857	42,202	48,097	50,406
	<i>Non state</i>	16,413	15,084	17,577	18,807
	<i>FIS</i>	30,806	30,431	28,974	33,620
Tinned Milk (Mill. Tons)	<i>Total</i>	169.0	188.4	185.0	201.0
	<i>State</i>	161.0	147.3	139.0	141.0
	<i>FIS</i>	8.0	41.1	46.0	60.0
Milling rice, maize (Thousand. tons)	<i>Total</i>	16,116	18,839	19,242	19,427
	<i>State</i>	699	529	1,208	1,222
	<i>Non state</i>	15,317	18,271	17,994	18,164
	<i>FIS</i>	100	39	40	41
Sugar, sugar syrup (Thousand. Tons)	<i>Total</i>	636.0	649.1	736.0	932.0
	<i>State</i>	178.0	220.5	257.0	503.0
	<i>Non state</i>	458.0	395.8	396.0	257.0
	<i>FIS</i>	-	32.8	83.0	172.0
Granulated sugar (Thousand. Tons)	<i>Total (State)</i>	111.0	122.0	143.0	147.0
Bean (Thousand. Tons)	<i>Non state</i>	36.0	44.7	51.0	53.0
Tea (Ton)	<i>Total</i>	32,930	44,974	52,668	53,043
	<i>State</i>	18,228	24,110	25,894	26,112
	<i>Non state</i>	13,809	18,873	20,984	21,116
	<i>FIS</i>	893	1,991	5,790	5,815
Fish Sauce (Mill. Litters)	<i>Total</i>	167	170	164	170
	<i>State</i>	55	40.5	34	38
	<i>Non state</i>	112	129.5	130	132

FIS: Foreign Invested Sector

BEVERAGE INDUSTRY
(Data from Statistical Yearbook 1999)

Liquor: Thousand liters

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel. 1999</i>
<i>Total</i>	67,112	93,600	96,093	96,862
<i>State</i>	36,910	5,474	5,313	5,442
<i>Non state</i>	30,000	87,988	89,632	90,168
<i>Foreign invested sector</i>	202	138	1,148	1,252

Beer: Million liters

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel. 1999</i>
<i>Total</i>	533	581	670	648
<i>State</i>	365	392	448	464
<i>Non state</i>	28	34	37	36
<i>Foreign invested sector</i>	140	155	185	148

AGRICULTURAL PRODUCTS

(Data from Statistical Yearbook 1999)

A- CULTIVATION: (Whole country)**1- Paddy:**

	1996	1997	1998	Prel. 1999
Area (thousand. ha)	7003.8	7099.7	7362.7	7648.1
Gross output (thousand tons)	26936.7	27523.9	29145.5	31393.8
Yield (quintal/ha)	37.7	38.8	39.6	41.0

2- Maize:

	1996	1997	1998	Prel. 1999
Area (thousand. ha)	615.2	662.9	649.7	686.9
Gross output (thousand tons)	1536.7	1650.6	1612.0	1751.9
Yield (quintal/ha)	25.0	24.9	24.8	25.5

3- Sweet potatoes:

	1996	1997	1998	Prel. 1999
Area (thousand. ha)	302.7	267.2	253.5	269.0
Gross output (thousand tons)	1697.0	1691.0	1526.1	1745.3
Yield (quintal/ha)	56.1	63.3	60.2	64.9

4- Cassava:

	1996	1997	1998	Prel. 1999
Area (thousand. ha)	275.6	254.4	235.5	226.8
Gross output (thousand tons)	2067.3	2403.4	1773.4	1806.9
Yield (quintal/ha)	75.0	94.5	75.3	79.7

5- Soybean:

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel 1999</i>
Area (thousand .ha)	110.3	106.4	129.4	129.2
Gross output (thousand tons)	113.8	113.0	146.7	144.7
Yield (quintal/ha)	10.3	10.6	11.3	11.2

6- Peanut:

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel 1999</i>
Area (thousand .ha)	262.8	253.5	269.4	248.2
Gross output (thousand tons)	357.7	351.3	386.0	318.7
Yield (quintal/ha)	13.6	13.9	14.3	12.8

7- Sugar cane:

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel 1999</i>
Area (thousand. ha)	237.0	257.0	283.0	350.8
Gross output (thousand tons)	11430.3	11920.9	13843.5	17840.0
Yield (quintal/ha)	479.8	463.8	489.2	508.6

B- LIVESTOCK:**Livestock population (Whole country)**

<i>Kinds</i>	<i>Amount (thousand heads)</i>			
	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel. 1999</i>
Buffaloes	2953.9	2943.6	2951.4	2955.7
Cattle	3800.0	3904.8	3987.3	4063.6
Pigs	16921.7	17635.9	18132.4	18885.8
Horses	125.8	119.8	122.8	149.5
Goats, sheep	512.8	515.0	514.3	470.7
Poultry (<i>million heads</i>)	151.4	160.6	166.4	179.3

C- SEA PRODUCTS: (Whole country)**1- Sea products:**

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel. 1999</i>
Area of water surface (ha)	498,687.7	504,137.0	524,500.9	535,000.0
Gross output (tons)	1,701,002	1,730,432	1,782,001	1,881,800

2- Gross output of some sea products (tons):

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel. 1999</i>
Breeding shrimp	49,479	49,298	54,853	58,996
Breeding fish	255,959	279,323	285,626	305,717
Exploited sea fish	808,226	835,318	856,710	920,500

D- FRUIT-TREE:

AREA-YIELD-GROSS OUTPUT OF SOME MAIN FRUIT TREE BY REGION IN 1995

(Area: 1000 ha; Yield: quintal/ha; Gross output: thousand tons)

No	Kinds	Area, yield, gross output	Whole country	By regions						
				(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Total	Area	211.53	-	-	-	-	-	-	-
		Gross output	2042.29	-	-	-	-	-	-	-
2	Orange, mandarin	Area	59.52	7.82	3.86	6.15	0.48	0.44	0.53	40.58
		Yield	105	62	70	49	62	54	105.5	130
		Gross output	379.4	24.87	23.9	23.24	2.25	0.36	3.47	304.31
3	Banana	Area	91.75	8.73	15.6	10.95	9.91	22	10	34.36
		Yield	159.1	163	184	87.3	132	407	344	11.9
		Gross output	1282.2	124.8	269.7	90.5	128.2	20.8	324.95	323.18
4	Pineapple	Area	24.04	1.7	1.1	4.04	1.4	0.4	0.4	15.5
		Yield	76.8	4.37	14.5	4.8	6.4	9.2	92	8.4
		Gross output	184.75	7.46	16.1	19.45	8.65	1.06	1.16	130.87
5	Mango	Area	21.1	2.1	0	0.37	2.84	0.37	2.65	12.74
		Yield	93	-	-	120	94	47	153	89
		Gross output	152.5	428	-	0.16	24.07	1.04	21.97	101.4
6	Apricot	Area	4.14	4.14	-	-	-	-	-	-
		Yield	57	57	-	-	-	-	-	-
		Gross output	5.14	5.14	-	-	-	-	-	-
7	Plum	Area	2.55	2.55	-	-	-	-	-	-
		Yield	87	87	-	-	-	-	-	-
		Gross output	11.15	11.15	-	-	-	-	-	-
8	Longan	Area	1.96	0.76	1.32	-	-	-	-	-
		Yield	120	-	-	-	-	-	-	-
		Gross output	14.3	3.4	7.15	-	-	-	-	-
9	Litchi	Area	6.47	3.6	2.88	-	-	-	-	-
		Yield	40	-	-	-	-	-	-	-
		Gross output	12.85	6.7	6.15	-	-	-	-	-

(1): Mountainous district and midland

(3): The forth region

(5): Tay Nguyen

(7): Cuu Long river's delta

(2): Hong river's delta

(4): Middle sea - coast

(6): South-east area

THE MAIN REGIONS PLANNED ARRANGE PLANT FRUIT TREE

No	Regions	Areas in present condition	Areas in 2010	Kinds of main fruits-trees
1	Mountainous district and midland			
	<i>Regions plant temperate zone fruits: BacHa, Sapa (LaoCai), MocChau (SonLa), HaGiang, and LangSon.</i>	8,200	40,000	Apricot, plum, peach, pear, apple
	<i>Regions plant special fruit-tree CaoLoc-LocBinh-BacSon (LangSon)</i>	6,000	15,000	Persimmon, peach, mandarin
	<i>Regions plant orange, mandarin: LucYen, YenBai</i>	8,300	50,000	Orange, mandarin
	<i>Regions plant litchi, longan, pineapple: DongTrieu(QuangNinh)</i>	14,400	60,000	Litchi, longan, pineapple
	<i>Regions plant banana, pineapple: PhuTho-YenBai</i>	3,500	35,000	Pomelo, orange, mandarin
	<i>Regions plant special pomelo DoanHung(PhuTho)-YenSon-YenBinh(YenBai)</i>	1,800	5,000	Apricot, plum, peach, pear, mango, longan, litchi, ...
	<i>Regions plant fruit-tree along national highway N°6</i>	23,000	40,000	
2	Hong river's delta			
	<i>Regions plant pineapple, banana: PhuTho, LapThanh, TamDuong (Vinh Phuc)</i>	2,200	15,000	
	<i>Regions plant fruit-tree along highway N°21A HaTay</i>	300	2,000	Litchi, longan, apricot, persimmon, custard-apple
	<i>Regions plant litchi, longan, pineapple: HaiDuong, Hung Yen</i>	9,600	40,000	Litchi, longan, pineapple
	<i>Regions plant banana along Hong river</i>	14,600	15,000	Banana
	<i>Suburbs of Hanoi</i>	300	2,000	Citrus, sapodilla, apple, banana
	<i>Dong Giao (Ninh Binh)</i>	2,000	4,000	Pineapple

3	The former forth region			
	<i>HaTrung (Thanh Hoa)</i>	1,700	2,000	Pineapple
	<i>QuyHop (NghiaDan-NgheAn)</i>	3,900	8,000	Orange, pineapple
	<i>HuongKhe, HuongSon, KyAnh (HaTinh), -TuyenHoa (QuangBinh)</i>	3,500	25,000	Pomelo PhucTrach, orange, pineapple
	<i>Huong Thuy, Huong Tra (ThuaThienHue)</i>	150	1,000	Pomelo, sapodilla.

THE NUMBER OF FOOD PROCESSING ENTERPRISES
(Data from Vietnam Business Directory 2000)

<i>N^o</i>	<i>Kinds of food industry enterprise</i>	<i>Quantity</i>
1.	BEER	68
2.	SOFT DRINK	34
3.	WINE & ALCOHOLIC DRINKS	18
4.	CONFECTIONERY	32
5.	FRUIT & VEGETABLE	48
6.	SUGAR	35

Appendix 5

REQUIREMENT FOR TECHNOLOGY TRANSFER FROM PROVINCES

No.	Organization names	Requirement
1	Tan hai fishing Cooperative, Hai Thinh, Hai hau, Nam dinh	Fish sauce production with shorten fermentation cycle
2	Dai thanh fishing Cooperative, Hai hau, Nam dinh	Ditto
3	Nam hai fishing Cooperative, Hai Hau, Nam dinh	Ditto
4	Hong phong fishing Cooperative, Hai hau, Nam dinh	Ditto
5	Thai nguyen Pharmaceutical Company	Production of amino acid tablet from pork liver
6	Department of Science, Technology and Environment, Bac Ninh Province.	Transfer technology for production of Soybean Milk and fruit processing.
7	Department of Agricultural and rural Development, Lai Chau Province.	Transfer technology for fruit and starch processing.
8	Lang son Trading Company	- Fruit wine production - Special spirit
9	Ba vi Beer Company, Ha tay province	- Fruit wine production - Water treatment
10	Dong ha Beer Company, Quang tri province.	Water treatment
11	Thang long Private Company, Quang ninh Province.	Transfer technology for beer production.
12	Beer Company in Quang ninh Trading Company.	Transfer new technology for beer production.
13	Fish sauce Company, Cat Hai, Hai phong.	Technology for fish sauce production from salty fish.
14	Van loc Company, in Hanoi.	Carbonated pineapple fruit juice.
15	Foodstuff exports Company, Hung yen Province.	Improve the quality of drought beer.
16	Department of Science, Technology and Environment of several provinces such as Hai duong, Soc Trang, Can tho.	Transfer technology for production of fertilizer by biological method.
17	Tobacco Company	Providing cafe, orange flavor

No.	Organization names	Requirement
19	Some provinces such as Ha tay, Hai duong, Hung yen..	Quality control of food products, beverage, soy sauce..
20	Some provinces such as Quang ninh, Nam dinh, Thai nguyen, Hung yen, Hai phong, Ha tay, Hanoi, Ho Chi Minh City.	Providing yeast for production of ethanol.
21	Hai phong	Transfer Technology for production of vinegar.
22	Hung yen	Transfer Technology for production of soy sauce.
23	Many factories in the whole country	Asking for providing microorganism strain for industries.
24	Hanoi	Transfer technology for production of sausages at small scale
25	Hai duong Beer Company	Transfer technology for wine production
26	Ha bac HABADA Company	Transfer technology for wine production
27	Son tay Foodstuff Company	Transfer technology of meat processing
28	Ha tinh	Transfer technology for production of pickle and chili sauce
29	Nam dinh	Transfer technology for starch processing
30	Information Centre, Department of Science, Technology and Environment, Ha giang Province	Transfer technology for production and rape seed processing
31	Minh duong Company, Ha tay	Transfer technology for production some vegetarian salam
32	North Red River Company	Transfer technology for production some fruit juices

質問票に対するヴィエトナム側の回答(2)

食品産業研究所強化計画に係る質問表

適宜、工業省、食品産業研究所の双方にて回答を作成の上、10月4日までに送付願います。

1 要請の背景、内容の確認

- (1) 国家開発計画との整合性について、最新のヴィエトナム国家開発計画における、本プロジェクトの位置付けを明確にしてください。
- (2) ヴィエトナムの主要農業、食品加工業の概要を、統計実績と併せて示してください。
- (3) 農村地域の小農に裨益するようように、プロジェクトで扱う農産物原料は、輸入に依存する原料でなく、国内農産物（一例として自給率80%以上）とすることを検討中。したがって、原料を輸入に依存するビール、油脂等は適当ではないと思料。その観点から、FIRIで要望する開発課題を分析してください。
- (4) 裨益対象企業は外資系大企業でなく、地場の中小規模の企業が生産する加工食品を対象とすべき。その観点から、FIRIで要望する開発課題を分析してください。
- (5) プロジェクトにより、日本の食品産業が圧迫されることは避けるべきことから、プロジェクトで開発される加工食品は、輸入代替や国内自給率の向上を主とする食品を対象とすべき。その観点から、FIRIで要望する開発課題を分析してください（ただし、想定される輸出先が日本以外であれば可）。
- (6) 対象となる食品は、安全性、栄養性、嗜好性、機能性が高いものが望ましいことから、その観点から、FIRIで要望する開発課題を分析してください。

2 先方実施体制の確認

- (1) 工業省及び食品産業研究所の組織機構図を示してください。また、食品産業研究所の設置法に基づき、農村地域の小企業が支援の対象になるか等、本プロジェクト活動が規定に沿っているか確認してください。
- (2) 科学技術環境省、農業農村開発省等の関連機関の関与について、組織再編の動向、支援体制について、述べてください。
- (3) 予算措置について、過去5年間の実績を示してください。
- (4) カウンターパート、人員の配置について、現状のデータに加え、主要な研究開発実績

等カウンターパートの技術がわかる資料を示してください。

(5) 建物施設の概要、今後の整備計画について、示してください。

(6) 現有資機材リスト、今後必要となる機材のプライオリティーリストを示してください。
併せて現地調達可否についても記してください。

3 協力要請分野の範囲、基本計画（マスタープラン）案の作成に向けて、各活動項目の現状と問題点を把握したく、以下について回答してください。

3.1 食品加工

(1) 伝統発酵食品（ニョクマム、蝦味噌、醃酵調味料、醃酵肉等）のクローニングによる有用菌の探索と保存・継代技術の現状について示してください。

(2) 酵素利用技術及び発酵工学に係る応用技術に関し、現在実施している技術開発の現状を示してください。

(3) 幼児、高齢者、病人等を対象とする自然食品の開発に関して、どのような技術開発の実績があるか、示してください。

(4) 加工対象の食品について、原料供給する農家サイド、加工を行う食品加工中小企業サイド、及び最終消費者のニーズについて、これまで貴研究所で把握している内容を教えて下さい。

3.2 分析・検査

(1) マイコトキシン検査は行っていますか。検査している場合は、マイコトキシンの種類と検査方法を教えて下さい。

Y/N

Aflatoxin	Ochratoxin	T-2 toxin	others()
(AOAC/Viet.Std)	(AOAC/Viet.Std)	(AOAC/Viet.Std)	(AOAC/Viet.Std)
()	()	()	()

(2) 缶詰検査は行っていますか。検査している場合は、その対象と検査方法を教えて下さい。

Y/N

Incubation	Vacuums	Weigh	Brix	Fat
------------	---------	-------	------	-----

(AOAC/Viet.Std) (AOAC/Viet.Std) (AOAC/Viet.Std) (AOAC/Viet.Std) (AOAC/Viet.Std)
 () () () () ()
 Acid Seam others()

(AOAC/Viet.Std) (AOAC/Viet.Std) (AOAC/Viet.Std)
 () () ()

(3) 果汁飲料の検査は行っていますか。検査している場合は、その対象と検査方法を教えてください。

Y/N

Inner pressure Weigh pH Brix others()
 (AOAC/Viet.Std) (AOAC/Viet.Std) (AOAC/Viet.Std) (AOAC/Viet.Std) (AOAC/Viet.Std)
 () () () () ()

(4) 細菌検査は行っていますか。検査している場合は、その対象と検査方法を教えてください。

Y/N

E.coli Coliform TPC Botulinus Welsh
 (AOAC/Viet.Std) (AOAC/Viet.Std) (AOAC/Viet.Std) (AOAC/Viet.Std) (AOAC/Viet.Std)
 () () () () ()
 others()
 (AOAC/Viet.Std)
 ()

(5) 食品添加物の検査は行っていますか。検査している場合は、その対象と検査方法を教えてください。

Y/N

Bolic acid SO2 Color additive TBHQ Polysolvate
 (AOAC/Viet.Std) (AOAC/Viet.Std) (AOAC/Viet.Std) (AOAC/Viet.Std) (AOAC/Viet.Std)
 () () () () ()
 Benzoate others()
 (AOAC/Viet.Std) (AOAC/Viet.Std)
 () ()

(6) 上記の検査をする際に不足する機器を示してください。

(7) 上記の検査に必要な試薬で輸入に頼っているものを示してください。

(8) FIRI に腐敗変敗事故の調査を持ち込まれたことがありますか。その実績がある場合は、その対象を教えてください（生鮮果実、加工果実、魚、魚類加工品、その他）。また、腐敗変敗事故の調査の原因を教えてください。

(9) HACCP 技法による総合的衛生管理システムの導入と認証能力のあるスタッフの養成について、現状を教えてください。

3.3 食品保全

(1) 農産物流通過程において何%位のロスが生じますか。

(2) 農産物流通及び貯蔵過程でのロスを防ぐために、どのような方策を採っていますか。

(3) 食品の品質向上のため、日本の JAS 規格に相当するような国家規格の基礎を構築する計画はありますか。

(4) 食品の保全性向上のための研究は行っているか（生鮮果実の経済的かつ効果的殺菌法の開発、臭化メチルに代わるくん蒸法の開発等）。

(5) 長期保存を期待しうる野菜、果実の保存に関する技術開発があれば、示してください。

3.4 環境汚染対策技術

(1) 現在、所有する廃水処理技術（例、活性汚泥等）について示すとともに、どのような業種に適用されているか、教えてください。

(2) 活性汚泥法の中でも、特に注目される特殊な技術を開発していれば、示してください。

3.5 技術普及活動

(1) 食品加工技術の指導、普及体制について示してください。

以上

N°1: Define the background and tenor of suggestion:

1.1. The project impact

Under national development plan for Vietnam, the ministries and related branches have designed the strategies of social- economical development for period of 2001- 2020.

For implementing the strategies of social- economical development, the ministries and related branches have designed the strategies of scientific- technological development.

For the coming 20 years , the economy of Vietnam will face with structural shift, which means Vietnam will change from a country based on agriculture to the one based on industries. It is a process of industrialization and modernization of agriculture and rural areas, which includes the following:

- Based on agriculture, forestry and fishery developments, specialized areas for agricultural cultivation are to be set up. These areas will provide raw materials for industrial processing, which provides products for domestic and international markets.
- Application of scientific and technological achievements for breeding, cultivation and agro- product processing.
- Development of industrial processing in rural areas, raw material areas. This process will shift some manpower from agricultural to industrial activities, accelerate urbanization and industrialization of rural areas.
- Development of service industry in agriculture
- Prioritized for development villages with traditional craft manufacturing, agro- product processing, producing good commodity for domestic market and export.
- Investment in infrastructure construction for rural areas such as electricity, road systems, schools, stations.
- Electrification, mechanization, and irrigation in agricultural activities and agro-product processing.
- Improvement in education, technological transfer and training.
- Hunger eradication and poverty reduction.
- Improvement the life standard for farmers, which include housing, eating, education, environment, social perception ..

The impact of the project on national scientific development:

- The project on enforcement for research, training, and technological transfer capacities of the Food Industries Research Institute (FIRI) is matching with the strategies for scientific and technological development aimed at improvement of agricultural production, agro-product and seafood product processing and the strategies of social - economical development of Vietnam, and the strategies of development of agricultural, rural areas and improving living standard of farmers.
- The output of the project is to help accelerate the development of processing industries, which use agro-product as raw materials, to find an answer to the question whom farmer sell their products, to solve the problem of surplus of workers involved in agriculture by moving them to processing fields, to apply scientific- technological service in rural areas, to encourage traditional manufacturer villages and their products, to improve quality of products for meeting domestic needs and export standards, to take part in industrialization of agro-product processing, technological transfer, and personnel training. The consequence of above mentioned activities has direct impact on hunger eradication, poverty reduction and living standard improvement.
- The output of the project will have an important role in rural Industrialization and modernization procedure.

- The project has an important impact on the development of the agro- product processing industry, which vice versa will support the breeding and cultivation development. As a result, it will bring economical effects and added value to agro-products through processing technologies.
- The project will help decrease the loss after harvest for 15 - 20 % of the total products.
- The project will help improve food hygiene and safety for consumers at large scale.
- The project will help produce high quality products having competition ability to meet the demanding needs of domestic and export markets.
- This project has been approved by the relevant ministries (Ministry of Industries, Ministry of Science, Technology and Environment, Ministry of Planning and Investment), and the Primer Minister. Besides that farmers and enterprises, who dependent on technological transfer, and people involved in scientific- technological activities are all in anticipation with the hope that the project will be put on action.
- This project is matching with the strategy on biotechnological development of Vietnam. This strategy is the one prioritised under the program on scientific- technological development for the period of 2001- 2020.
- This project is matching with the development program on science, technology and environment for the period of 2001- 2005 of Vietnam, which includes the following:
 - To enhance basic and applied researches; this will have an important role in industrialization and modernization of the country.
 - To carry on technological modernization in production activity by technological import, mastering the imported technologies, applying achievements of research and development (R+D), partial modernization in processing and in some cases to invest in advanced technologies.
 - To develop high technologies which include Biotechnology, Information technology, Material technology and automatic technology.
 - To develop science and technology based on infrastructure enforcement, creation of manpower for scientific- technological research organizations (research institutions).
 - To create markets of scientific and technological service, and conditions, which enable science and technology, take part in improving the growth of GDP (Gross Domestic Production).
 - The government is to design the program, which enables the synchronic development of science and technology over all country.
 - To develop agriculture and rural areas by implementing the following:
 - To improve productivity and quality of agro-products
 - To prioritize the development of agriculture, forestry and fishery
 - To co- operate with foreign partners in scientific and technological researches.
 - To combine the development of traditional, advanced and imported technologies.

1.2. Xin cho biết khái quát về các ngành nông nghiệp chủ yếu và ngành công nghiệp thực phẩm Việt nam bằng con số thống kê thực tế?

The main agricultural Branch:

A. CULTIVATION: (Whole country)

1- Paddy:

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel. 1999</i>
Area (thousand. ha)	7003.8	7099.7	7362.7	7648.1
Gross output (thousand tons)	26936.7	27523.9	29145.5	31393.8
Yield (quintal/ha)	37.7	38.8	39.6	41.0

2- Maize:

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel. 1999</i>
Area (thousand. ha)	615.2	662.9	649.7	686.9
Gross output (thousand tons)	1536.7	1650.6	1612.0	1751.9
Yield (quintal/ha)	25.0	24.9	24.8	25.5

3- Sweet potatoes:

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel. 1999</i>
Area (thousand. ha)	302.7	267.2	253.5	269.0
Gross output (thousand tons)	1697.0	1691.0	1526.1	1745.3
Yield (quintal/ha)	56.1	63.3	60.2	64.9

4- Cassava:

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel. 1999</i>
Area (thousand. ha)	275.6	254.4	235.5	226.8
Gross output (thousand tons)	2067.3	2403.4	1773.4	1806.9
Yield (quintal/ha)	75.0	94.5	75.3	79.7

5- Soybean:

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel. 1999</i>
Area (thousand .ha)	110.3	106.4	129.4	129.2
Gross output (thousand tons)	113.8	113.0	146.7	144.7
Yield (quintal/ha)	10.3	10.6	11.3	11.2

6- Peanut:

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel. 1999</i>
Area (thousand .ha)	262.8	253.5	269.4	248.2
Gross output (thousand tons)	357.7	351.3	386.0	318.7
Yield (quintal/ha)	13.6	13.9	14.3	12.8

7- Sugar cane:

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel. 1999</i>
Area (thousand. ha)	237.0	257.0	283.0	350.8
Gross output (thousand tons)	11430.3	11920.9	13843.5	17840.0
Yield (quintal/ha)	479.8	463.8	489.2	508.6

B. LIVESTOCK:

Livestock population (Whole country)

<i>Kinds</i>	<i>Amount (thousand heads)</i>			
	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel 1999</i>
Buffaloes	2953.9	2943.6	2951.4	2955.7
Cattle	3800.0	3904.8	3987.3	4063.6
Pigs	16921.7	17635.9	18132.4	18885.8
Horses	125.8	119.8	122.8	149.5
Goats, sheep	512.8	515.0	514.3	470.7
Poultry (<i>million heads</i>)	151.4	160.6	166.4	179.3

C. SEA PRODUCTS: (Whole country)

1- Sea products:

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel 1999</i>
Area of water surface (ha)	498,687.7	504,137.0	524,500.9	535,000.0
Gross output (tons)	1,701,002	1,730,432	1,782,001	1,881,800

2- Gross output of some sea products (tons):

	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>Prel 1999</i>
Breeding shrimp	49,479	49,298	54,853	58,996
Breeding fish	255,959	279,323	285,626	305,717
Exploited sea fish	808,226	835,318	856,710	920,500

D. AREA-YIELD-GROSS OUTPUT OF SOME MAIN FRUIT TREE BY REGION IN 1995

(Area: 1000 ha; Yield: quintal/ha; Gross output: thousand tons)

N ^o	Kinds	Area, yield, gross output	Whole country	By regions						
				(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Total	Area	211.53	-	-	-	-	-	-	-
		Gross output	2042.29	-	-	-	-	-	-	-
2	Orange, mandari n	Area	59.52	7.82	3.86	6.15	0.48	0.44	0.53	40.58
		Yield	105	62	70	49	62	54	105.5	130
		Gross output	379.4	24.87	23.9	23.24	2.25	0.36	3.47	304.31
3	Banana	Area	91.75	8.73	15.6	10.95	9.91	22	10	34.36
		Yield	159.1	163	184	87.3	132	407	344	11.9
		Gross output	1282.2	124.8	269.7	90.5	128.2	20.8	324.9 5	323.18
4	Pineappl e	Area	24.04	1.7	1.1	4.04	1.4	0.4	0.4	15.5
		Yield	76.8	4.37	14.5	4.8	6.4	9.2	92	8.4
		Gross output	184.75	7.46	16.1	19.45	8.65	1.06	1.16	130.87
5	Mango	Area	21.1	2.1	0	0.37	2.84	0.37	2.65	12.74
		Yield	93	-	-	120	94	47	153	89
		Gross output	152.5	428	-	0.16	24.07	1.04	21.97	101.4
6	Apricot	Area	4.14	4.14	-	-	-	-	-	-
		Yield	57	57	-	-	-	-	-	-
		Gross output	5.14	5.14	-	-	-	-	-	-
7	Plum	Area	2.55	2.55	-	-	-	-	-	-
		Yield	87	87	-	-	-	-	-	-
		Gross output	11.15	11.15	-	-	-	-	-	-
8	Longan	Area	1.96	0.76	1.32	-	-	-	-	-
		Yield	120	-	-	-	-	-	-	-
		Gross output	14.3	3.4	7.15	-	-	-	-	-
9	Litchi	Area	6.47	3.6	2.88	-	-	-	-	-
		Yield	40	-	-	-	-	-	-	-
		Gross output	12.85	6.7	6.15	-	-	-	-	-

(1): Mountainous district and midland

(3): The forth region

(5): Tay Nguyen

(7): Cuu Long river's delta

(2): Hong river's delta

(4): Middle sea - coast

(6): South-east area

E. THE MAIN REGIONS PLANNED ARRANGE PLANT FRUIT TREE

Nº	Regions	Areas in present condition	Areas in 2010	Kinds of main fruits-trees
1	Mountainous district and midland			
	Regions plant temperate zone fruits: BacHa, Sapa (LaoCai), MocChau (SonLa), HaGiang, and LangSon.	8,200	40,000	Apricot, plum, peach, pear, apple
	Regions plant special fruit-tree CaoLoc-LocBinh-BacSon (LangSon)	6,000	15,000	Persimmon, peach, mandarin
	Regions plant orange, mandarin: LucYen, YenBai	8,300	50,000	Orange, mandarin
	Regions plant litchi, longan, pineapple: DongTrieu(QuangNinh)	14,400	60,000	Litchi, longan, pineapple
	Regions plant banana, pineapple: PhuTho-YenBai	3,500	35,000	Pomelo, orange, mandarin
	Regions plant special pomelo DoanHung(PhuTho)-YenSon-YenBinh(YenBai)	1,800	5,000	Apricot, plum, peach, pear, mango, longan, litchi, ...
	Regions plant fruit-tree along national highway N°6	23,000	40,000	
2	Hong river's delta			
	Regions plant pineapple, banana: PhuTho, LapThanh, TamDuong (Vinh Phuc)	2,200	15,000	
	Regions plant fruit-tree along highway N°21A HaTay	300	2,000	Litchi, longan, apricot, persimmon, custard-apple
	Regions plant litchi, longan, pineapple: HaiDuong, Hung Yen	9,600	40,000	Litchi, longan, pineapple
	Regions plant banana along Hong river Suburbs of Hanoi	14,600	15,000	Banana
		300	2,000	Citrus, sapodilla, apple, banana
	Dong Giao (Ninh Binh)	2,000	4,000	Pineapple
3	The former forth region			
	HaTrung (Thanh Hoa)	1,700	2,000	Pineapple
	QuyHop (NghiaDan-NgheAn)	3,900	8,000	Orange, pineapple
	HuongKhe, HuongSon, KyAnh (HaTinh), -TuyenHoa (QuangBinh)	3,500	25,000	Pomelo PhucTrach, orange, pineapple
	Huong Thuy, Huong Tra (ThuaThienHue)	150	1,000	Pomelo, sapodilla.

NUMBER OF FOOD AND FOOD STUFF ENTERPRISE BY LABOUR SCALE

(Update to 1/7/1995)

Nº	Scale	Number	Number of labourer
1	1	92	92
2	2-3	384	982
3	4-5	558	2,517
4	6-10	993	7,692
5	11-20	738	10,731
6	21-50	550	17,357
7	51-100	204	14,444
8	101-200	173	24,471
9	201-500	150	47,825
10	501-1,52000	47	30,655
11	1,001-2000	19	24,969
12	Higher 2,000	1	2,460
	Total	3,909	184,195

THE NUMBER OF SOME KIND FOOD PROCESSING ENTERPRISES

<i>N°</i>	<i>Kinds of food industry enterprise</i>	<i>Quantity</i>
1.	BEER	68
2.	SOFT DRINK	34
3.	WINE & ALCOHOLIC DRINKS	18
4.	CONFECTIONERY	32
5.	FRUIT & VEGETABLE	48
6.	SUGAR	35

1.3. While most of beer products in the Vietnam market are imported, it is still necessary to produce them?

To improve living- standard life for farmers in rural areas, it is necessary to help them to have knowlegde on food-technology in local areas at medium and samll scales. Therefore, it can be soled with "out put" problems and stadable and enhanced producing. On the other ways, using imported raw materials is very important and necessary.

However, some imported materials is necessary to reseach such as beer. Beers have been producing more than 100 years in Hanoi and Ho Chi Minh ciites under France government. Yield production is about 60.000.000-70.000.000L/year. Since 1990, Governments has opend policy, many international beer companies have investigated into Vietnam leading to quickly develop beer products. According to staticstical data, beer yield is about 800.000.000 L/years or 8,5 L/person/year and leading to racing Government buget is 800 bilion/year.

FIRI has been paying attention in some research areas, especially:

- Using rice, corn replacing for imported malt. The result is: it can be replacing 40% malt while stadable quality malt product. When replacing is 50%, it is necessary to add enzymes. By replacing method, the cost of beer products are reduced (if use malt, cost of beer product is 5200d/kg while replacing of rice andcorn cost of beer product is 2600d/kg and 2000d/kg respectively.
- Using rice-malt (from rice or balley) replacing for imported malt. The research is not completed yet because of flavour is not very attracted.
- Application of new technology to reduce the time production.
 - * Application technologies of Japan and Germany on fermentation and preservation of beer product.
 - * Using α -axetolactat-decacboxylaza to fastly reduce diaxetyl.
 - * Primary research on producing beer by stadable yeast fermentation.
- Using yeast componets to produce high quality of beer products.
- using number of enzyme to increase recovered yield capacity the soluble or improve the filltation processing (β -glucanaza)
- Adding domestic ingredients or diatomyte replacing for international ones.
- Designed, produced beer equipments at small scale with capacity from 1000- 20.000 L/day to place into provinces, locals, rurals, or mountainours. FIRI have been buiding more than 100 factories, transfred technology to more than 150 enterprices.

- While most of oil products in the Vietnam market are imported, it is still necessary to produce them?

Vegetable oil extraction and processing is an area of food industry. Government vegetable oil, essence and perfume Company comprises six local oil factories and enterprises. The main materials providing for oil field include peanut, cocoa, soybean, and sesame

Peanut	300,000-380,000 tons per year
Soybean	100,000-140,000 tons per year
Sesame	15,000-20,000 tons per year
Cocoa	1,000,000-1,200,000 tons per year

Government factories have main responsibility for oil processing into products (fried oil, shortening, margarine), while local factories have responsible mainly for oil extraction (pressing). There are some local factories have refining facilities with small capacity (Habac, Vinh provinces). Vegetable oils mainly provide domestic market and only very small for exporting. According to business data from 1996 to 1999 the export value was only smaller than 10%.

Among oil factories, there are only two have joint venture with foreign countries (Nha be, Cailan), mainly import raw oil to refine the remainders use domestic materials. In addition only two above factories have relatively modern production chain, local factories have small capacity, old and backward technology and equipment, low recovery yield and product quality.

There is an oil import from Malaysia as it is cheaper. Basically two large factories use imported oil, whereas local factories still use domestic materials.

Through production results in 1999 and estimation in 2000 show that productivity of oil products of Oil, Essence and Perfume Company (Vocarimex) only occupies around 30% of total national productivity of oil products

	1999	2000
National	192,048 tons	215,000 tons
Vocarimex	55.000 tons	66,000 tons

The remainders is oil products of local oil industry

Oilseed materials not only serve oil industry but also use in confectionery and other food areas (For example peanut, sesame and coconut use in confectionery industry, soybean use for production of tofu, soybean milk, fermented food and diet food...)

In scientific and technology strategies of vegetable oil industry have emphasis on?

- Investment and development of domestic oil-producing areas (improvement of oil-seed planting capacity and quality of oil-seeds)
- Improvement of quality and verification products to compete and replace imported products

Based on recent situations of oil industry, FIRI would like to:

- Help locals (rural and remote areas) to develop oil-producing areas (rapeed) providing for oil extracting and refining industry able to use locally available materials in the local itself with suitable capacity (in term of material ability and technology knowledge), also help to create employment in oil-producing areas and surrounding areas, to improve use value of agro-product (oil-seeds) and people income
- Study and transfer new technology to available production enterprises to verify products and suit Vietnamese consumer favours, to improve production yield and product quality, able to compete with imported products.

- Use enzymes to produce the function food products and pharmaceutical products from oil (for example: produce the food products contain non- fat acid, or using this acid to produce the medicine for patient)
- Use enzymes for exploitation the oil from some raw material: coconut, maize,... to increase the extract output and upgrade the quality of oil.

Major food products will be researched to develop in the project, will be replace the importation or will take part in the interior quantity's increase.

1.4. FIRI's expectation from research and development program on science and technology to meet the needs of agro- product processing enterprises with medium and small scales.

1.4.1. *Technologies based on microbial application*

- Isolation, selection and improvement of microbial strains having application in fermentation industries and traditional fermented products (Soya source, fish source, fermented vegetable, soy margarine).
- Application of fermentation technology to produce several kinds of beverages (beer, fruit wine and rice wine), organic acids (lactic acid), waste water treatment (anaerobic and aerobic fermentation).
- The technologies based on microbial strains should guaranty food safety (selection on fungal strains not producing toxins). FIRI takes part in control and supervise product quality.

1.4.2. *Technologies based on enzymatic application*

- Research on enzyme biosyntheses by microbial strains
- Application enzymes in processing starch resource materials such as maize, potato, cassava, and starch hydrolysis to dextrin, modified starch, syrup of maltose, glucose, fructose 42%..
- Application of enzymes in the processing of oil, essential oils, aroma and flavors, protein rich products, and amino acids.

1.4.3. Technologies for vegetable and fruit preservation and processing

- Application biological preservatives, preservative membranes, cool storage, micro-climate environment.. to replace chemical preservatives, when their residues might be harmful for consumers.
- Processing vegetable drinks.
- Processing clear juice, nectar and concentrated juice.
- Other processing technologies: vacuum frying, spray drying, infrared drying, homemade drying

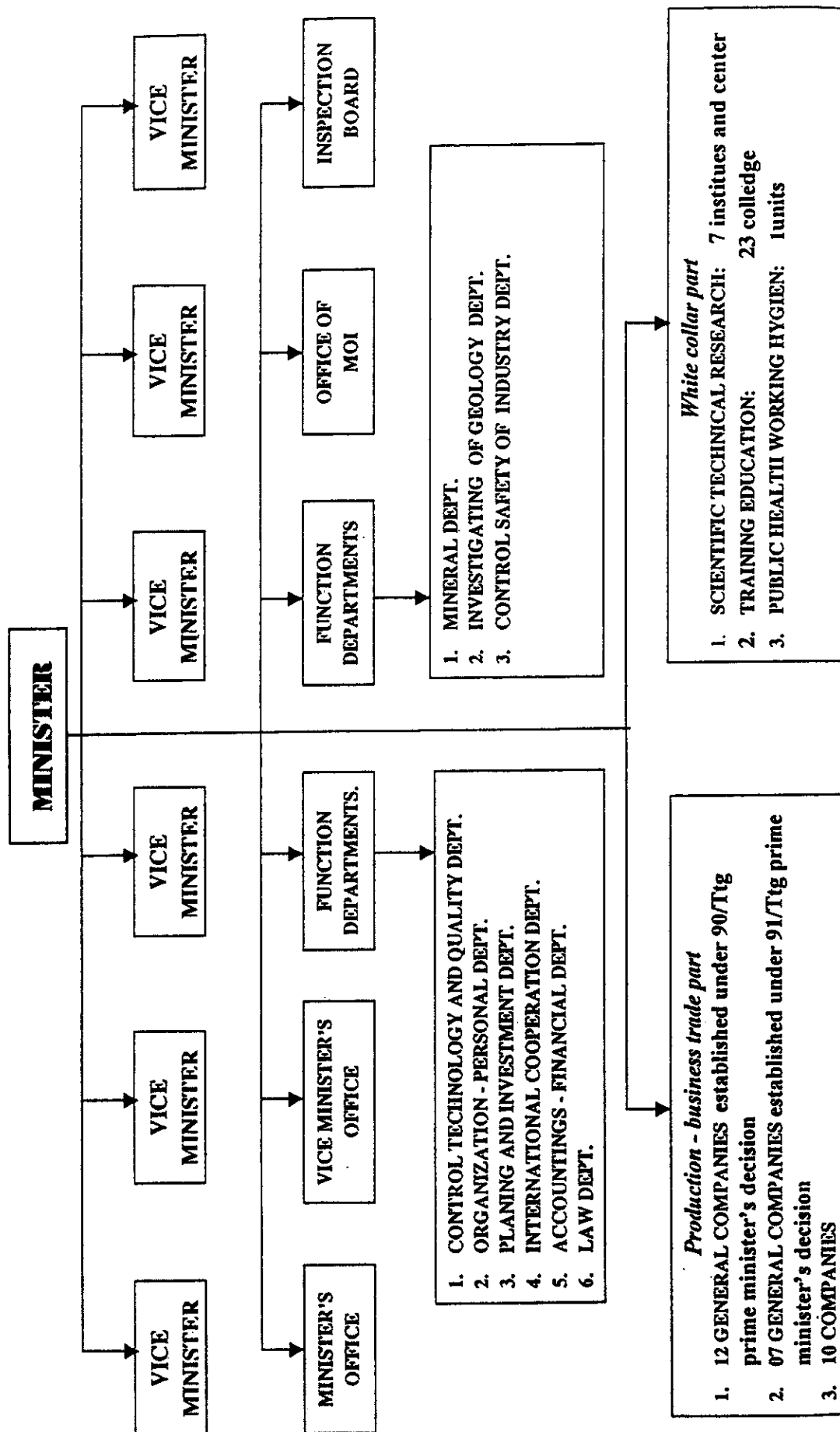
1.4.4. Reinforcement on equipment

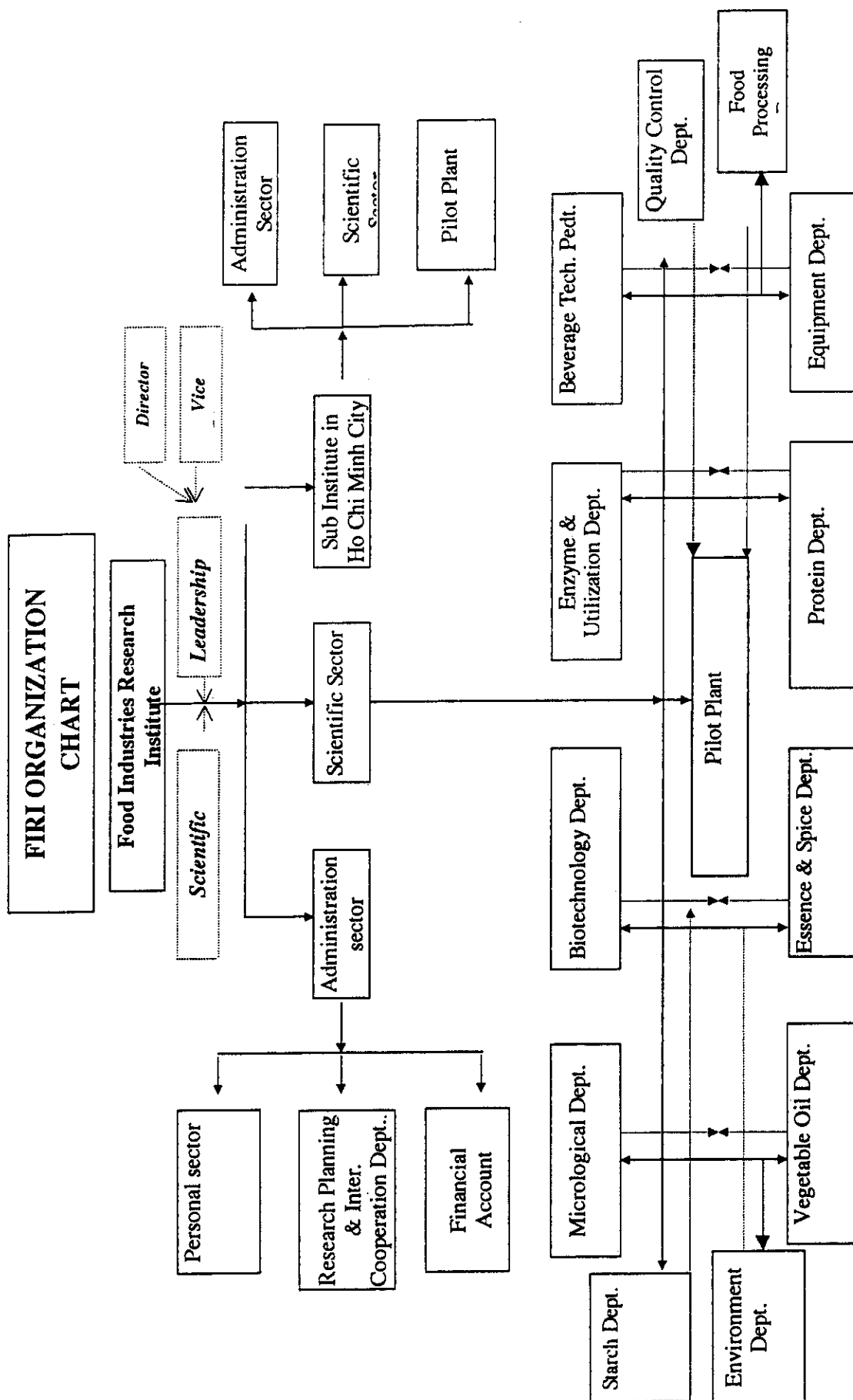
- To equip laboratories with analytical devices and other modern techniques (Gas Chromatography, High Pressure Liquid Chromatography, Atom Absorbency Spectrograph, Infrared Spectrograph, Water Analysis Device, Beer Analysis Device, Freeze Dryer, Fermentation Device, Toxic, Pesticide Residue, and Preservative Residue Analysis Techniques).
- To equip pilot with the following equipment:
- Equipment for beverage production, for vegetable processing, for TATE processing

2. Relationship with other offices and investment policies

- Ministry of Agricultural and Rural development
- Ministry of Science, Technology and Environment
- Ministry of Science and Investment
- Ministry of Industry
- Restructured Policy

MOI ORGANIZATION CHART





1.5. Phân trả lời của cô Đào

1.6. Food for already use has to be safe, nutrition, taste and healthy. Base on this oppinient, the airm of FIRI's researches and improvements are

- Using the safest preservation methods and preventing of changing product qualities during technological processes.
- Maximum limit of using chemicals, ingredients in preservation
- Maximum limit of using changed gen products.
- Set up the model systems for control quality, hygien and safe to get fastest the analytical control results.

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Question 2: : Xác nhận lại thể chế thực thi dự án

2.1.Xin cho biết (sơ đồ) cơ cấu tổ chức của Bộ Công nghiệp và Viện CNTP. Đồng thời xin xác nhận lại : dựa theo QĐ thành lập: Viện CNTP có chức năng hỗ trợ chi viện cho các xí nghiệp nhỏ ở vùng nông thôn không? Cũng như xác nhận lại xem hoạt động của dự án này có phù hợp với quy chế của cơ quan sở tại không?

The Food and light industries research institute established under Prime Minister's Decision 182/CP dated 02-11-1961.

As requirement of the development of food branch, the Food Industries Research Institute was established under Prime Minister's Decision 112/CP dated July 21st, 1967.

According to the Decision 782/Ttg of Prime Minister dated 24-10-1996 the Food Industries Research Institute is one among six National Institute of the Ministry of Industry.

Technological Scientific Activity License No. 113 dated July 10th, 1993 was approved by Ministry of Science, Technology and environment.

According to the Decision 2998/QD - TCCB of the Ministry of Industry dated October 8th, 1996 FIRI's Pilot Plan was established to complete and demonstrate the technology; design, manufacture and install equipment; produce technological and science products; train staffs and workers; etc.

According to the Decision 1134/QD dated July 30th, 1998, FIRI have taken in Consulting Board for Program applying science and technology to serve country and mountainous district.

The Food Industries Research Institute is an entity specializing in research and application, especially applying Biotechnology in the food industry. The Institute is responsible for the following activities:

1. Studying scientific & technological development strategy and policy, especially biotechnology in the food industry.
2. Carrying out the implementation of scientific and technological research projects and themes on the fields of genetic engineering, microbiology, fermentation technology, enzyme technology and food processing from agro- products.
3. Training workers, technical staffs, tertiary and post-graduate.
4. Developing technological and scientific information activities and information network in the food technology.
5. Establishing technological process, taking part in formulating branch and State standards, quality control of food products.
6. Developing co-operative relations on science and technology.
7. Designing, manufacturing and installing equipment, transferring technology in the field of biotechnology, producing various types of foodstuff and drinks.

2.2. Relationship with other offices and investment policies

2.2.1 The Ministry of Agricultural and Rural development

- FIRI was priority belonged to the Ministry of Agricultural and Rural development. It has been belonging to The Ministry of Industry since 1993.
- FIRI has been set up relationships with food-processing and agro-product enterprises at medium and small scales. Preservation products are agro-products such as animal products, cultivation products.
- The director of FIRI is a member of leading group of technological-economical programmer that is leaded by Minister of The Ministry of Agricultural and Rural development.
- In order to serve enterprises or person, who need to be helped, FIRI has been transferring its food-technological and preservation to them. Other ways, FIRI expected that its technology could be transferred to be people who need it.

2.2.2. The Ministry of Science, Technology and Environment

- FIRI's Science and Technological activities have been managed by The Ministry of Science, Technology and Environment. This management concluded science researches, science technological services, which based on Government legislation documents guidance of The Ministry of Science, Technology and Environment.
- Government Science and Technological project programmers have been guidance and supported by some fund- resources from the Ministry of Science, Technology and Environment during carrying out processes, especially in priority fields and application fields.

2.2.3. The Ministry of Science and Investment

- The Ministry of Science and Investment has been approved priority projects for Science and Technology Cooperation at International levels.
- The Ministry of Science and Investment has been cooperating with other Ministries to approve projects, to observe carrying out projects and assess project's results.

2.2.4. The Ministry of Industry

The Ministry of Industry is relevant Ministry for FIRI. This was signed by Primer Minister as No 783 regulation at 4/10/1996.

Food fields have been listed following electricity, texture and leather-foot ware.

FIRI's Organization and restructures, functions and responsibilities has been approved by The Ministry of Industry.

FIRI has to report any kind of its activities to The Ministry of Industry.

2.2.5. The Restructured Policy

*** Institutes belonging Ministry**

- FIRI is one of six Institutes belonging Ministry of Industry
- FIRI is the only Governments one researching on food technological and preservation according to Government legislation.
- Institutes with Ministry relevant guidance have been mainly investigated to support for restructures, salary- budget, running management activities, research funding, services, investigating equipment.

*** Institutes belonging General Companies**

For example:

The research institute of alcohol, and beer belonging to the co-operation of alcohol, beer and beverage under the Ministry of Industries.

The research institute of tobacco economy and techniques belonging to the co- operation of tobacco, under the Ministry of Industries.

The research institute of vegetable is belonging the co-operation of Vietnam vegetable, under the Ministry of Agriculture and Rural Development.

The government has been supporting a part of salary budget and running management activities. The general companies invest infrastructure, equipment and research funding

for institutes. Institute activities are attached with the commercial and production activities of general companies

2.3. FIRI fund within 5 years

(Million VND)

	1995	1996	1997	1998	1999	2000
From the Government						
Themes	1.667	2.574	3.603	3.675	3.420	3.340
Project investment	0.824	1.098	2.500	3.000	3.000	<u>10.000</u>
B. FIRI						
Technology transfer and production in a pilot	3.338	5.739	2.524	3.424	3.745	4.000
Total	5.829	9.411	8.627	10.099	10.165	<u>30.107</u>

(FIRI's budget %)

N ^o	Source	1995	1996	1997	1998	1999	Preliminary 2000
1.							
2.	MPI	14,1	11,7	29,0	29,7	29,5	----
3.	MOI	26,9	21,5	30,2	26,1	26,4	15,1
4.	MOSTE	1,7	4,8	11,5	10,3	7,3	33,3
5.	FIRI	57,3	62,0	29,3	33,9	36,8	13,3

2.4. Về đối tác làm việc, phân công nhân sự: ngoài các dữ liệu hiện có, xin cho biết thêm về thành tích nghiên cứu đã đạt được, để hiểu về nghiệp vụ của đối tác

Technology transfer by FIRI

No.	Product	Area	Number of enterprises	No.	Product	Area	Number of enterprises
1	Beer	Ha Noi	18	5	Vegetable oil	Ha son binh	1
		Hai phong	11			Ha noi	1
		Hai hung	8			Ha bac	1
		Hai duong	2			Ha tinh	1
		Thanh hoa	3			Hai phong	1
		Ha son Binh	1			Ha giang	1
		Quang ninh	3			Ho Chi Minh City	2
		Da nang	1			Son la	1
		Vinh phu	2			Tien giang	1
		Ha nam ninh	4				
2	Beverage	Son la	1	6	Baby food	Yen bai	1
		Quang tri	1			Thai binh	1
		Thai binh	2			Hai duong	1
		Ha tay	9			Lai chau	1
		Ha giang	1			Quang trp	1
		Thai nguyen	1			Dac lac	1
		Tuyen quang	2			Lang son	1
		Hue	1				
		Thanh hoa	1	7	Glucose	Ha tay	2
		Ha bac	1			Ha noi	1
3	Alcohol	Ha tay	2			Quang ngai	1
		Hai phong	2			Nam Dinh	1
		Ha noi	1			Thanh hoa	1
		Tuyen quang	1				
		Son la	1				
		Ha bac	1			Hoa binh	1
		Ha tay	1			Nghe an	2
		Hai duong	2				
		Thanh hoa	1			Can tho	1
		Thai binh	1			Soc trang	1
4	Instant coffee	Bac giang	1	10	Environmental evaluation		
		Bien hoa	1				
				11	Soy cheese	Ha noi	3
						Lang son	1

2.5- Foundtion of matter, pilot :

2.5.1-Land and house :

- Amount : 25.000m²
- Land in use : 22.174m²
- Land will use :
 - + Expenditure from government 960m²
 - + Expenditure from project: 720 m²
- Amount of laboratory square : 1.650m²
- Amount of aministration office square : 597m²
- Amount of pilot square : 1.944m²

2.5.2 – Electricity source :

- 1 transformer station 680 KVA, on mission: 600 KW/giờ .
- 1 transformer station 320KVA - on mission: 270KW/ giờ.

2.5.3 – Water source:

- 01 Ha Noi's water system with source conduct's diametter Ø 100.
- 01 water tank - 200m³
- 01 water tank - 60 m³
- 01 water tank - 20 m³.
- 01 agent water pump station with 02 pumps on mission 6 m³/h.
- 01 water tank 8 m³ .

2.5.4. Sack water :

- 01 system preliminary treat sack water of pilot use microorganism technology
- Một hệ thống thoát nước thải liên hoàn góp với mương thải chung của thành phố.

2.5.5- Steam source:

- 01 boiler on mission 800kg steam/h – pressure on mission: 4KG/cm².

2.5.6- Equipment system be invested can buy in general:

- Beverage producing system.
- Presever and process fruite, vegetable system
- Baby food producing system
- Processing agriculture product system.

2.6. Equipment in use

<i>The name of equipment</i>	<i>Department</i>	<i>Supplier</i>
Analytical balance	Food analysis and control	FIRI
HPLC system		UNIDO
Spectrophotometer H-200		FIRI
Fluorescence spectrophotometer F-200		Ditto
Furnace		Ditto
Shaker incubator CH4103	Biotechnology	UNIDO
Micro Kjeldal		Ditto
Microscope		Ditto
Centrifuge		FIRI
Microscope and photo, video system NIKON	Microbiology	Ditto
BOD v _μ COD analyser		Ditto
HACCH-DREL/2010 deep freezer – 85°C		UNIDO
Centrifuge		Ditto
Laminar air flow		Ditto
Rotary vacuum evaporator BUCCHI R144/A	Spices and aroma	FIRI
Centrifuge ALC 4217	Enzyme	Ditto
Incubator		UNIDO
Homogenizer	Oil and oilseed tech.	FIRI
Freeze dryer BETA-216	Food tech.	UNIDO
Fermenter Biostat E x 2		Ditto
Microscope		Ditto
Electrical steamer		FIRI
25 litter fermentation system		KIRIN BREWERY CO.
Spectrophotometer JANWAY 6300	Biological preparation	FIRI
Spectrophotometer	Beverage tech.	Ditto
Microscope		Ditto
Spray dryer APV	Engineering	UNIDO
Canning machine		Ditto
Butter separator		Ditto
Freeze room		FIRI
Vertical autoclave		Ditto
Universal grinding machine		Ditto
Wet grinding machine		UNIDO
Double water distiller		-nt-
Pilot plan (Beer)		
Pilot plan (Soft drink)		
Pilot plan (Enzyme)		
Pilot plan (Oil)		
Pilot plan (Baby food)		

New equipment

<i>The name of equipment</i>	<i>Department</i>
Infrared moisture analyser, Model MB200	Common laboratory
Spectrophotometer	Food analysis and control
Vacuum fractional distiller	Biotechnology
Soxhlet system, Ser 148/3	Oil and oilseed tech.
Homogenizer	Common laboratory
Circular shaker	Microbiology
Horizontal shaker	Microbiology
Centrifuge Universal 16A	Common laboratory
OD Spectrophotometer, P-022660-10, Model 6300	Food analysis and control
Automatic Kjeldal, KB8-SV ap30	Common laboratory
Automatic titrator E24900-05	Food analysis and control
PCR PE 9700	Microbiology
Horizontal Electrophoresis GNA100	Food analysis and control
Vertical electrophoresis VE	Food analysis and control
Room incubator	Common laboratory

Equipment to be granted by JICA

Equipment	Number	Usage
1. Gas chromatography	1 set	Flavor component
2. HPLC	1 set	Carbohydrate, amino acid
3. Beer analyzer SCABA	1 set	OP, Alc. pH, Color
4. Atomic absorption anly.	1 set	Metal
5. Autoclave	2 set	Microbiology
6. Centrifuge	1 set	Jointly
7. Microscope	1 set	Jointly
8. Aseptic room	1 set	Microbiology
9. Pure water prod. equip.	2 set	jointly
10. Freeze dryer	1 set	
11. UV spectrophotometer	1 set	
12. Evaporator	2 set	
13. Glovebox	1 set	
14. Homogenizer	1 set	
15. Incubator	3 set	
16. Cleanbench	2 set	
17. Viscosimeter	1 set	
18. Extruder	2 set	
19. Vacuumdryer	1 set	
20. Fat rapid analyzer	1 set	
21. Crude fiber analyzer	1 set	
22. Spraydryer	1 set	
23. Lyophilisator	1 set	
24. Pressure pump	2 set	
25. Fermenter	1 set	
26. Jar fermentor	1 set	
27. Homoiothermal room	1 set	
28. Others	Many kind	

3.

3.1

3.1.1 Phần BM Vi sinh:

3.1.1. Present background for isolation, maintain and replacement for useful microorganisms in the traditional fermented products

a) Isolation technique

Microorganisms are isolated, screened, selected from the traditional fermented products. These microorganisms play important roles in created and converted flavour and preservation.

- Wine products are fermented from cassava, corn and rice

"Banh men Thuoc bac"- a traditional fermented products for producing wine- (a kind of microbial preparations based on a combination of microbial strains and dried dough as carrying agent). From these traditional products, FIRI has been collection, appropriate strains are selected for their application in some traditional fermentation such as manufacturing for local vodka production from starch resources.

- Soy sausages, fish sausages and pea sausages

Isolation and selection of some fungi, which can be, extracted high activity enzymes such as amylase, protease. These enzymes play an important role in hydrolyses processing

- Fish sausage

FIRI has been isolating from traditional fermented fishes to select microorganisms, which can be created special flavour in fish sausage. However, this part is not completed.

- Fermented meat

Some lactic acid bacteria's were isolated, screened and selected from traditional fermented meats by FIRI.

Some lactic acid bacteria's can be produced high bacteriocin activities. The next researches intend to apply these LABs as a starter culture to bio preserve and improve quality of the traditional fermented meats such as "Nemchua".

- Wine products are fermented from rice

FIRI has been isolating from " Banh men Thuoc bac "to select microorganisms produced special flavour.

- Fermented vegetables, fruits

There are some LABs were isolated, screened and selected from fermented vegetables. However, these LABs have been not applied in the industrial scale yet.

There are some corporation- strains from foreigner countries

- Sour milk

Bulgaria strains

- Wine preservation

Malolactic bacterial strains

b) Maintenance and preservation techniques for microbial strains Maintenance on slant agar

Microbial strains are cultivated on adequate nutritious media. After exponential phase of growth, microbial strains are kept at temperature of 5°C, for period of 1- 3 months.

- Maintenance in liquid paraffin

These techniques are applied mostly for yeast and fungal strains. After exponential phase of growth, microbial strains are flooded with sterilized liquid paraffin. The tubes of strains are kept at temperature of 5°C, for period of 6- 12 months.

- Maintenance in sand

This technique is applied for fungal strains. The cultures are kept at 5°C, for period of 1- 3 years.

- Maintenance by freeze- drying

Some trials were made. However, because the uncompleted equipment system was not functioning well, this technique has not been applied for culture maintenance. (Needs to be agreeable to Mr. Hien's opinion)

- Maintenance by deep freezing

At the present, some yeast strains are maintained at -20 °C.

3.1.2. Present problems for development and application of using yeast strain to fermentation processes

Since it has a limitation on funding-budget and equipments for general biotechnological researchs and yeast researchs and fermentation is low-technology.

There are some the results

a) *Application on yeast technology*

- Isolation, collection and screeence strains from natural beverage fermentations.
- Screening and choosing imported strains which can be suited in Vietnam conditions (water, materials, climite..) to produce beverage products.
- Primary research on “Banh men thuoc bac” to isolate and characterize natural strains. produced novel “Banh men thuoc bac” to apply in alcohol and wine products.
- Isolation yeast from natural fermentation process which can be hydrolization starch to glucose, protein and application them on feeding animals.
- Research on using yeast subsension in beer fermentation:
 - * Sterilize pathogen and spoilage strains
 - * Sterilize killed yeast
 - * Activation
- Using yeast solid waste to produce high nutritio of acid amin to add into baby- food or fish-food.
 - * Using genetic technology to hybryde yeast
 - * UV or chemical mutation
 - * Preparation for using techniques of protoplast hybrisation and genetic manipulation (some researchers were sent to Germany and Japan for studying these techniques)
 - * Primary study on application of immobilized yeast in wine fermentation.

Beverage technology:

*Beer fermentation

- Research on short-time beer fermentation technology, which allows to shorten primary and secondary fermentation to 10- 12 days and has been applied to large and small -scale beer brewery production (batch fermentation).
- Research on diacetyl reduction by α - acetolactate- decarboxylase treatment or by heating before secondary fermentation.
- Primary research on fermentation by immobilized yeast cells in Ca- alginate and glass cotton.
- Research on designing low- alcohol beverage technology (Kvas).

* Wine fermentation

- Research on wine making from fruit (grape, apple, apricot, plum, litchi, mulberry.) and rice (rice, sticky rice or black rice) by batch fermentation based on traditional technology and innovated technology (with enzyme application).
- Research on malo- lactic fermentation by using *Leuconostoc oenos* in fruit wine fermentation (strain selection, study on physiological and biochemical properties of the selected strain, innoculum preparation and fermentation).
- Primary research on continuous wine fermentation by using yeast and bacteria immobilized in Ca- alginate at lab scale (study on immobilization condition, cell concentration, and fermentation procedure, searching for more advanced carrying agents).
- Research on champagnisation in bottles, containers by using yeast or immobilized yeast cells (study on yeast strains, their nutritious requirement, quantity of yeast cells, fermentation condition and preservation).

* Alcohol fermentation technology

- Research on alcohol fermentation from molase by continuous fermentation (study on yeast strain selection, molase treatment by acid or polymer methods, concentration of molase to be added and speed of molase addition).

As the result, the effectiveness of ethanol fermentation from sugar reached at 48 % and the concentration of ethanol in fermented liquid was 9- 10% (v/v).

3.1.3.

Research on some functional food products to enhance the healthy

We used papain enzyme to hydrolyze chicken proteins to amino acids and functional peptides since it has the highest ability to hydrolyze protein with the degree of hydrolysis was 55,51%, at 65°C. The optimal conditions for chicken hydrolyses production using papain enzyme was determined: at the temperature of 62°C, for 140 min with Papain concentration of 0,135%, the maximal degree of hydrolysis (61,5%) can be attained. The received hydrolyses have not only contained many amino acids and functional peptides but also good sensory evaluation. We have determined the production process for essence chicken with reishi, which were fortified with autolysis yeast powder, reishi and carrot extract. The product contains 8,22% of protein and completely 21 essential and non- essential amino acids, especially functional peptides, vitamin A, B₁, B₂, PP and other high bioactivity substances such as triterpenoids. The product was also clinical tested achievevely in The Centre of Hanoi Family Doctor Service.

The processing conditions of germinating was determined at temperature of 25°C, for 3 days, germinated soybean have highest protein concentration (45,5%) than the others. Moreover, vitamins A,C,E..., lecithin also increase considerably. Base on the high pressor extruder cooking technology and appropriate fortification method, we have resulted in the production process of germinated soybean cake functional food. This product contains 25,5% of protein, full of amino acids, including the high bioactivity substraces such as vitamins A,C,E, lecithin. Germinated soybean powder was also fortified to sausage with 20% of concentration for improvement the quality of its product and reduction of the cost. Especially, functional break was achively produced with 10% of germinated soybean powder fortified at Balan Company.

Research on use of Reishi for nutritious liquour production:

Reishi (*Ganoderma lucidum*) is one of the valuable crude drugs, which has long been used in China, Japan, Vietnam and other countries as a traditional medicine for the treatment of various kinds of diseases. Recent studies have shown that Reishi contains 100 biosubstances, including triterpenoid, polysaccharide, ganoderic acid, germanium. In this study, extracts obtained from fruiting body of Reishi are used to fortify with liquor. Three extract methods are carried out. Extract productivity obtained by using hot water method is 8.3%, by ethanolic method is 8.8% and by enzyme method is 10.2% (enzyme cellulase). The optimal conditions of extract method by enzyme are: concentration of Novozym is 0,21%, temperature 60°C for 120 minutes. Extracts are rich in triterpenoid, reduced compounds and 21 amine acid. Reishi special liquor 20° alcohol and 12.5° alcohol, which are produced from Reishi extract are highly appreciated in quality through clinical trials in Center of Doctorate Service and Balan Company.

Research on nutritious beverage production by lactic fermentation

- In this study, optimal temperature and time of saccharification of rice were determined at 60°C for 90 minutes with AMG enzyme 0.15%. A hydrolyzed soymilk was achieved by 0.06% Neutrase enzyme treatment during hydrolysis. The best conditions for fermentation process from saccharified rice-hydrolyzed soymilk mixture were determined at temperature

42° for 12 hours. The product was nutritious, palatable and superior in quality and it was named Risogurt.

- Fermentation process for fruit yogurt production was determined by using bacterial strain *Leuconostoc mesenteroides* with inoculum of 0.2%, fermentation for 4 hours at 40-43°C. Product is specific taste and good appearance, contains protein 26-28 g/l, lipid 30-35 g/l, hydrate carbon 120-200g/l.

Research on production technology for superior instant beverage by enzymatic method, using cereal and malt.

Beverage from malt and cereal has high quality, non- alcoholic and caffeine content, suitable with elderly, patients, children, stress people. This product enhances the body health.

There is some imported nutritious beverage in Vietnam market such as CEREALKING, TEMASEK, PAKER, SUPER..... produced in Singapore.

To reduce the cost and to replace imported products, technology process for nutritious beverage production by enzymatic method using malt and cereal to produce a product with valuable high carbohydrate and hydrolysed-protein content, easy digestion, long preservation without sugar and chemicals, assuring hygiene and food safety.

Theme contents :

- 1) Selection of materials and material
- 2) Mixing formulation to make new products
- 3) Technology process
- 4) Production equipment
- 5) Label and packing study
- 6) Estimation product costs and product methods

Obtained results :

- 1) Suitable materials for production process was determined: malt, rice, rice flour, cassava flour, milk powder, sugar, cooking oil, salt and other additives ... and their proportional ratios
- 2) Technology process suitable with Vietnam conditions was selected to assure product quality and cost reduction
- 3) Suitable technology process with easy mechanization, high productivity, and domestic manufacture was selected
- 4) Suitable labels, easy preservation, long storage (>6 months), easy transportation and use were designed which is easy for customers to select
- 5) Product quality was registered and assured hygiene and food safety
- 6) Rapid estimation product costs

Based on cost estimation, we suppose that if production enterprises have given effective investment into production chain, conducted good marketing work and sold products, good receiving and technology transfer, kept stable product quality and applied good policy on reduction of tax for new product and experimental products, investment and installation of production chain for nutritious beverage will be very efficiency.

Study on Production of Phylamin Tea

Phylamin Tea was studied for production based on the mixed

Determination of situation and content of inquiry

Vietnam is a developing country so as there are plenty of policies involved in improvement of production yield and living standard, especially for poor people in rural areas (account for more than 70% of total population).

Food is one of the most important fields to process agro-products into food and foodstuff products serving most domestic consumers.

3.1.4. Food processing (from farmers as producer, through food processing enterprises to consumers)

* *By producers*: The economy of Vietnam is mainly based on agriculture, which involves 75% of population. These farmers are agro- product producers but meanwhile they are low-income people who can not afford the high price products processed by industrial processing. To satisfy their everyday needs, the farmers have to process their own food:

- Processing domestic poultry at home conditions
- Processing cattle at private or government- own slaughterhouses or at home conditions. The favorable processed items in these cases are traditional food and sausages.
- Processing sea and other aquatic agro- products by drying, cooking or making different kind of soups (from fish, crevette, prawn or crab).

* *By family- scale entrepreneurs*:

These entrepreneurs produce mostly the following food items: Pork or beef sausages, fermented pork sausages, soy curd and milk, different kinds of soups from soy and fish, different vegetarian food items, different kinds of rice food and sweets....

* *By medium and small- scale enterprises*:

There some medium and small- scale enterprises in Vietnam:

- Halong company for meat and fish canned food processing, which produces many varieties of products with high capacity (.... Ton/ year).
- Vietnam meat companies, which produces many varieties of products for domestic and export markets.
- Some local food processing companies in provinces and cities.

Except some new companies, which are equipped with modern techniques, the others are old using outdated technologies and producing the products, which satisfy only domestic markets.

* *Consumer needs*: See the annual statistics, the part of food processing companies with their capacities and varieties.

3.2. Phân tích và kiểm nghiệm:

(1) Mycotoxin analytical :

Aflatoxin (AOAC/ Viet Std) (Not often)	Ochratoxin (AOAC/ Viet Std) (No)	T-2toxin AOAC/ Viet Std) (No) ,	Lo'i kh,c (AOAC/ Viet Std) (No)
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(2) Canny quality controls: Yes

Incubation (AOAC/ Viet Std) (No)	Vacuums AOAC/ Viet Std) (No)	Weigh (AOAC/ Viet Std) (Yes)	Brix (AOAC/ Viet Std) (Yes)
Fat (AOAC/ Viet Std) (Yes)	A xit AOAC/ Viet Std) (Yes)	Seam (AOAC/ Viet Std) (No)	Tro (AOAC/ Viet Std) (Yes)
Kho,ng (AOAC/ Viet Std) (Yes)	Kimlo'i nÆng AOAC/ Viet Std) (Yes)	Protein (AOAC/ Viet Std) (Yes)	Gluxit (AOAC/ Viet Std) (Yes)

(3) Fruit juice quality controls : Yes

Inner pressure (AOAC/ Viet Std) (No)	pH (AAC/ Viet Std) (Yes)	Weigh (AOAC/ Viet Std) (Yes)	Brix (AOAC/ Viet Std) (Yes)
Fat (AOAC/ Viet Std) (Yes)	A xit (AOAC/ Viet Std) (Yes)	Seam (AOAC/ Viet Std) (No)	Tro (AOAC/ Viet Std) (Yes)
Minerals (AOAC/ Viet Std) (Yes)	Heavy metals (AOAC/ Viet Std) (Yes)	Protein (AOAC/ Viet Std) (Yes)	Gluxit (AOAC/ Viet Std) (Yes)

(4) Microorganisms controls :

E. Coli (AOAC/ Viet Std) (Yes)	Coliform (AOAC/ Viet Std) (Yes)	TPC bacteria (AOAC/ Viet Std) (Yes)
Fungi, yeast (AOAC/ Viet Std) (Yes)	Salmonella (AOAC/ Viet Std) (Yes)	Clo. perfringens (AOAC/ Viet Std) (Yes)

(5) Control of ingredient quality: No

6) Lack of the following equipment which are necessary for analytical controls

- Machine (GC)
- Machine (HPLC)
- Spectrocooper (AAS)
- Machine measure Eliza (STATFAX NEOGEN rEADER)
- Evaporation SO₂ equipment (Sulphur Dioxide Distillation Appratus)
- Spectrocooper HY- LiTE

(7) Chemicals need to be for carrying out of these analytical controls :

- Standaridation chemicals .
- Some kinds of Kit, indicators.
- Special media for microorganisms.
- Pure liquid media for HPLC machine.

(8) FIRI has been carrying out analytical controls for food problems such as lower qualities, rooten included:

- Many kinds of brewage, fish sausage, soy sausage, milk...(unreal products, low quality)
- Imported Malt (transportation problems)
- Check in basing on requirements of organisms, offices or enterprises..

(9) Application of HACCP in general hygiene systems and staff -training for having and improving the abilities of analytical controls

- HACCP has been known in Vietnam since 1991, however, it has only pay attended and applied since 1995.
- FIRI staffs were trained to understand and apply of HACCP International course (Hollands)
- HACCP programs and documents were referenced from CODEX, FAO, America , Canada, EU.
- Analytical staffs were trained and improved their analytical knowledge and practical abilities at The general measurement and control for quality products company
- The application of HACCP has initially been carrying out at some food factories, enterprises under MOI's guidance.

3.3. Food preservation:

Food Industries Research Institute has been carrying out some researches, which aim to develop the abilities of food bio-preservation by some following methods:

1. Heat treatment (Pasteur, dry, low temperature)
2. Bacteriocin
3. Using permitted chemical treatment: SO₂, acid ascorbic, NaHSO₂, H₂O₂...
4. Using UV (Ultra Violet)
6. Using biological membranes
7. Using salts, sugar

The technologies for preservation of some fruits have been studying.

The technology for preservation of lemon, orange, grape fruit

After harvesting, fruits are chosen and selected to rig out damaged ones and cutted.. and packed to avoid effecting the quality of others. Fruit skins are treated by fungi killing chemicals and covered by kitozan thinning membrane to eliminate respirations of fruits and to prevent water evaporation of fruits and leading to reducing their weights.

After initial treatment, fruits are dried and packed into large polyethylen boxes and put them into the selfs, preserved into room temperature. By this method, the self-life of fruits products (such as lemon, orange and grape fruit) are longer than 30- 40 days comparing to the control samples which do not cover kitozan thinning membranes).

The technology for preservation of plump

Preservation self were designed which can be maintained temperature, humidity by control-temperature boxes and cool, hasking. After choosing, plumps are packed into the preservation selfs. By this methods, plumps are remained 92% initial weight after 7 days at 300C.

3.4. Environmental process

1. FIRI has studied on wastewater treatment in Food industry by activated sludge and setting up beer wastewater plan with capacity 25m³/day. Quality of treated water has standard of Vietnam (TCVN - level B)
2. We has studied natural activated sludge with adding selected microorganisms 90 - 91%.
3. In recently, we have been studying wastewater treatment in sugar and starch processing with high pollution (COD ≥ 5000mg/l by anaerobic and aerobic methods.

3.5 Technological training and distribution activities

To apply the technological progress from researches, training and distribution activities are very important and they are carried out by some following methods:

- Though "food processing" classes, FIRI has been annually training food technologies for many people from factories, enterprises, plans, many cities and locals.
- Attending to the International and Domestic cinema:
 1. Cinema held by The Ministry of Science, Technology and Environment
 2. Cinema held by ASIAN
 3. National Cinema: agriculture, aquatic, environment
 4. Meeting with people from medium and large scale factories
- Through Government programmes corporation with locals to set up projects
 1. Biological technological programmes
 2. Distribution and application of high technological progress from research into mountainous and rural areas.
 3. Food technological programmes
- Transferring directly technologies to factories (funds from factories)
 1. Wine technology

2. Short time fermented beer
 3. Fish sausages
 4. Glucose
 5. Soy milk
 6. Fruit juices
- Attending the International and domestic markets
 1. Exhibition of Agricultural and Industrial products
 2. Exhibition of Beverage
 3. Exhibition in India
 - Advertisement and distribution of FIRI informations.

**THE IMPLEMENTATION OF THE OBJECTIVES OF SCIENTIFIC
RESEARCH AND TECHNOLOGICAL DEVELOPMENT FOR THE
PERIOD
1996 - 2000 AT GOVERNMENTAL LEVEL**

Below are projects funded by the government budget; and FIRI was the main organization of implementation

**1. Project title: *Research on fruit preservation and processing at small scale
(for Vietnamese farms at hill- land areas) by application of
biotechnological techniques (1998- 2000)***

Achievements:

- Research on production of high quality wine: 4 strains of high fermentation ability were selected. The technology was transferred to some companies. The product was accepted by the consumers.
- Research on enzyme application in wine production: Some enzymes were studied for fruit juice treatment before fermentation and clarification of wine. The research is being carried on for the determination of some technical parameters.
- Research on juice making: The study on enzymatic treatment for increasing juice extraction rate was carried on. Some kinds of product such as clarified juice, nectar, concentrated juice, and squash were developed at lab scale. The production at pilot scale is under way to be implemented.
- Research on fermented juice production (Cider): 4 strains of high fermentation ability were selected. The enzymatic application was carried on for juice clarification and improvement of the product aroma.
- Research on Fruit Gel : The microbial strain of high ability of membrane formation was selected. The media recipe and fermentation conditions were determined. The technological scheme was designed for pilot scale. The product had a shelf life from 12 to 20 months.
- Research on fruit preservation: The study on application of some permitted chemicals for repression of spoilage microorganism. The ethylene was applied for respiration rate limitation. The initial results showed that lemon could be stored for 1 month, orange (Vinh specie) for 2 months, orange (thick rind specie) for 2.5 months and grapefruit for 3 months.

**2. Project title: *Production of crystallized glucose by enzymatic methods
(1996- 1998)***

Achievements :

- Research on glucose powder production: By using enzymatic method, the convertibility rate increased for 10 % (by using enzymatic method the convertibility rate accounted for 95%, meanwhile by using acid method the convertibility rate accounted for 85%). The product met the requirements established by the Ministry of Health; Its quality (sweeteners, aroma) was improved in comparison with the product of acid method application.
- Research on glucose syrup: The contents of reducing sugar, dextrin, oligosaccharide, disaccharide and trisacchride were controlled by using enzymatic method. The FIRI transferred the technology to Hai-ha confectionery company (Viet-tri province), 19-5 Sontay company, Lamson Sugar production company, Quang- ngai Sugar production company, Minh- duong company Ltd., Namdinh honey production company.

3. Utilization of enzyme preparations in food industry

- Optimal conditions for enzyme utilization was determined. The use of preservatives and sterilization conditions for fish sausage production process were selected, therefore the production cycle of fish sausage from salted fish was reduced to 2,5-3 months.
- Technology processes for the production of fructose syrup from cassava starch, soy sausage, fruit juice were determined.

4. Production of snack food from cereals to provide for rural areas

- Suitable technology process for the production of corn snack was selected
- The price and quality of the product were accepted by consumers.

5. Production technology for super instant beverage from barley malt and cereals, by using enzymes. Suitable equipment and technology were selected which are easy mechanization and domestic manufacture and produce the products with high production yield and standard quality.

6. Production of Linh-Chi nutrition wine

- Formulations for production of strong wine and light wine in combination with sticky rice wine and red wine were determined.
- The products were initially accepted by some enterprises.

7. Production of beverage from medicinal plants to enhance the body immune system and prevent some diseases.

The products were successfully tested on human (was vegetarian patients at the friendship village) and introduced into the society, especially for elderly people.

8. Study on agro- product processing by micro-biological technology.

- Some suitable materials were selected for agro- product processing, applying enzyme and micro-biological technology.
- The products were initially accepted and signed contract for technological transfer.

9. Study on technology and equipment for production of tomato ketchup.

- Technology process and equipment for production of tomato ketchup were proposed. Formulation for tomato ketchup was basically determined.
- Suitable equipment for tomato ketchup production was selected based on available equipment.

10. Study on utilization of biological supplementary food for fish feeding.

The feed ratio was determined for fish at experimental scale.

11.. Study on production of champagne from sticky rice wine.

Production of champagne was carried out on the prepared containers.

12. Study on technology for production of sticky rice flavors from pineapple and its utilization in food. 3 kinds of sticky rice flavors were produced and used in milk, wine, white coconut cake, grille cake of fresh rice.

13. Study on creation of high activity microbial populations waste treatment is sugar cane industry and use as organic fertilizer.

- Too filamentous fungal strains HS1 and HS2 with high activity of cellulose synthesis were selected among 19 studied strain.
- Suitable inoculates medium for the chosen strains selected. Conditions for garbage treatment and used medium for surfaced fermentation were selected.

14. Utilization of immobilized bacterial cells of the *Leuconostoc oenos* strain in malolactic fermentation. The conditions for immobilization of bacterial cells and malolactic fermentation were determined to produce the wine product in the shortest time.

15. Utilization of uniform microbial strains to improve the quality of yeast cake.
- The yeast cake was produced at industrial scale.
 - Initial fermentation time was reduced from 24 hours down to 17 hours.
 - The strains and technology were provided for some yeast-cake production enterprises in Haiphong, Quang ninh, Hatay and Danang.
16. Study on soybean processing into high protein and lipid food products by advanced biotechnology.

Technology process for production of four kinds of food products from soybeans: mayonnaise fried soybean, soybean diet and soybean cheeses were proposed.

17. Improvement of production technology for modified starch used in food and pharmaceuticals.

Production process for modified starch by acid and enzyme methods was proposed. The product has high quality and is much lower price than the imported product.

18. Technology improvement for oil rape seeds processing (continue)

- Two kinds of imported France and German unite rape seeds were planted at Ha giang province and resulted the yield of 1,800 Kg/ha for German rape seeds and 1,350 Kg/ha for the France one.
- Suitable technology process for oil rapeseed processing was proposed.
- Production of sauce and cattle feed from rape seed cake.

19. Contraction of scientific and technological strategies to 2001 and technology itinerancy to the year 2005 in the food technology field.

20. Using nisin for food preservation. Synthesis nisin by isolated strain from Vietnamese fermented food.

21. Study on production technology for some functional foods to enhance body health.

- Optimal recovery technology of nutrition components and biological active compounds from materials was determined.
- Functional food products on paste formulation were experimentally produced.

22. Utilization of protease enzyme for the production of high amino acid capsule
 - The product was experimentally produced at the capacity of 35 kg of materials per batch.
 - Spray drying product was medically tested
23. Study on creation of microorganism preparation with high activity for waste treatment in cassava starch processing and use as cattle feed
 - The microorganism preparation for waste treatment was created
 - Initially experimental trials were carried out 3 times and obtained good results. The samples have been brought into applied enterprises.
24. Study on technology for lipid acid separation from soybean and sesame oils and their utilization in pharmaceutical industry
 - Technologies for lipid acid separation by chemical and enzyme methods were determined
 - Lipid acid product was used for treatment of patients with the troubled lipid in the blood at the 108 Hospital
25. Technology for cacao processing
 - Cacao production areas were surveyed and investigated
 - The content of commercial fresh cacao and cacao seeds was determined
 - Technology for cacao processing was determined
 - Cacao powder was used in food products
26. Improvement and development of production technology for pepper essence
 - Suitable biotechnological preparation was selected for refining pepper essence
 - Technology and applying methods were selected and the efficiency was assessed
27. Production of new beverage from agro and food products
 - Technology processes and equipment for the production of rice wine, sticky rice wine, soybean milk, based on fruit flavors, and some beverages from vegetables were determined
28. Technology for production of egg wine
 - Technology process for egg wine production was selected .
29. Study on some elements affecting the quality of beer product at medium and small scales (on progress)
30. Utilization of enzyme in production of vegetable oils, fructo-oligosaccharides, new fermentation technology for lactic acid production from molasses, and production technology for pine-apple juice with CO₂ (on progress)
31. Study on waste treatment in sugar cane industry and utilization of ATP bio-optical method to control environmental hygiene and food safety (on progress)
32. Technology and equipment for agro and food processing at small scale for rural and remote areas (on progress)

33. Accomplishment and improvement of LinhChi wine quality and special sticky rice wine in Vietnam; production technology for instant fruit tea (on progress)
34. Utilization of PCR technique in studying synthesis of zymocin. Nisin and Bs toxin proteins from microorganisms (on progress)
35. Technology for extraction of food colors from vegetables and microorganisms (on progress)

Experimental production projects at ministerial level :

1. Experimental production of corn syrup and corn oil
 - Corn syrup was applied in beer production with the ratio of 15%, the beer price was reduced to 74,670 VND/1000 liters of beer. The quality of beer product obtained fixed norm, good flavor and taste, low alcohol level.
2. Experimental production of paste fruit concentrate from glucose and other fruits in Vietnam
 - The products were registred quality and label to sell in the market. The products were generally accepted
 - More than 5 tons of sweets and 3.5 tons of candied fruits were experimentally produced and provided for the confectionery enterprises (Haichau confectionery company)
3. Improvement of production technology for red wine from some fruits in Vietnam
 - Experimental batch fermentation in 3000-liter tank was carried out
 - Exchanged with 2 enterprises for technology transfer of fruit wine production
4. Development of sausage production by advanced technology
 - Sausage was produced with capacity of 10-20 kg/day, based on technological parameters determined such as preserved time, sterilization time and pressure to assure preservation period during 3-6 months
 - Utilization of some new materials for fermented sausage production was tried.
5. Experimental production of gelatin used in food industry
 - Experimental production at capacity of 30 kg/batch has been carried out. Samples are prepared for Thien Huong confectionery factory for jelly candy production
 - Grinder was designed and manufactured, cutting machine and lipid separator have been manufactured for larger scale production

1. Microbiology

By product of sugarcane

a) Alcohol

Sugar cane and molasses:

Gross output of sugar cane and molasses:

Year Planted aerea Sugar cane Mlasses
(thous/ha) (thous/tonne) (thous/tonne)

1996 237 11,432 x 42,% 480

1997 257 11,921 x 4,2% 500

1998 283 13,844 x 4,2% 582

1999 251 17,840 x 4,2% 750

1.2.Alcohol and liquor (thous/litres)

Year Total State Now state Foreign invested sector

1996 67112 36910 30000 202

1997 93600 5474 87988 138

1998 96093 5313 89632 1148

1999 96862 5442 90168 1252

1.3.Sugar cane factories, sugar and sugar syrups factories (unit)

Year Sugar and Sugar syrups
(thous/tons)

Total State Now state

1996 636 178 458

1997 650 221 396

1998 736 257 396

1999 932 503 257

38 (gross) state (3 foreign invested unit in Thanh Hoa, Binh Dinh, Dong Nai- Dai Loan-An Do - Phap)

1.4.Technical impact

Engineers of agricultural cooperstives and sugar cane factories

Labour power of manufacturing of Industry and Food beverage (1.7.1995)
(person)

Total ≥Engineers Practical engineer Technical worker Other worker
Famillia worker

Manufacturing 1,234.116 3,928 6,026 10,182 1,213.980 973,115

Food and beverage 321.343 793 1,601 2,126 316,823 271,986

1.5.Income of and sugar cane factories

In Food and beverage industry there are 3,909 units. The income of workers is different:

Income level(thous/dougs)	Number of unit
non estimated	260
<100	37
101-105	103
151-200	169
201-300	765
301-400	1006
401-500	718
501-600	409
601-700	207
701-800	117
801-900	33
901-1000	34
1001-1200	25
1201-1500	14
>1500	12

b) Field of activities: Biofertilizer

Farm products (self-sufficiency rate (percentage), amount of production, etc, to be mentioned):

Waste product of sugar cane (1 million ton of sugar/year), Agricultural waste (188 million of cattle and domestic fowls head and 29 million ton of rice and 1.612 thousand ton of maize), peaty soil

Processed materials, or final products (present condition and problem):

Biofertilizer nitrogen, biofertilizer phosphorus, biofertilizer organic substance. The technology of processing biofertilizer are limited with low level and small scale.

Social impact on target beneficiaries, especially vulnerable such as the poor, women and children from the viewpoint of nutrition, health, etc..

It cant be denied that the economic, social impact of development these products for sugarcane factories (there are 44 sugarcane factories producing 1 million ton sugar/year) and farmer, clean for environment.

Technical impact (target of technical transfer considering level of techniques of the industries)

Sugarcane factories

Economic Impact (contribution to the rural economy and industries)

Farmer

Sugarcane factories

Important Assumption and Overall Evaluation

The development of biofertilizer industry also lead to the development of sugarcane industry (using sugarcane waste product), agriculture and farmers.

C) YEAST BIOMASS FROM MOLASSES

1. Now in Vietnam have 44 sugarcane factory

North of Vietnam : 13

South and Centre of Vietnam : 31

And about 150 mini enterprises of farmers and cooperatives

Produce : 763,000 tons of sugar/year (by sugar cane factories)

350,000 tons of sugar/year (by farmers and cooperatives)

Consumer of utilisation cane : 10,000,000 tones/year

Consumer of cane molasses : 400,000 tones/year

Now cane molasses mainly was used for alcohol production

For yeas biomass :

In the North of Vietnam

No factory produces yeast biomass from 1985.

Befor 1985 :

Three factory produced yeast biomass for bread production in Hanoi : Tuong Mai; Chua Boc; Nghia Do.

Two factory produced yeast biomass for animal feed :

+ Van Diem sugar cane factory.

+ Vinh Tru sugar cane factory.

Problem :

- Not have fermentor for biomass production.

- Not have continuous flow centrifuge for biomass recovery.

- Not have dry drier.

In the South of Vietnam

La nga Sugar cane factory have a Pilot-plant, which cooperative with a Australia company for production yeast biomass using on bread production, but now the product can not sell because in the black market have dry yeast biomass of France with low price.

2. Preliminary results in the study in production yeast biomass from cane molass of FIRI.

- Production yeasts biomass from *Candida utilis* strains using pretreatment molass on the 200 L tank with yield of 95 - 110 gram/liter
- Using decant method for recovery yeasts biomass. Yield of this method reached 80 - 85% in comparison with centrifugal method.
- Using heating and drying ovens with forced air circulation for dry yeasts biomass.

3. Objective of cooperative.

- Develop fermentation, high yield fermentation with using good strains and equipments.
- Develop down stream processes to improve product economy.
- Develop low cost of products.

2. FERMENTATION TECHNOLOGIES

(1) Traditional fermentation food

a) Fish Sauce

* Production amount: 150,0.10⁶ liters/year.

* From raw material: Small salt - water fish.

* Self-sufficiency rate: 100% (150.000, tons small salt-water fish).

* **Present condition:**

- Fish sauce is produced by traditional method. It takes us about 6 months to 12 months to produce fish sauce from raw materials.

- Salt and small fish are mixed with ratio 1: 3 or 1: 4 in the tank;

$V = 5 \div 7m^3$. After 6 - 12 months, a clear - brawn extract can be drawn as special fish sauce. With 20 ÷ 24g Nito/litter to drawing lower quality fish sauce, salt solution 25 ÷ 28% is used to get the second and the third extract. Commercial products in Vietnam market are different from each other by Nitrogen contents and their special flavors.

Super quality	26 - 28 - 30g N/litter	20.000@/l
Special	20 - 25g N/litter	15 ÷ 16.000@/l
The first grade	15g N/litter	8.000@/l
The second grade	11g N/litter	6.000@/l
The third grade	9g N/litter	3 ÷ 4.000@/l

* **Problems:**

- Long lasting time for a cycle.

- Difficult for filtration.

- Large capital investment for raw materials.

Many Researchers paid attention to solve these problems, special to the first one, including researchers from Food Industries Research Institute (FIRI). They had use protease from Bac. Subtitles to improving hydrolization processing. With the adding of enzyme, production time of fish sauce can be reduced to 2 ÷ 3 months in the summer condition. Nitrogen content in final product increases 8 ÷ 10% in compression with product - producing by traditional method, but the flavor only be accept by customers if we mix together with traditional fish sauce.

1992 - 1995: New technology in fish sauce production can be transferred into Nghe An province. With enterprise: Cua Hoi, producing 1 million liters/year. Now, they produce with capacity: 2 millions/year.

1999- 2000: A small enterprise in Hai Hau, Nam Dinh had been received new technology by FIRI. Production scale: 400.000 liters/year.

In fact, new technology from FIRI must be fulfilled with the following questions:

- Investigating the relation ship between flavor and Microorganism system in producing time of traditional fish sauce.

- Indicate the most important strains of microorganism involving with flavor creation.
- Determine the most important ingredient in complex of fish sauce flavor.
- Improving flavor of fish sauce - producing by new technology.
- Improving filtration by using other enzyme.

*** Social impact:**

- Saving capital investment.
- Create product with the same quality of flavor with traditional one.

*** Technical impact:**

- More enterprises will be accepted new technology if our product will be improved.
- Keeping hygiene condition.
- Production line can be able to scale up into industrialization levels

*** Economic impact:**

- Fishermen may use small salt - water fish for home - made fish sauce with high content of nitrogen (providing amino acid for women and children in rural region). At present, the price of special fish sauce and super- quality of fish sauce is too high for them).

- Fishermen may earn money by producing fish sauce because of decreasing capital investment (Reduce time).

- **Overall evaluation:** 150 millions liters fish sauce per year is not small capacity. Solving long lasting time for production is important and valuable for us.

b) .Fermented meat

- * Production amount: 6.10^6 tons/year.
- * From raw material: pork meat and ingredients.
- * Self-sufficiency rate: 100%

*** Present condition:**

"Nemchua" is defined as comminuted fat, meat and pork skin mixed with salt, sugar, spices, fire-rice and guava leave, wrapped into banana leaves, uncooked and subjected to fermentation by natural existing lactic acid bacteria (LAB). "Nemchua" is dried and can be stored a sort time without refrigeration.

*** Problems:**

Because of "Nemchua" production is passively carrying out by non-selected microorganisms from raw materials or environment and home-made processing. That's why, the quality of "Nemchua" is certainly unpredictable, unsafe, and its shelf -life is short (only 1-5 days).

The situation would be improved and ensured by an application of nisin-producing lactic acid bacteria, which is designed as a starter culture into "Nemchua" system.

This is a research with target to maintain and develop the traditional fermented foods of Vietnam.

In fact, new technology from FIRI must be fulfilled with the following questions:

- Investigating the relationship between flavor and Microorganism system in producing time of traditional fermented meat.

- Indicate the most important strains of microorganism involving with flavor creation.

- Determine the most important ingredient in complex of fermented meat flavor.

*** Social impact:**

- Saving capital investment.

- Create product with the same quality of flavor with traditional one.

*** Technical impact:**

- Many LAB produce bacteriocins inhibitory to other, usually related bacteria. The best-characterized inhibitor to date is nisin, a bacteriocin produced by certain strains of *Lactococcus lactis*, which is active against Gram (+) bacteria, including food pathogens such as *Listeria monocytogens*. Nisin is effective against Gram (-) bacteria only if used in combination with chelating agents. Since *Lactococci* are principal starters in a variety of fermented products, some investigators have attempted to use nisin and/or nisin-producing (Nip⁺) strains to improve product quality. The incorporation of bacteriocin-producing lactococci in foods provides a very attractive alternative to the addition of purified bacteriocin, which would consider a food additive.

More enterprises will be accepted new technology if our product will be improved.

- Keeping hygiene condition.

- Production line can be able to scale up into industrialization levels

*** Economic impact:**

The fermented meat problem would be improved and ensured by an application of nisin-producing lactic acid bacteria, which is designed as a starter culture into "Nemchua" system.

This is a research with target to maintain and develop the traditional fermented foods of Vietnam.

- **Overall evaluation:** 6 millions tons fermented meat per year is not small capacity. Solving long lasting time for production is important and valuable for us.

c) Soybean:

- 1997 - 1999: Soybean yield: 120.000 – 140.000 ton/year.

- Estimation: Cultivated area: 300.000 ha.

Soybean yield: 360.000 ton/year.

- Soy sauce:

+ Traditional fermentation (using *Asp.oryzae*) to increase soy sauce quality
FIRI transferred technology and supplied *Asp.oryzae* to many provinces.
In which Hai Hung.

Soy sauce produced in Hai Hung is well-know. Selling amount (only Hai Hung): 10.000 l/day. Mainly individual production.

+ Fermentation (using enzyme)

Mainly: import from China and Thailan.

- Soy cheese:

+ Traditional fermentation

Using: - Natural microorganism (individual production).

- Mucor (factory).

FIRI supplied Mucor strain and tranfered technology for some factivies at Lang Son, Hanoi, ect... In Hanoi soy cheese was used for production of seasoning. Soy cheese is prefer in South Vietnam. But production in South Vietnam is individual capacity.

d) . Vegetable:

- Estimation 2000: 8 Mio ton/year.

- Consumer: 100 kg/person/year.

* Traditional fermentation

FIRI: - Tomato preservation by lactic fermentation using natural microorganizm.

- Transfer technology of vegetable fermentation for Dong Anh (legume, onion, egg plant fermentation etc...)

Now fermented vegetable mainly individual capacity.

- Vegetables juice.

e) Pickle: 1000 ton/year – In which 90% export.

Mainly: Cucumber baby, shoot bambo, chilli, mainly produced by factories.

(2) Alcoholic beverage

2.1.Rice and other cereals

Planted aere (hous/ha)

Year	Planted aere (hous/ha)		Gross output (thous/tons)	
	paddy	Other cereal	paddy	Other cereal
1996	7007	1214	26,397	2821
1997	7100	1231	27,524	3094
1998	7363	1224	29,146	2708
1999	7648	1220	31,394	2860

2.2.Beer (mile litres)

Year	Total	State	Non state	Foreign invested sector
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1996	533	365	28	140
1997	581	392	34	155
1998	670	448	37	185
1999	648	464	36	148

2.3. Small and medium enterprises located in the whole country consumers and farmers: about 500 units

2.4. Technical impact (target of technical transfer considering level of techniques of the industries)

For small privately owned enterprises and medium local enterprises it is important that:

- Improvement of the yeast quality
- Prevent contaminating micro organisms (infected bacteria and wild yeasts)
- Substitute raw material for imported malt
- Training technical workers

2.5. Economic impact (contribution to the rural economy and industries)

*Average income for months of labour in state sector by kind of economic activity (agriculture and forestry) (thous/dougs/months/person)

Year	1995	1996	1997	1998	1999
Income	367	422	480	514	493

*Average income for months of labour in privately owned beer enterprises is about 500,000 and different according to the season (in North Viet Nam)

In summer: 500,000-800,000

In winter: 200,000-400,000

3. Enzyme technology

(1) *Glucose syrup, Glucose powder, Fructose syrup.*

Productivity of Farm products (1999):

- Maize : 1. 612.000 tones
- Sweet potato : 1.526.100 tones
- Cassava *: 1.773.400 tones

*Only cassava is used for industries.

Products in present condition and problems

- Glucose syrup is produced in some companies , for example:
 - + 19/5 Sontay Food technologies company: 2.000 tones/year
 - + Minh duong company : 5.000 tones/year
 - + Haiha confectionery company : 3.000 tones/year
 - + Quang ngai sugar company : 4.200 tones/year
- Glucose powder is produced by 19/5 Sontay Food Technologies Company only , productivity is 50 tone/year.
- Fructose syrup : it not produces until now
- Social impact :
 - + Enterprises using enzymes instead of germinated paddy, which make lower price of product, if enzyme instead of acid ,it not influence on person and environment.

Consumers : of glucose syrup are the confectionery industry, which can use glucose syrup instead of the import.

+ Farmer : Job for farmers

Technical impact : The technology can be used by small and medium scale enterprises.

Economic impact:

- Farmers' income : every tone of starch from cassava can make profit for farmer around 90.000VND.
- Enterprise benefits by every tone glucose syrup from 200.000 dong to 500.000dong

(2) PRODUCTS WITH HIGH PROTEIN CONTENT

a) High protein products and rich in amino acids from Animal resources

*** Raw materials:**

a) Animal liver - by product of meat industry.

Beer yeast- second product of beer enterprises.

From 16 million pigs/year, Vietnam has about 23.000 tons of liver (1,4kg/one pig). Only a small part is used to produce liver - past, the large amount is only used freshly. In tropical climate as Vietnam, liver very easy to damage.

*** Present condition:**

Freshly use; beer yeast (small part) is used for baby food.

*** Problems:**

- Vietnamese children have low living condition special in rural area about 38% of them are malnutrition.

- By product of meat industry such as: liver, lung, bone, blood can't be used effectively.

- Supplement product rich in amino acids is very necessary for malnutrition children, women and old persons in Vietnam.

*** Interesting subject:**

- FIRI has a group of Researchers carrying out experiments on hydrolization of liver by enzymes: Neutrase, Alkalase, esperase and flavor enzyme. Final product, rich in amino acids expects to be used as functional food, or supplement to baby food; semi-product for some nutrition medicine of malnutrition children, women, old.

*** Social impact:**

- Making a valuable product from by-product of meat industry and beer industry

- Providing product with reasonable price for malnutrition children women, old people and patients in rural areas.

*** Technical impact:**

- Using different kinds of enzyme protease to produce high-protein product, rich in amino acids is a new technology in Vietnam.

- It can transfer into industrial scale after fulfilling in pilot-plant (FIRI).

- Address of enterprises:

- Thai nguyen pharmaceutical enterprise

- Haiphong pharmaceutical enterprise.

*** *Economic impact:***

- Liver is very easy to spoilage by microorganism
- Use effectively it, can make benefit for farmer.

b) High protein products and rich in amino acids from Vegetable resources.

*** *Raw materials:***

Soy bean.

*** *Present condition:***

Products include bean curds and vegetable oils. Products produced from soybean can be use for anyone, especially for vegetarian.

*** *Problems:***

Requirement on vegetarian food has been increasing in Vietnam for patient who need to be diet and vegetarian.

In 1998, gross out put of soybean is 146 700 tons, bean curds is 51 000 tons and vegetable oils is 94 648 tons.

*** *Interesting subject:***

- FIRI has a group of Researchers carrying out experiments on vegetarian food products.

*** *Social impact:***

- Using vegetarian protein instead of animal one.
- Providing product with reasonable price for people.

*** *Technical impact:***

- Using different kinds of enzyme protease to produce high-protein product, rich in amino acids is a new technology in Vietnam.
- It can transfer into industrial scale after fulfilling in pilot-plant (FIRI).
- Address of enterprises:
- Minh duong company (Hoai Duc- Hatay)
- Minh duc company (Hanoi).

*** *Economic impact:***

- Created job
- New product

c) functional foods

Field of activities	Farm products (self sufficiency rate (%), amount of production, etc, to be mentioned)	Processed materials, or final products (present condition and problem)	Social impact on target beneficiaries, especially vulnerable such as the poor, women and children from the viewpoint of nutrition, health, etc..	Technical impact (target of technical transfer considering level of technologies)	Economic Impact (contribution to the rural economy and industries)	Important Assumption and Overall Evaluation
Bio	Pork, beef, livestock, farmer products (self sufficiency rate 100%. In 1998 Productivity of pork, beef and poultry is 18.13; 3.98; 166.4 million of heads, respectively.	1. fermented pork, 2. fermented sausage and 3. jambon. Processing technologies of all fermented meat products are limited with low level and household scale, the quality of these products is unstable Fermented sausage is rarely made by some food enterprises, such as Vissant, Hien Thanh, Ha long Ltd Co.	It encourages the farmers to produce more and more pork, beef and livestock, and meet the demand of consumers. Development of fermented meat products and technical transfer to small scale enterprises is necessary and indispensable for the progress of the Market economic policy.	Small scale enterprises.	- farmers income, benefit for small scale enterprises.	The development of fermented meat food industry also lead to the development of agriculture and farmers itself. It means the ripple effect of fermented meat food industry should not be neglected for the total development of national production.

functional food	Rice, maize, germinated soybean, Quinoa seed, carrot, black chiken, onion garlic, reishi, The productivity of soybean of Vietnam in 1998 is about 141.3 thousand tons	1. Functional food for baby Processing technology of these products are limited with low level of small scale. Thus, the proportion of malnourished children below 5 years of age in Vietnam Baby food in Vietnam is poor of protein and energy. Most of them are not required nutritious balance of FAO standard. Thus, the proportion of malnourished children below 5 years of age in Vietnam oscillated around 36-38% and reach to 50% in some rural areas and mountain regions. In order to overcome the situation, applying extrusion cooking technology using locally available materials are necessary. However, in Vietnam, there are some single screw extruders, which made in domestic. They are not complicated. Therefore, quality of baby food could not afford consumer's requirements. Development and improvement of production of function baby food through twin screw extruders plays important role in modern processing industry.. 2. Functional food from herbs 3. Functional food from animal These products are not produced widely. In Vietnam, functional foods are not many produced	Production of these functional foods is developping, consumers, especially the poor, women and children has health benefit and well being when they use these products. Moreover, it will encourage the farmers to produce much soybean, black chiken, solve the environmental problem of breweries and brings benefit for small scale enterprises.	Small scale enterprises.	- farmers income, benefit for small scale enterprises.	The development of fermented functional food industry also lead to the development of agriculture and farmers itself. It means the ripple effect of functional food industry should not be neglected for the total development of national production.
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(3) Fruit juice with high quality:

Agricultural products: (First column)

- **Self- sufficiency's:**

Main materials for fruit processing are provided by local resource.

- a. Fruit cultivation in Vietnam**

Vietnam is an agricultural country with tropical climate, which is suitable for plantation of many valuable fruit trees such as pineapple, orange, bananas, mango, green papaya, apricot and others. According to the statistic data, the area for cultivation of fruit trees in the whole country is about 370.000hectare. E very year provide around 4 million tone of fruits including (orange: 379.450 tone, bananas: 1.282.231 tone, pineapple: 184.753 tone, mango: 125.546 tone. See appendix 1 and 2). In the whole country was formed some special area for certain kind of fruits such as mango is cultivated in Tien giang, dragon fruit in Binh thuan, litchis in Bac giang, pineapple in Tien giang, Long an and Kien giang

In the near future (2005), according to the development plan of Ministry of Agricultural and Rural Development, Vietnam plan to cultivate about 710.000 hectare fruit trees. Although carpophagous gardens have a great production, this kind of product only accounts for 7.5% of agricultural production value, and even smaller percent of processing industry. At present, the post harvest technology and preservation of fruit mainly taking by manual. Almost fruits are preserved by drying with small scale at plantation by farmers. Several kinds of fruits are drying as follows: litchis, mango, longan and little amount of bananas. It was estimated that around 10% of fruits are processed. Main reason is low level of processing technology, after harvest fruits can not preserved properly, therefore the lost is very high - around 25-30%

- b. Consumption**

The fruits mainly consumed by local market in fresh form. Exported fruit is very little (about 1.3% of production amount). According to the survey of fruit consumption in Vietnam is 38kg/person/year. With the increasing GDP from 5-10%, population increases 2%/year at an average consumption of fruits increasing 10%, it is estimated that the consumption of fruit will be 80-90kg/person/year by year 2010

Recently, living standard of Vietnamese people is improved. Therefore, the consumption of high quality fruit product is also increasing. Some fruit products are imported from region countries such as from Singapore, Malaysia, Thailand, Philippines, Indonesia, New Zealand, Australia and others. Even some very high quality fruit products are imported from Europe countries.

Besides that Vietnam also imported some fresh fruits such as apple, pears, grape, orange from China, America and South Africa (estimated around 7-8 million \$ US /year)

- Processed materials, or final products(Column 2):

Some kind of fruit can be used for production of clear and concentrated fruit juice as follows: Apple, orange, plum, bananas, apricot ect....and almost provided by local source.

The use of pectolytic enzymes has become an indispensable part of fruit juice processing. In this application the enzyme improves the extraction process, resulting in higher yields of juice. It also causes a viscosity reduction, which improves filtration and clarification of the fruit juice.

Various types of enzymes from NOVO Industry Ltd. Companies have recently been introduced into Vietnam and the methods for enzyme applications are also provided. The costs of the enzymes are reasonable. Technology processes for the applications of the enzymes in fruit processing, were carried out at FIRI. This research project is focused on the development of the methodology for application of enzyme for extraction of fruit juices. The aim is to replace the conventional methods so that can obtain **high yield with high quality products**.

Enzymatic conversion process used to replace conventional process in fruit processing also used for clarification of fruit juice and create a remarkable achievement such as product becomes **clearer, less viscous, purer, light color, good flavor, easily digested and dissolved**

The clear juice also can be used for making high quality of wine and also used for production of concentrated fruit juice.

The proposed project is one of Vietnamese Government priorities in National socio-economy development program to attain the modernization and industrialization goals. The research Cooperation between Vietnam and foreign countries will give the opportunities to exchange technology, scientific knowledge and to improve the socio-economy of Vietnam.

III. Social impact

1. *Benefit for small and medium enterprises*

Despite having high production, fruit tree only contributes 7.5 percent of agricultural production value and smaller proportion of processing industry. According to UNDP and General Vegetable Corporation of VN's documentary, up to early 1995 only 13 vegetable and fruit processing enterprises in Vietnam get capacity of 45 ton per year. Newest data (Statistics Press, Enterprises of VN, see appendix 3) shows that 48 enterprises process fruit products in many different methods and scales in the whole country, and major in canning and freezing. All those above have processed only 10% of fruit production in country. Therefore, fruit is mainly distributed in domestic market, and partly exported in form of low price of fresh / non-processing / primary product. On the other hand, common conditions of vegetable processing industry in VN is adequate for small and medium enterprises, especially the farming household as the reasons follows:

- Fruit bottle-tree using now giving low productivity, separate producing, low production make it hardly possible to process by industrial scale.
- Lacking and ebbing of infrastructures, roads, store stations, ports and so fort, difficulties in transportation of products from material zones to processing zones and factories, and even the problem of preservation before putting in the process are the big issues. As being particularly easy to decompose and addle, fruit should be primarily or ex-farms processed in household or small and medium units, so that it would be higher economic effective.
- Technology level and equipment are still backward, and the assembly lines with an exceptional production scale are lack.
- Market searching and expanding is weak, and goods exchange on the market is too disadvantaging to produce and consume in vast scale.

As the result, investing in small and medium enterprises is most suitable. They will get technology transfer from FIRI to strengthen / enhance their product's quality, be consulting about equipment, and create more jobs for labor in local areas.

2. *Benefit for consumers*

Consumers in VN can rarely use high quality products because of the less development of fruit processing industry. Only people in main city

have been familiar with several types of canned fruit products, of which majority is imported with high cost of transportation's and taxes causing higher price that consumers have to pay. Several domestic enterprises have dealt in canned products, though the quality is not quite perfect; consumers have accepted these products for their reasonable price. They are Dong Giao Food import and export Co, Dona New tower and so on. Anyway, majority living in rural area that account for 80% of population so far has only used fresh fruit. Price of processing fruit products is much higher than farmer's earnings.

As the matter of fact, if fruit processing industry of Vietnam produce new kind of products with high quality and good appearance, to meet and promote consumer's taste and demand, it will use effectively and almost of domestic fruit inputs. This not only helps farmers to sell their harvested fruit, compete against other products in region, and reduce imported processing products but also promotes consumers, especially in rural, highland and remote areas to use high quality processing products.

3. Benefits for farmers:

Currently, farmers in VN have been under the great pressure of processing fruit and vegetable in time of harvest crop. Fruit tree plantation zones are too far from large processing factories, and difficult for transportation, so that fruit decompose very much (25-30%) and the price in turn is also low. If we invest in small and medium processing works nearby the material zones, it will help farmer to settle their harvested fruit.

On the other hand, if processing industry develops along with government's investment in major plantation of area, it will settle unemployment, raise income from fruit trees for farmers, and eliminate hunger and alleviate poverty.

The viewpoint of nutrition, health, etc.

The most important components in fruit can be grouped as follows: Water, proteins, carbohydrates, fats, minerals and vitamins. Most of these components are essential nutrients that are needed by human body. The amount of each of these nutrients required by the body depends factors such as age, mass, sex, health and physical activities.

- Water: more than 80%, some may contains up to 93% in tomatoes.
- Protein: Usually less than 1%.

- Lipid: Less than 1%
- Minerals: 14 minerals elements: Ca, Na, Zn, iodine, Cu, Pb, K, S, F, Mn, Fe, Mg, Co, Cl,
- Vitamins: C, Carotene
- Chlorophyll's, carotenoids and anthocyanins are pigments that responsible for fruit color.

Technical Impact:

FIRI plan to transfer technology into different provinces with small and medium scale enterprises such as:

- Lai Chau (already signed a contract and the process will be taken soon at the end of October or November, 2000).
- Dong giao factory: already made a proposal for production of clear fruit juice and concentrated fruit juice.
- Tan Thinh Co. Ltd, have finished a contract of making clear fruit for production of fruit wines and will continue to cooperate in the future.
- Bac Song Hong fruit juice production Company: Have discussion and making minute of Cooperation to produce clear fruit juice.
- Other provinces also have requirement of fruit juice processing as we have mentioned in the appendix that fruit is cultivated in the whole country.

Economic Impact:

Contribution to the rural economy and industries

- Increase farmer's income, as reduction of lost after harvest.
- Create the jobs for people in every areas where fruit will be processed.
- At present, an average farmers income is about 400.000 VND/month
- The rate of time of labor in rural areas is always used around 72,28% - 73,98%

Appendix 1

AREA-YIELD-GROSS OUTPUT OF SOME MAIN FRUIT TREE BY REGION IN 1995

(Area: 1000 ha; Yield: quintal/ha; Gross output: thousand tons)

N ^o	Kinds	Area, yield, gross output	Whole country	By regions						
				(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Total	Area	211.53	-	-	-	-	-	-	-
		Gross output	2042.29	-	-	-	-	-	-	-
2	Orange, mandarin	Area	59.52	7.82	3.86	6.15	0.48	0.44	0.53	40.58
		Yield	105	62	70	49	62	54	105.5	130
		Gross output	379.4	24.87	23.9	23.24	2.25	0.36	3.47	304.31
3	Banana	Area	91.75	8.73	15.6	10.95	9.91	22	10	34.36
		Yield	159.1	163	184	87.3	132	407	344	11.9
		Gross output	1282.2	124.8	269.7	90.5	128.2	20.8	324.95	323.18
4	Pineapple	Area	24.04	1.7	1.1	4.04	1.4	0.4	0.4	15.5
		Yield	76.8	4.37	14.5	4.8	6.4	9.2	92	8.4
		Gross output	184.75	7.46	16.1	19.45	8.65	1.06	1.16	130.87
5	Mango	Area	21.1	2.1	0	0.37	2.84	0.37	2.65	12.74
		Yield	93	-	-	120	94	47	153	89
		Gross output	152.5	428	-	0.16	24.07	1.04	21.97	101.4
6	Apricot	Area	4.14	4.14	-	-	-	-	-	-
		Yield	57	57	-	-	-	-	-	-
		Gross output	5.14	5.14	-	-	-	-	-	-
7	Plum	Area	2.55	2.55	-	-	-	-	-	-
		Yield	87	87	-	-	-	-	-	-
		Gross output	11.15	11.15	-	-	-	-	-	-
8	Longan	Area	1.96	0.76	1.32	-	-	-	-	-
		Yield	120	-	-	-	-	-	-	-
		Gross output	14.3	3.4	7.15	-	-	-	-	-
9	Litchi	Area	6.47	3.6	2.88	-	-	-	-	-
		Yield	40	-	-	-	-	-	-	-
		Gross output	12.85	6.7	6.15	-	-	-	-	-

(1): Mountainous district and midland delta

(2): Hong river's

(3): The forth region coast

(4): Middle sea -

(5): Tay Nguyen

(6): South-east area

(7): Cuu Long river's delta

Appendix 2

THE MAIN REGIONS PLANNED ARRANGE PLANT FRUIT TREE

N ^o	Regions	Areas in present conditi on	Areas in 2010	Kinds of main fruits-trees
1	Mountainous district and midland			
	<i>Regions plant temperate zone fruits: BacHa, Sapa (LaoCai), MocChau (SonLa), HaGiang, and LangSon.</i>	8,200	40,000	Apricot, plum, peach, pear, apple
	<i>Regions plant special fruit-tree CaoLoc-LocBinh-BacSon (LangSon)</i>	6,000	15,000	Persimmon, peach, mandarin
	<i>Regions plant orange, mandarin: LucYen, YenBai</i>	8,300	50,000	Orange, mandarin
	<i>Regions plant litchi, longan, pineapple: DongTrieu(QuangNinh)</i>	14,400	60,000	Litchi, longan, pineapple
	<i>Regions plant banana, pineapple: PhuTho-YenBai</i>	3,500	35,000	Pomelo, orange, mandarin
	<i>Regions plant special pomelo DoanHung(PhuTho)-YenSon-YenBinh(YenBai)</i>	1,800	5,000	Apricot, plum, peach, pear, mango, longan, litchi, ...
	<i>Regions plant fruit-tree along national highway N^o6</i>	23,000	40,000	
2	Hong river's delta			
	<i>Regions plant pineapple, banana: PhuTho, LapThanh, TamDuong (Vinh Phuc)</i>	2,200	15,000	
	<i>Regions plant fruit-tree along highway N^o21A HaTay</i>	300	2,000	Litchi, longan, apricot, persimmon, custard-apple
	<i>Regions plant litchi, longan, pineapple: HaiDuong, Hung Yen</i>	9,600	40,000	Litchi, longan, pineapple
	<i>Regions plant banana along Hong river</i>	14,600	15,000	Banana
	<i>Suburbs of Hanoi</i>	300	2,000	Citrus, sapodilla, apple, banana
	<i>Dong Giao (Ninh Binh)</i>	2,000	4,000	Pineapple
3	The former forth region			
	<i>HaTrung (Thanh Hoa)</i>	1,700	2,000	Pineapple
	<i>QuyHop (NghiaDan-NgheAn)</i>	3,900	8,000	Orange, pineapple
	<i>HuongKhe, HuongSon, KyAnh (HaTinh), - TuyenHoa (QuangBinh)</i>	3,500	25,000	Pomelo PhucTrach, orange, pineapple
	<i>Huong Thuy, Huong Tra (ThuaThienHue)</i>	150	1,000	Pomelo, sapodilla.

FRUIT AND VEGETABLE enterprises

1. A.V.W VIETNAM CO., LTD. (*BENTRE Province*)
2. AGRICULTURAL PRODUCTS AND FOODSTUFF CO. DIST 1 (*Ho chi minh city*)
3. AGRICULTURAL PRODUCTS FOODSTUFF PROCESSING export factory (*nghe an province*)
4. Agrimac co., ltd (*long an province*)
5. asia food co., ltd. (*lam dong province*)
6. Asia-pacific agriculture development corp. (*hai duong province*)
7. asuzac foodstuff co., ltd. (*Ho chi minh city*)
8. bonnie farm co., ltd. (*lam dong province*)
9. bright farm co., ltd. (*tay ninh province*)
10. cam ranh trading co. (*kh, nh hoa province*)
11. CANTHO FOODSTUFF, FRUITS AND VEGETABLE CO. (*CANTHO Province*)
12. Dalat agro products co., ltd (*lamdong province*)
13. dong giao foodstuff export co., (*ninh binh province*)
14. duyhai export foodstuff factory (*Ho chi minh city*)
15. GIAIVIET FOODSTUFF CORP. (*Ho chi minh city*)
16. HAIDUONG AGRICULTURAL AND FOODSTUFF PROCESSING IMPORT EXPORT CO. (*HAIDUONG Province*)
17. HAIDUONG IMPORT EXPORT CO. (*HAIDUONG Province*)
18. HANOI BIO-TECHNOLOGY FOODSTUFF TRADE CO. (*HANOI*)
19. HANOI MUSHROOM PRODUCTION, PROCESSING AND EXPORT CO. (*HANOI*)
20. HANOI VEGETABLE, FRUIT AGRICULTURAL PRODUCTS CO. (*HANOI*)
21. hatchando(vietnam) co., ltd. (*Ho chi minh city*)
22. hiep phat joint- stock co. (*Ho chi minh city*)
23. hcmc vegetables and fruits co. (*Ho chi minh city*)
24. hoa trang foodstuff processing j.v.c (*binh duong province*)
25. hung yen export foodstuff co. (*hung yen province*)
26. lunsun vietnam co. (*Ho chi minh city*)
27. mai xuan fruit export co., ltd. (*Ho chi minh city*)
28. meko food processing factory. (*can tho province*)
29. mushroom research – development center. (*Ho chi minh city*)
30. nam ha export foodstuff factory (*nam dinh province*)
31. natural house co., ltd (*lam dong province*)
32. pacific co., ltd. (*Ho chi minh city*)
33. pan viet banana and vegetabes for export co. (*Ho chi minh city*)
34. quang nam pineapple concentrate processing co. (*quang nam province*)
35. sankyo co., ltd (*tay ninh province*)
36. son tay export foodstuff factory (*hatay province*)
37. tanbinh foodstuff export co. (*Ho chi minh city*)
38. thai binh vegetable agricultural products processing and export co. (*thai binh province*)
39. tien giang vegetable and fruits export cobination (*tien giang province*)
40. vanny agricultural products (viet nam) ltd. (*lam dong province*)
41. vegetable and products export import co. n° 1 (*TP Ha noi*)
42. vegetable and products export import co. n° 2 (*da nang city*)
43. viet nam national vegetable and fruits corp.3 (*Ho chi minh city*)
44. viet nam national vegetable and fruits corp (*hanoi*)

45. vinh phuc export foodstuff co. (*vinh phuc province*)
46. vitafoods co. (*Ho chi minh city*)
47. vung tau integrated food industries (*bariavung tau province*)
48. wonderful foods co., ltd (*hai duong province*)

Field of activities	Farm products (self sufficiency rate (%), amount of production, etc., to be mentioned)	Processed materials, or final products (present condition and problem)	Social impact on target beneficiaries, especially vulnerable such as the poor, women and children from the viewpoint of nutrition, health, etc..	Technical impact (target of technical transfer considering level of techniques of the industries)	Economic Impact (contribution to the rural economy and industries)	Important Assumption and Overall Evaluation
Traditional fermentation food	Pork, beef, livestock, farmer products (self sufficiency rate 100%. In 1998 Productivity of pork, beef and poultry is 18.13; 3.98; 166.4 million of heads, respectively.	4. fermented pork, 5. fermented sausage and 6. jambon. Processing technology of all fermented meat products are limited with low level and household scale, the quality of these products is unstable Fermented sausage is rarely made by some food enterprises, such as Vissant, Hien Thanh, Ha long Ltd Co.	It encourages the farmers to produce more and more pork, beef and livestock, and meet the demand of consumers. Development of fermented meat products and technical transfer to small scale enterprises is necessary and indispensable for the progress of	Small scale enterprises.	- farmers income, benefit for small scale enterprises.	The development of fermented meat food industry also lead to the development of agriculture and farmers itself. It means the ripple effect of fermented meat food industry should not be neglected for the total development of national production.

functional food	Rice, maize, germinated soybean, Quinoa seed, carrot, black chiken, onion garlic, reishi, The productivity of soybean of Vietnam in 1998 is about 141.3 thousand tons	4. Functional food for baby Processing technology of these products are limited with low level of small scale 5. Functional food from herbs 6. Functional food from animal These products are not produced widely. In Vietnam, functional foods are not many produced	the Market economic policy. Production of these functional foods is developing, consumers, especially the poor, women and children has health benefit and well being when they use these products. Moreover, it will encourage the farmers to produce much soybean, black chicken, solve the environmental problem of breweries and brings benefit for small scale enterprises.	Small scale enterprises.	- farmers income, benefit for small scale enterprises.	The development of fermented functional food industry also lead to the development of agriculture and farmers itself. It means the ripple effect of functional food industry should not be neglected for the total development of national production.
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FOOD INDUSTRY RESEARCH INSTITUTE (FIRI)

FOOD ANALYSIS AND ASSESSEMENT DEPARTMENT

I. Objectifs

- Analyse, control the quality of materials, food, semi-products, fermented foods,...for research works in FIRI.
- Analyse, assess food quality and other services for different enterprises and institutions.
- Research projects focus on the development of new methods for food analysis.
- Collaborate with the other institutions for the establishment of Food Standards of Vietnam (TCVN).
- Organize training courses for the other institutions in order to improve staffs' technical skills in food analysis.

II. Capabilities

We can determine most important parameters in the quality of food products as nutrition, toxical, microbiology and some other.

2.1 Objects for analysis

- Materials used for food production as fruits, cereal, molasse...
- Food products as meat and its products, milk products, plant oil, sauce, caned products...
- Beverages as beer, fruit juice, non-alcohol drink products...

2.2 Parameters can be determined

2.2.1 Nutritional components

- Protein as nitrogen components.(Total N₂, N₂ Formol)

- Carbonhydrate: starch; sugars as glucose, fructose, sucrose, maltose...; sorbitol, glycerol...
- Lipid.

2.2.2 Mineral components

- Total ash
- Trace Elements as Ca, Mg, P, Cu, Zn, Fe, Mn,...and Contaminated Heavy Metals as Pb, Hg, As...

2.2.3 Other parameters

- Aldehyde, Ester, Furfurol, Diacetyl...
- Acid index, Iodine index, Peroxyt...
- Examination of parameters of water used in food production
- Pathogenic Microorganisms as *E.coli*, *Clostridium perfringens*, *Salmonella*,...

2.3 Main Equipments

- 1 Incubator
- 2.Drying Ovens
- 3.Furnaces
- . Analytical balances
- 5.Moisture analyzer balances
- 6.Kjeldahl distillation system
- 7.Fat extraction
- 8.UV-VIS Spectrophotometer
- 9.Flouescence Spectrophotometer
- 10High Performance Liquid Chromatography
- 11.PH meter

III. Main development directions

Upgrade laboratories in both equipments and working conditions in order to detect other parameters: sensory and nutritional quality; toxicants as mycotocin, residual pesticide; pathogenic microorganisms; food additives,...

Base on the proposals above, we would like to establish new laboratories and improve present laboratories:

1. Laboratory for sensory quality analysis.
2. Laboratory for chemical and instrumental analysis
3. Laboratory for microbiological analysis

Equipments:

(New equipment have to supplement for Lab.)

- AAS- Atomic Absorption Spectrophotometer
- Gas — Chromatography
- Centrifuges
- Autoclave
- Shake Incubator
- Water bath
- Infrared Spectrophotometer
- Hy-LiTE
- STATFAX-NEOEN READER
- Amino acid Analyzer
- HPLC

FUNCTION AND TASKS OF THE FOOD TECHNOLOGY AND NUTRITION DEPARTMENT

1. Screening and development of bio-functional products from available resources in Vietnam.
2. Develop utilization technology for production of high nutritious food products, which meet requirement of domestic and export.
3. Development of new food material in use of enzymatic reaction and extrusion cooking technology.
4. Development and improvement useful micro-organisms for production of traditional fermented food in Vietnam.
5. Transfer technology of production on food products and functional beverages to local province.

RESEARCH DEVELOPMENT AND PRODUCTION OF FOOD TECHNOLOGY AND NUTRITION DEPARTMENT
FROM 1990 TO 2000

N°	Date	Research project	Objective	Results	Responsibility by
1	1996	Production of baby food from local materials using malto - dextrin	Research the hydrolysis processing starch to produce malto - dextrin powder from cereal using in baby food processing technology	Making a process of malto - dextrin powder using enzyme α - amylase and glucoamylase in FIRI ■ Making a formulation of baby food from rice, maize, soybean, mungbean, fortified maltodextrin powder, yeast extract powder, which permits to use FAO nutritional requirements. it permits to be adequate for feeding infants 4 - 6 months and 12 months • Production of baby food powder by extrusion cooking in FIRI • Transfer technology of baby food production to local province such as Laichau, Haiduong, Thaibinh, Yenbai, Quangtri	Dr. Truong Thi Hoa
2	1996	Research on <i>nutrit.</i> production beverage by lactic fermentation	Produced non alcohol drink with nutrition value and good sensory evaluation by lactic fermentation	Determined optimal temperature and time of saccharification of rice were: 60°C for 90 minutes with AMG enzyme 0,15%. A hydrolysed soymilk was achieved by 0,06% neutrase treatment during hydrolysis Chosen condition of fermentation process from saccharified rice hydrolysed soymilk mixture temperature 42°C for 12 hours. Making of technology process producing risogurt from rice and soybean in small scale, the product was nutritious, paratable and superior in quality.	Dr. Nguyễn Văn Việt

3	1997	Research on production of Retort-Sterilized sausage	Research on the optimal conditions of sausage processing, using the PVDC membrane for improve quality of sausage and the quality of product is unchanged for a long time	Chosen ratio of materials for production of Retort-sterilized sausage: lean meat 73%, fat 8,7%, maize powder 5,5%, ice 12,8% and other additives. Determining optimum parameters of sausage production. The product us of high protein (17%). The quality of product is unchanged for a long time of 3 months in room temperature and 6 months in cold condition, and has not only high nutritions components but also good taste and flavour.	Dr. Truong Thi Hoa
4	1998	Research on processing quinoa in order to make high nutritious products	Treatment and dehuling quinoa seeds, and removing saponins then utilizing treated quinoa seed for production of some high nutritional foods	The processing of dehuling of quinoa seeds was determined and the saponis content of quinoa was reduced to 0,37%. Production of high nutrition quinoa powder, which is used for soups or cook dishes. cooking or in combinations with other flour cereals to improve the nutritional value of some products such as protein cakes, cookies, breads and noods	Dr. Truong Thi Hoa
5	1997	Research on the using of brewing yeast for food processing technology	Brewing yeast which is by product of the breweries is treated and processed to produce protein rich yaest powder. It is valuable material for food processing technology	The optimum conditions of yeast treatment process was determined. Parameters for yeast biomass autolysis are defined. The yeast powder which is rich in protein 56.76% obtained. It suitable to fortify protein in baby food , biscuit production as well as production of soup pellet, energy protein tablet, creating great potential for the yeast powder to be applied in food processing industry The results have been applicated sucessfully at HongDuong Co.Ltd in HaiDuong province, Hatay food stuff company with good evaluation	Dr. Truong Thi Hoa

6	1998	Research on use of reishi for nutritions liquor production	Extract of over 100 biosubstances from fruition body of reishi, use to fortified with liquor	Three extract methods are carried out. Extract productivity in hot water method is 8,3%; in etanol method is 8,8% and in enzyme method is 10,2%(enzyme cellulase). The optimal condition of extract method by enzyme are concentration of Novozym is 0,25%, temperature 60°C for 120 minutes. Extracts are rich in triterpenoid, reduced compound and 21 amino acid. Reishi special liquor 20° alcohol and 12,5° alcohol, which are produced from reishi extract are highly appreciated in quality through clinical trials in centre of doctorate service and Balan company.	Dr. Truong Thi Hoa
7	1998	Research on utilization enzyme to Improve the quality of Fermentation sauce	• Research nigglingly on supplementary hydrolysis process in combination with kojizyme finiched - product to improve the quality of fermentation sauce.	• Formed technical production process of fermentation sauce with supplementation of Kojizyme obtained α high quality. - High complete nitrogen content, delicious flavour - Retrievable efficiency of protein has been raised from 15 - 20% (obtained over 70%). - Lowered the price of the product to 6.85% in comparison with control experiment.	Eng. Truong Dinh Tri

8	1998	Research on production of snack food from cereals for rural area, high mountain regions	Using of available cereals and national equipment for producing snack food	- Making a process of extruded snack food from corn and rice. - The effect of feed ingredients ratio was studied for sweet snack the optimal ratio of corn and rice was 85:15 expectively and it was 80:20 expectively for salt snack. The product condition was optimised: material moisture was 165, screw speed 300 rpm, temperature : 150°C - Production of snackfood on small scale 500 kg in FIRI. The product is of good quality with suitable cost	Dr. Truong Thi Hoa
9	1999	Research on the production of functional foods in order to improve healthy for human body	Research on essence of black chicken with reishi functional food product. Research on production of some functional foods from germinated soybean	The production processing of functional essence chicken with reishi was determined, which was also clinical tested achievevely in the centre of Hanoi Family Doctor Service because of their supporting for the mental and physical well being and nourishing for people of all age. The processing conditions of soybean germinating was studied, base on the high extruder cooking technology and appropriate fortification method, the germinated soybean cake functional food as well as functional sausage, functional bread were produced which have high anti-aging activity and enhance memory for people of all age.	Dr. Truong Thi Hoa

10	1999	Research on using enzyme for improvement of <i>pleurotus</i> mushroom productivity	Research on the effects of enzyme utilisat for the <i>pleurotus</i> productivity . Studies on the bacterie <i>Cellvibriogilius</i> utilisation to encrease the <i>pleurotus</i> productivity 110%	Using bacteries <i>cellvibriogilius</i> for treatment the cotton , straw and bagasse compost on which <i>pleurotus</i> is cultivated, is experimented achievevely. It can increase the <i>pleurotus</i> productivity 110%, 95% and 74% respectively <i>Pleurotus</i> productivity cultivated on cotton compost which was treated enzymetically Celluclast 1.5 L for 3 days reaches effectyvely on 100%, where it's 67% in control experriment	Dr. Truong Thi Hoa
11	1996	Research on production of silkworw wine	Research on condition of extraction acidamin from silkworm. Research on the production of silkworw wine	Determined optimal grade of alcohol for the extraction acidamin from silkworm is 45° and the rate of carbon active used is 2 %. The silkworw wine was produced have good taste and flavour. It is used for oldman and diseased man to increase physical strength	Dr. Nguyen Minh Hanh
12	1998	Research on production of jam, jelly, marmelade from tropical fruits	Putting out technology process producing jam, jelly, marmelade from tropical fruits	The technology of production of jam, jelly, marmelade were research with conditions: concentration of sugar is 65%, PH: 3, Pectin : 1- 1,5%. Marmelade was used for production of confectionery in the Haichau confectionery company and ThienHuong confectionery company	
13	1999	Research on production of products of food from protein vegetable	Using protein vegetable to produce products of food	Products of food were produced by protein vegetable have hight nutritions components and good taste, which is used for individuals who are diseased such as cancer, hight blood presure, cholesteron in blood. In addition, the products of food is popular among vegetarians who wish to avoid animal products	

114	1999	Study on technology cocoa seeds processing	- Study on technology of drying cocoa seeds by the heat. - Study on technology of removing hull, germ from cocoa seeds. - Study on technology of grinding cocoa paste. - Study on technology of separating butter. - Study on technology of refining cocoa butter. The production of cocoa powder and using them in confectionery, beverage.	- Technology of cocoa seeds processing : drying, removing hull, germ from cocoa seeds, grinding, causticsalt treating cocoa paste, separating butter - refining butter, producing cocoa powder. - using of cocoa powder, cocoa butter for confectionery, beverage industries.	Eng. Luong Cam Thach
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TENTATIVE OF RESEARCH ON FOOD AND NUTRITION FROM 2001 - 2010

N ^o .	Date	Title	Contents	Researching reason	Tentative of results
1	2001-2002	Research on production of nutritious products from wheat in some provinces of Northern area.	• Use of microbial enzyme to obtain nutritious extract. • Use of technology of fermentation to make some kinds of drinks from the extract, which is of high nutritious value and good sensory evaluation. • Use of wheat to be adjunct for beer production and snack food production.	Wheat is grown widely in some northern provinces of Vietnam but processing of wheat is limited.	Products: - High nutritious drinks, beer, low alcohol beverage, and snack food. - Technology process of production of nutritious drinks from wheat. - Technology processing for production of snack from wheat.
2	2002-2004	Research on production of lactic acid bacterial preparation using for technology of food processing and preservation.	• Selection of lactic acid bacterial strains, which is of high activity for fermenting meat, creating some product such as fermented sausage, fermented pork. • Optimizing conditions to obtain lactic bacterial biomass. • Choosing appropriate carrying substances for production of lactic acid bacterial preparation	Development and improvement of traditional fermented products	• Products: lactic bacterial preparation, fermented pork, fermented sausage. • Setting up an appropriate process to produce lactic acid functional preparation

3	2002-2005	Research on use of biotechnology to produce functional drink from flower fruit and cereals.	• Use of germinated cereals such as maize, soybean through enzyme technology to obtain functional drink • Use of extract methods to obtain bioactive substances from chrysanthemum flower and canhkina	- Meet the demand of consumer requirements. - Functional food products are rarely produced in Vietnam.	Product: functional drink from chrysanthemum flower, canhkina, germinated soybean. - Making an appropriate technology process to produce functional drinks.
4	2003-2005	Research on production of traditional fermented sauce from cereals such as cassava.	- Selection of microorganisms having high activity to conserve carbohydrate from cassava into fermentable substances. - Use some microbial biomass products to fortify with hydrolysed cassava to create high nutritious mixture, which is necessary for sauce fermentation.	- Casava productivity in Vietnam is very high but casava processing is not paid attention. - Microbial Biomass such as Brewing Yeast is available. - Production of sauce is development traditional fermented products in Vietnam.	Product: the sauce is of good quality with low cost. - Making a technology process to produce sauce from cassava and microbial biomass products.

5	2001-2003	Research on technology solution to improvement beer quality	• Selection of yeast strain applying for high gravity beer. • Selection of yeast train making specific flavor for beer • Use some kinds of enzyme preparation to enhance ferment efficiency	Quality of Vietnam beer is limit, especially in small and medium enterprises	• Beer is of good quality with specific flavor and taste. • Pure yeast train applying for high gravity • Pure yeast train, which create specific flavor for beer
6	2004-2005	Research on fermentation of reishi biomass	• Selection of reishi strain, which has high fermentation ability. • Choosing suitable medium from available materials for production of reishi biomass • Determining technology parameters for reishi biomass fermentation. • Determining bioactive substances of the reishi biomass. • Use of reishi biomass for functional food processing technology.	- Reishi is valuable herb using for treatment many kinds of diseases, especially cancer treatment. - Fruiting body of Reishi is high cost because Reishi cultivation in Vietnam is not efficient. Reishi Biomass is very cheap.	• Reishi biomass, which is of bioactive substances. • Technology process of reishi biomass fermentation

7	2005-2007	Research on preservation vegetable, fruit and food products by film method and biotechnology.	• Determining the time to harvest vegetable, fruit, which are good condition to preserve. • Choosing the suitable film for each kind of vegetables, fruits and food products. • Determining technology parameters of preservation	• Vietnam is diversified in vegetables, fruits with high productivity but technology level of preservation is low.	- Vegetables, fruits and food products is long self-life. - A Technology process for preservation of vegetables, fruits and Food products.
8	2005-2007	Research on use of biomass to improve quality of traditional fermented products such as sauce.	• Make a scheme of debitterness of yeast biomass, which obtained from brewery. • Determining optimum parameters of yeast autolysis. • Fortifying yeast extract with fermentable substances such as soybean, casava in order to improve fermentation efficiency, enhance quality of sauce.	- Biomass of yeast is not applied widely in food processing	- Product: the sauce is of good quality. - Setting up a technology process of sauce production from low cost material as yeast biomass
9	2005-2010	Study on extrusion cooking technology by tween screw extruders to diversify national fast food products.	• Study on temperature, pressure and screw speed to use many kinds of materials from cereals. • Study on production of some kinds of fast food products from rice, maize, soybean, mungbean and additives to meet the demand of consumers. • Study on conditions of packaging the products	- National fast food products is not popular. - Fast food products, which were made from cereals by extrusion cooking is cheap. It is suitable in economic level of Vietnam consumers. - Production of fast food by twin will extruders diversify products	• Snack food, fast food, with high nutritious value and suitable cost • Technology process of extrusion cooking by twin screw to produce fast food products local materials.

2002-2007	Study on extrusion cooking technology for production some functional foods for infant, children and old age.	• Research on production of balance food for infant, which promote growth and development in infant. • Research on production of some functional food for prevention of obesity in children. • Research on production of some calcium rich foods, which use for prevention of osteoporosis and increase in bone density in old age (aged 51 years and above). • Research on production of some functional food, which improve digestible ability. • Research on production of some functional food anti-aging effect. • Research on production of some functional food anti-fatigue.	• Baby food for infant and children is not balance • National functional food products is rarely produced. • Extrusion cooking technology is modern one to produce functional food from available materials. • Meet the demand of consumers.	• Functional food products, which is balance of protein in energy. • Functional foods, which prevent obesity, osteoporosis, improve digestible, anti aging effect, anti fatigue. • Technology process of production of the function foods.
2007-2010	Research on production Reishi beer and non alcohol beer.	• Research on production of Reishi beer from Reishi biomass and fruiting body, which is good for health. • Research on production of non alcohol beer, which is suitable for children, women and old age.	• These is new products. • Be diversified Vietnamese beverage market	• Products • Reishi beer having bioactive, nutritious substances. • non alcohol beer having high energy.

TENTATIVE OF RESEARCH PROJECTS OF FOOD AND NUTRITION

(Trinh Kim Van)

TT	Time	Title	Contents	Researching reason	Tentative of results
12	2001 - 2005	Enzymatic product of fructo-oligosaccharide (FOS). Using in functional food product.	- Selected and isolated strain - Optimization to the biosynthesis of β-fructosyltransferase - Study on production FOS from sucrose. - Using FOS on functional food product.	- Total of sucrose product in Vietnam is very high. - Functional sweet and functional food is still unconsidered in Vietnam yet.	- To get out the FOS product - Using FOS in some functional food such as diet of infants and preschool children.
13		Enzymatic product of Xylooligosaccharide from corn cob. Using in functional food product	- Selected and isolated strain - Optimization to the biosynthesis of enzyme - Study on production Xylooligosaccharide from corn cob. - Using on functional food product.	- Connor productivity in Vietnam is very high - The corn cob processing human food is rarely paid attention. - Functional sweet and functional food is still unconsidered in Vietnam yet.	- To get out the Xylooligosaccharide product - Using Xylooligosaccharide in functional food product.
14	2009 - 2010	Study on the preservation of several fruits by using edible film.	- Research on preparation of film solution. - Research on handles fruits. - To apply on the preservation of some fruits	- Total of fruits in Vietnam is big. - The particularity of fruit productivity is to follow crop season.	- Product: The film solution for coating fruits to preservative them - To apply on the preservation of some fruits such as oranges and bananas.

			such as oranges and bananas.	- The preservation of fruit in order to increase their consuming time is necessary	
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RESULTS OF TRANSFER EQUIPMENT AND TECHNOLOGY
(*Food technology and nutrition department*)

N°	Substance of transfer	Appling address	Result comment	Time
	1	2	3	4
1	Transfer technology of soy sauce	Hadong agricultural production and food processing factory		1990
2	Transfer technology of rice noodles	Namdinh food managing and processing factory, Namdinh province		1991
3	Transfer equipment and technology of high nutrient baby food.	Bao Ai Village Yen Binh District Yen Bai Province		1992
4	Transfer equipment and technology of high nutrient baby food.	Kienxuong District Thaibinh Province		1992
5	Transfer equipment and technology of high nutrient baby food.	Nguyen Xa Village Donghung District Thaibinh Province		1993
6	Transfer equipment and technology of high nutrient baby food.	Caobang committe of protect and care for children		1993
7	Transfer equipment and technology of high nutrient baby food.	Daclac committe of protect and care for children		1995
8	Transfer equipment and technology of high nutrient baby food.	Yenbai committe of protect and care for children		1995
9	Transfer equipment and technology of high nutrient baby food.	Haiduong scientific technological and		1997

			enviromental service			
. 10	Transfer equipment and technology of high nutrient baby food, using quinoa seed		Hongduong Limited company, Haiduong scientific technological and enviromental service			1997
11	Transfer equipment and technology of high nutrient baby food.		Laichau committe of protect and care for children			1998

FOOD INDUSTRIES RESEARCH INSTITUTE (FIRI)
DEPARTMENT OF ENZYME AND APPLICATION

FUNCTION AND RESPONSIBILITIES:

1. Study on production and application of enzyme preparations in food and other industrial fields such as textile, leather, pulp, oil essence, domestic and detergents.
2. Study on production and application of single cell protein (SCP) from yeast, entomopathogenic protein crystals from the bacterial strains.
3. Fruit preservation and processing by applying advanced biotechnology.
4. Experimental production and technology transfer.
5. Training graduate students, master and PhD students, microbiological technicians in the relating field studies.

ACHIEVEMENTS:

I. MICROBIAL ENZYME SYNTHESIS AND APPLICATION INCLUDING GROUPS OF AMYLASE AND CELLULASE:

1. Enzyme for starch hydrolysis (α - amylase).

- a. Study on production of α -amylase from bacterial strain *Bacillus subtilis* by submerge culture method at industrial scale with capacity of 5,000 liters/batch in the Pilot-plant of FIRI (The project was at Governmental level and assessed excellent result).

Product: Liquid and powder formulations.

Application: In food industry and textile industry;

- Application in Hanoi Brewery for replacement of 18% imported barley malt without changing beer quality.
- Application for production of dextrose syrup to replace 28% of rice malt and increase recovery yield of 3% in Haiha Confectionary.
- Application at Hanoi Distillery and Binhtay Distillery (in HoChiMinh City) to replace the conventional method of using acid and to increase alcohol fermentation yield of 2.14-8.0%.
- Application at Viethang Textile (HCM city), Hanoi 8-3 Textile, Minhkhai Textile (Vinhphu) and Namdinh Textile for removing starch from polyester and cotton fabrics and for replacement of using alkaline.

Technological transfer: Transfer technological fermentation to HCM Chemical Co. with capacity of 1,500 l/batch at their Pilot-plant.

- b. Study on production of amylase from bacterial strain *Bacillus subtilis* and from fungal *Asp.niger*, *Asp. awamori* and *Aps. niger* strains at lab. scale by surface fermentation method.

Application: Crude preparation were applied for:

- Production of corn and cassava traditional sauces.
- Production of cattle feeds.
- Liquefaction stage in beer production.

Technological transfer: Technology was transferred to Food Enterprises at Haihung, Namha, Thanhhoa and Nghean... provinces.

2. Enzyme for starch saccharification (Glucoamylase)

a. Study on biosynthesis of Glucoamylase from *Endomycopsis fibuliger*, and *Endomycopsis* sp. strains.

- By submerge culture method in laboratory.
- By surface culture method in laboratory, the crude preparations produced was used for cattle feeds.

b. Study on production of Glucoamylase (GA) from fungal *Asp. niger*, *Asp. awamori* and *Asp. oryzae* strains.

- By submerge culture method with capacity of 500 liters/batch in the Pilot-plant of FIRI (The project was at Ministerial level and assessed successful result). GA crude liquid preparation with activity 500-600 UI was used for production of starch-sugars and alcohol. GA hydrolysed starch at concentration of 20% and the conversion rate was of 96% after 42 hrs.

- By surface culture method at industrial scale (The project was at Governmental level and assessed successful result).

Application: Production of dextrose syrup in Haiha Confectionary, crystal glucose by enzyme method at 19-5 Glucose Factory in Sontay province.

3. Study on biosynthesis of glucoisomerase by submerge culture method from actinomyces *Streptomyces robeus*. The cells of *Strep. robeus* strain were immobilized on husk of beer for using in the production of fructose syrup.

4. Study on production and application of microbial protease enzymes.

a. Study on production and application of neutral protease from the bacteria *Bacillus subtilis* and from the fungal *Asp. oryzae* strains.

- By submerge culture method at lab. scale.
- By surface culture method from bacteria *Bacillus subtilis* strains at industrial scale with capacity of 3-4 tons crude preparation/years in the Pilot-plant of FIRI (The project was at Ministerial level and assessed successful result).

Application: for production of fish sauce with capacity of 1 million liters/years in Cuahoi Seafood Processing Enterprise in Nghean province.

- By surface culture method from fungal *Asp. oryzae*, *Asp. awamori* and *Monacus* strains at experimental, industrial and semi-industrial scales (The project was at Ministerial level and assessed successful result).

Application: Production of corn, rice and cassava traditional sauces, salled tofu at the Food enterprises in Haihung, Namha, Thanhhoa, Nghean... provinces.

Use for beer production at the Hatay Food Enterprise to replace 20% adjunct materials, without changing quality of beer, and to reduce the price to 125,000 VND/1000 liters of beer.

- c. Study on production of alkaline protease from bacterial *Bacillus bravis* by submerged culture method at pilot scale. Application for production of detergents at the Institute of Industrial Chemical (The project was at Ministerial level and assessed successful result).

5. Study on biosynthesis of cellulase enzyme from the fungal *Mycoderma* and *Asp. niger* strains by surface cultivation method. Application for solid waste treatment and production of biofertilizer at the Vandiem sugar-cane factory.

6. Study on recovery of β -Glucosidase enzyme from lime seeds in lab. scale by chemical method. The crude liquid enzyme was used for hydrolysis of amygdalin in the lime juice.

II. STUDY ON UTILIZATION OF ENZYME PREPARATIONS (IMPORTED FROM NOVO NORDISK COMPANY IN DENMARK) IN FOOD INDUSTRY.

Enzyme preparations including amylase, protease, pectinase, lipase and cellulase groups from Novo Nordisk (Denmark) were studied and transferred to Food Enterprises in the North of Vietnam in the following fields:

- Utilization of Amylases for starch liquefaction and saccharification in Beer production (with capacity to 1 million liters/years), in Dextrose Syrup production (with capacity of 3-10 tons/day), and in Crystal Glucose production (with capacity of 10-30 tons/day).
- Utilization of Proteases for protein hydrolysis in Fish sauce production (with capacity of 3 tons of fish/batch at Dienchau Seafood Processing Enterprise in Nghean province); for Gelatin production in experimental scale at Pilot-plant of FIRI with capacity of 50 kg/batch, and the product was used for production of Jelly candy at Thienhuong Confectionary; in cheesemaking from combination of cow milk and soybean milk; for hydrolysis of vegetable protein for production of protein product with high amino acid content; in production food diet from hydrolysed-vegetable protein and technology transfer of to Minhduong Company in Hatay; for hydrolysis of yeast protein and pig liver for production of bioproducts used as feeds for shrimp and fish; in production of protein capsule with high amino acid content (at lab and experimental capacity of 20 kg/batch, the product is initially consumed and introduced into market).
- Utilization of Pectinases in Fruit Juice Processing for wine and fruit juice production in Tanthinh Company in Haihung province; Dongxuan Distillery in Vinhphu province.
- Utilization of Cellulases for hydrolysis of fibre in Beer production and in cultivation of *Pleurotus* mushroom to improve of production yield.
- Utilization of Lipases for hydrolysis of Fat and Oil, and for separation of fatty acid from soybean oil to produce super pharmaceutical product (Hypochol) for prevention and treatment of cardio-heart diseases at lab. scale.

Consumption of Novo enzyme preparations from 1997 up to now was 75 tons.

III. OTHER STUDIES:

1. Study on production insecticidal proteins from bacterial *Bacillus thuringiensis* strain with capacity of 40 tons/years in at Pilot-plant of FIRI and application for biocontrol of agricultural pests, pineforest at some provinces in the North of Vietnam (Hatay, Haihung, Habac, Namha, Thanh, Nghean)
2. Study on production of mosquitocidal proteins from bacterial *Bacillus thuringiensis* strain in lab. and experimental scales, and its application for control transmitting-disease-mosquito larvae of *Anopheles*, *Aedes* and *Culex* species.
3. Study on utilization of chitosan for tomato preservation at lab. scale.
4. Study on preservation of tomato by lactic fermentation at lab. scale.
5. Study on preservation of some food products by Nisin preparation at lab. scale.
6. Study on selection of technology and equipment for dry vegetables.

IV. TRAINING

Has been cooperating with Hanoi University of Technology, National University, Agriculture University, Hanoi Open Institute, Dong do Private University and has trained more than 50 Graduates, 4 Masters and 3 Ph.D. Has been training microbiological technicians for production enterprises in some provinces and cities such as Hanoi, Namdinh, Quang ninh, Lao cai.

V. PUBLISHED SCIENTIFIC ACHIEVEMENTS AND PRIZES:

- One "A" Grade award from Russian-Vietnamese Association in the year of 70th October Revolution
- Three Awards from the national Creative-labour service examination
- One Honourable certificate from Vietnames women's Union for the creative talent women
- Twenty Creative labour certificates for scientific achievements, from Vietnamese Federation of Trade Labour Union
- Two VIFOTEC Prizes.
- One US based Kovalevskaija Prize 1996 for scientific achievements of Women group.
- Published 65 scientific achievements in domestic journals and 26 scientific achievements in oversea journals and in Proceedings of Conferences and Symposiums.

RESEARCH AND APPLICATION PROJECTS ON PROGRESS:

1. Improvement of cultivation yield, recovery of alkaline protease enzyme from the bacterial *Bacillus bravis* strain by submerge culture method at experimental and industrial scales. Utilization of the enzyme preparation in leather industry and detergents production.
2. Improvement of cultivation yield, recovery of cellulase enzyme from fungal *Mycoderma, Asp. niger* strains by surface culture method at experimental and industrial scales. Utilization of the enzyme preparations for waste treatment in sugar cane industry and its use as biofertilizer at industrial scale.
3. Utilization of Lipase enzymes for fatty acid separation from soybean oil, sesame oil and corn oil at experimental scale to produce super pharmaceutical product (Hypochol) for prevention and treatment of cardio-heart diseases.
4. Utilization of pectinase enzymes in red wine and fruit juice production and technology transfer to local enterprises in Sonla and Ninhbinh provinces.
5. Production of yeast biomass in medium containing cane molasses, which is used as supplementary protein source in cattle feed.
6. Application of PCR technique in studying the bacterial strains synthesizing toxic proteins for control pest insects and insect transmitting diseases, and synthesizing food antibiotic nisin.

FUTURE RESEARCH STRATEGIES AND COOPERATION:

I. RESEARCH STRATEGIES:

1. Continue the research on synthesis and recovery of enzymes from microorganisms and other sources such as animals and plants. Investigate their applications in food and agro-products.
 - Study on synthesis of fructotransferase enzyme from the fungal *Asp.niger* strain and its utilization for production of functional sugars providing for children, elderly people and patients.
 - Study on synthesis and recovery of acid protease enzymes such as rennet and chymosin and their utilization for production of milk products
2. Continue the research on investigation of enzyme utilizations imported from Novo-Nordisk Company in Denmark for production of food, beverage, fatty acid separation from vegetable oils, textile, leather, pulp, comestic and detergent industries.
3. Carry out basic studies on genes coding thermostable amylase synthesis and enthomopathogenic protein synthesis, utilization of gene munipulation technique for

DNA recombinant, DNA recognition, creation of new strains with high productivity and desired characteristics.

4. Carry out experimental production of new products.

II. MATERIALS :

1. Cassava starch, corn flour, sweet potato flour and soybean are hydrolysed by enzymes and used for production of high nutritional value food products, products providing for the community (children, elderly people, pregnant women and patients).
2. Fishes are hydrolysed by microbial enzyme population to produce special fish sauce flavour and to reduce filtration time.
3. Molasses is used to improve fermentation yield, recovery and formulation of yeast biomass product which is used for supplementation in cattle feed.

III. CAPACITY :

1. Lab. and Pilot-plant scales in FIRI
2. Experimental production and industrial scales, commercialization of experimental food products.

LIST OF PRESENT INSTRUMENT:

No	Category	Quantity	Country	Quality	Price (USD)
<i>Instruments in Laboratory</i>					
1	Microwave	1	Korea	Good	300
2	Shaker	1	Vietnam	No Good	800
3	Bio Clean Bench	2	Vietnam	Good	2.000
4	Centrifuge	1	Germany	Good	2.100
5	Ultra centrifuge	1	Germany	Good	8.000
6	Oven	2	China	Good	300
7	Incubator	2	Germany	Good	2.000
8	Refrigerator	2	Korea	Good	700
9	Phase Constract Microscope Nikon E400	1	Japan	Good	4.000
10	Ultra homogenizer	1	Germany	Good	3.000
11	Water bath	1	Germany	Good	2.000
12	Technical balance	1	Germany	Good	300
<i>Instruments in Pilot-plant</i>					
1	Steam bath (800 kg/h)	4	Vietnam	Good	10.000
2	Electricity (560 KWA)	1	Vietnam	Good	5.000
3	Water tanks (200 m ³)	2	Vietnam	Good	20.000
4	Refregerated system (100.000 Kcalo/h)	3	Vietnam	Good	8.000
5	Fermentor 500 L	1	Vietnam	Good	5.000
6	Fermentor 5,000 L	2	Vietnam	Good	30.000
7	Air filter system	1	Vietnam	No Good	10.000

LIST OF ADDING INSTRUMENTS

No	Category	Quantity	Country	Catalog	Price (USD)
<i>Instruments in Laboratory</i>					
1	Shaker incubator	1	USA	Amerex	8.500
2	Bio Clean Bench	1	France	MCV-9BSF	14.000
3	Refregerated microcentrifuge	1	Germany	Heracus	5.000
4	Rotary Evaporator	1	Germany	Uniequip	8.500
5	Autoclave	2	Nhật	Hirayama	5.000
6	Vacuum oven	2	Germany	Heracus	5.000
7	Refregerated ultra centrifuge	1	Germany	Heracus	14.000
8	Phase Constrast Microscope with camera, computer and printer	1	Japan	Nikon E800	12.000
10	Other				30.000
	Total				102.000
<i>Instruments in Pilot-plant</i>					
1	Fermentor 5 lít	1	Japan	Marubishi	20.000
2	Fermentor 20 lít	1	Japan	Marubishi	45.000
3	Ultra filter	1	USA	Mili Po	40.000
4	Continuous centriguge	1	Germany	Heracus	40.000
5	Spectrophotometer UV-Vis	1	Germany	Uvicon	12.000
6	Forced air circulation oven	1	Germany	Heracus	10.000
7	Enzyme Clarification and Purification	1	Swiss	Amersham	65.000
8	Automatic protein analysis	1	Swiss	Amersham	14.000
9	Air Compressor	4	Denmark	Jun - air	8.000
10	Automatic protein analysis	1	Swiss	Amersham	66.000
11	Disc centrifuge	1	Germany	Heracus	15.000
	Total				335.000

LIST OF PRESENT INSTRUMENT:

No	Categories	Quantity	Country	Quality	Price (USD)
<i>Instruments in Laboratory</i>					
1	Microwave	1	Korea	Good	300
2	Shaker	1	Vietnam	No Good	800
3	Bio Clean Bench	2	Vietnam	Good	2.000
4	Centrifuge	1	Germany	Good	2.100
5	Ultra centrifuge	1	Germany	Good	8.000
6	Oven	2	China	Good	300
7	Incubator	2	Germany	Good	2.000
8	Refrigerator	2	Korea	Good	700
9	Phase Constrast Microscope Nikon E400	1	Japan	Good	4.000
10	Ultra homogenizer	1	Germany	Good	3.000
11	Water bath	1	Germany	Good	2.000
12	Technical balance	1	Germany	Good	300
<i>Instruments in Pilot-plant</i>					
1	Steam bath (800 kg/h)	4	Vietnam	Good	10.000
2	Electricity station (560 KWA)	1	Vietnam	Good	5.000
3	Water tanks (200 m ³)	2	Vietnam	Good	20.000
4	Refregerated system (100.000 Kcalo/h)	3	Vietnam	Good	8.000
5	Fermentor 500 L	1	Vietnam	Good	5.000
6	Fermentor 5,000 L	2	Vietnam	Good	30.000
7	Air filter system	1	Vietnam	No Good	10.000

LIST OF ADDING INSTRUMENTS

No	Categories	Quantity	Country	Catalog No	Price (USD)
<i>Instruments in Laboratory</i>					
1	Shaker incubator	1	USA	Amerex	8.500
2	Bio Clean Bench	1	France	MCV-9BSF	14.000
3	Refrigerated microcentrifuge	1	Germany	Heracus	5.000
4	Rotary Evaporator	1	Germany	Uniequip	8.500
5	Autoclave	2	Japan	Hirayama	5.000
6	Vacuum oven	2	Germany	Heracus	5.000
7	Refrigerated ultra centrifuge	1	Germany	Heracus	14.000
8	Phase Contrast Microscope with camera, computer and printer	1	Japan	Nikon E800	12.000
9	Other				30.000
	Total				102.000
<i>Instruments in Pilot-plant</i>					
1	Fermentor 5 lít	1	Japan	Marubishi	20.000
2	Fermentor 20 lít	1	Japan	Marubishi	45.000
3	Ultra filter	1	USA	Mili Po	40.000
4	Continuous centrifuge	1	Germany	Heracus	40.000
5	Spectrophotometer UV-Vis	1	Germany	Uvicon	12.000
6	Forced air circulation oven	1	Germany	Heracus	10.000
7	Enzyme Clarification and Purification	1	Swiss	Amersham	65.000
8	Automatic protein analysis	1	Swiss	Amersham	66.000
9	Air Compressor	4	Denmark	Jun - air	8.000
10	Disc centrifuge	1	Germany	Heracus	15.000
11	Other				14.000
	Total				335.000

DEPARTMENT OF BIOTECHNOLOGY

A. Some interesting subjects:

I. Fishsauce:

1. Investigation relationship between system of microorganism in fish-sauce process with it's flavour formation.
2. Analyze fish-sauce flavour (traditional product)
3. Improving flavour of fishsauce, producing by new technology of FIRI.
4. Improving filtration of fish-sauce by using enzyme and equipment.

II. Using cane-molasses by fermentation:

1. Lactic acid fermentation:

At present, we have strain *Lactobacillus acidophilus* in medium of cane-molasses. We get 60-70 gram acid lactic per litter by this strain. To develop fermentation into pilot-plant, we would like to increase its productivity to 90-100 gram per litter

III. Fruit processing

Although some good result were obtained, there are several problems relating to the fruit processing have to be solved as follows:

- Continue to select suitable enzyme using in fruit processing, especially the enzyme active at low temperature in order to maintain the natural flavor, taste and color of fruits.
- To study in fruit juice processing in order to stabilize the quality of the fruit juice, especially the colour of product, flavor and taste are losing during preservation of final products.
- To prolong the life of final product and maintain the constant quality.
- Continue to research in order to optimize the technology parameters and select suitable equipment for production of high quality products from fruits, especially:
 - + Pure fruit juice
 - + Mix fruit juice
 - + Fruit juice drink
 - + Concentrated fruit juice
 - + Fermented fruit juice with low alcohol content
 - + Clear fruit juice for wine making.

Beside that we are willing to get the help from expert on the field of fruit preservation. We are very weak on this field.

IV. Gelatin production:

- Continue to carry out the experimental production at pilot plant scale. Try to find out optimal conditions for productions of gelatin and selection of equipment for production line.
- Collaboration with confectionary enterprise to produce gelatin and use it in production of gummy candies.

B. Equipment to be granted:

1. Incubator: $t^{\circ}\text{C} = 50^{\circ}\text{C} - 60^{\circ}\text{C}$
 $V = 100$ liters
2. Rotamixer:
3. Incubator-shaker:
 $20-400$ orb/minute
 $t^{\circ}\text{C} = 5-60^{\circ}\text{C}$
4. Box for microbial fermenter
5. Microscope: (Japan)
6. Spectrophotometer (Specol US/VIS)
7. Water bath
8. Centrifuger
9. Hydraulic press machine
10. Multiple-effect evaporator
11. Centrifugal evaporator
12. Ultra-filter

Report TICA 2000

Field of activities	Farm products (self sufficiency rate (%), amount of production, etc, to be mentioned)	Processed materials, or final products (present condition and problem)	Social impact on target beneficiaries, especially vulnerable such as the poor, women and children from the viewpoint of nutrition, health, etc..	Technical impact (target of technical transfer considering level of techniques of the industries)	Economic Impact (contribution to the rural economy and industries)	Important Assumption and Overall Evaluation
Bio <i>Traditional fermented food</i>	Pork, beef, livestock, farmer products (self sufficiency rate 100%. In 1998 Productivity of pork, beef and poultry is 18.13; 3.98; 166.4 million of heads, respectively.	1. fermented pork, 2. fermented sausage and 3. jambon. Processing technologists of all fermented meat products are limited with low level and household scale, the quality of these products is unstable Fermented sausage is rarely made by some food enterprises, such as Vissant, Hien Thanh, Ha long Ltd Co.	It encourages the farmers to produce more and more pork, beef and livestock, and meet the demand of consumers. Development of fermented meat products and technical transfer to small scale enterprises is necessary and indispensable for the progress of the Market economic policy.	Small scale enterprises.	- farmers income, benefit for small scale enterprises.	The development of fermented meat food industry also lead to the development of agriculture and farmers itself. It means the ripple effect of fermented meat food industry should not be neglected for the total development of national production.

functional food	Rice, maize, germinated soybean, Quinoa seed, carrot, black chicken, onion garlic, reishi, The productivity of soybean of Vietnam in 1998 is about 141.3 thousand tons	1. Functional food for baby Processing technology of these products are limited with low level of small scale. Thus, the proportion of malnourished children below 5 years of age in Vietnam Baby food in Vietnam is poor of protein and energy. Most of them are not required nutritious balance of FAO standard. Thus, the proportion of malnourished children below 5 years of age in Vietnam oscillated around 36-38% and reach to 50% in some rural areas and mountain regions. In order to overcome the situation, applying extrusion cooking technology using locally available materials are necessary. However, in Vietnam, there are some single screw extruders, which made in domestic. They are not complicated. Therefore, quality of baby food could	Production of these functional foods is developing, consumers, especially the poor, women and children has health benefit and well being when they use these products. Moreover, it will encourage the farmers to produce much soybean, black chicken, solve the environmental problem of breweries and brings benefit for small scale enterprises.	Small scale enterprises.	- farmers income, benefit for small scale enterprises.	The development of fermented functional food industry also lead to the development of agriculture and farmers itself. It means the ripple effect of functional food industry should not be neglected for the total development of national production.
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					not afford consumer's requirements. Development and improvement of production of function baby food through twin screw extruders plays important role in modern processing industry..					
					2. Functional food from herbs					
					3. Functional food from animal					
					These products are not produced widely. In Vietnam, functional foods are not many produced					

Summary of Scientific Researches and Technological transfer in the field of Beverage Technology at Food Industries Research Institute

I.Functions and Missions of Beverage Technology Department

1.1.Information on beverage technology: To help FIRI leaders catch the situation of production,scientific research, and technological transfer of beverage products in the country, regional countries, and in the world. To predict development tendency of beverage industry. To adjust orientation of scientific research, and technological transfer in order to speed up the development of Vietnamese beverage industry how to elbow with that of regional countries recently and catch up that of the world developed countries in the future.

1.2. Scientific researches : Research and apply Biotechnology for processing agricultural products into traditional and modern drinking products in order to meet domestic demand and especially, for people in the country and distant areas, for beer, non alcoholic beverage and brandy. Works to be done:

- survey on raw material sources : to get main material quality, kinds, characteristics for processing and application.
- Collection, selection, isolation, hybridization of microbial strains for fermentation of beverage products.
- Investigation of nature of traditional technologies, modification and modernization for higher quality, hygienic safety and low cost products.
- Study on product diversification in order to replace imported material, and products for domestic demand.
- Application of new biotech advances to produce cheaper, better and better products.

1.3.Technological transfer:

- Summarizing research results, setting up procedures from raw material pretreatment to finished products, and transferring for partners.

- Technological transfer objects : Mainly individual, collective, private or state owned enterprises with home, small and medium scale.

- Mode of transfer : Consulting the setting- up design, technological transfer or equipments and technology

1.4. Labour source training:

- Compiling books, teaching material of beverage technology for students, professional pupils, and workers.

- Supervising students, and scientists to carry out their university or upper university these for beverage technology.
 - Organizing seminars, workshops on beverage technology for enterprise leaders related to beverage industry.
- 1.5 Co-operation with other organizations:** Co-operating with domestic and overseas research organizations in order to learn, study their experiences for speeding up researches, and reducing time, associating with production companies in research and development of products which both are interested in, to quickly apply results into production.

II/ Research situation on beverage industry from 1990 up to now.

No	Year	Subject Name or Topic	Research Content	Obtained Results	Subject heads
1	1990	Study on production of reduced time Brewing technology	1. Selection of yeast strains with high fermenting and low diacetyl content producing ability 2. Study on influence of temperature pressure, strain, fermenting time on formation of diacetyl in beer. 3. Setting up the reduced time beer fermentation with quality similar to that in traditional fermentation	1. High fermenting, low diacetyl content producing and good flocculation ability strain <i>Saccharomyces</i> GR2 was selected 2. Fermenting temperature in the range of 14 - 15 °C is suitable. Although, high diacetyl content is produced, its decomposition is rather fast. Fermenting under 1 kg/cm ² produces lower diacetyl content compared with that under atmospheric pressure 3. Total fermentation period from 10 - 12 days gives acceptable beer quality	Dr. Giang The Binh
2	1993 - 1994	Completion of reduced time beer fermentation technology and equipments	1. Study on design of isolated-conic shaped fermentor with 1500-150000 litre-capacity for both alcoholic and secondary fermentation. 2. Study on fermentation kinetics in 5000 litre fermentor : formation and decomposition of diacetyl in	1. Equipment production chain with 5000 litre /batch scale was established. 2. Experimental beer quality is similar to that of traditional fermentation. 3. 70 per cent consumers can not distinguish the differences from the experimental beer to traditional	Dr. Giang The Binh

			semiproduction condition. 3.Study on cooling condition to yeast flocculation 4.Beer quality assessment and consumers	fermentation one	
3	1990	Study on corn processing and application for beer and syrup production	1.Study on Technological procedure of corn syrup production (liquefied with α -amylase, saccharified with glucoamylase) 2.Study on technological procedure of beer production with corn partly replaced for malt.	1.Technological procedure of enzymic corn syrup production was established. 2.Application of corn in beer production with 30-40% replacement at laboratory scale was studied	Nguyen Van Viet
4	1991	Study on application of other substitutes for hop extract in beer production	1.Study on influence of rice replacement percentage on wort characteristics in hot extraction method. 2.Study on influence of rice replacement percentage on mashing process.	Enzyme addition is effective on wort composition stabilization as 50% percent rice replacement	Eng. Nguyen Thu Vinh
5	1994	Study on application of protease preparation in beer	1.Study on characteristics of enzymic preparations <i>oryzae</i> , Neutrase 2.Study on application of <i>E.oryzae</i> , and	1.Outline for <i>E.oryzae</i> , Neutrase application in beer production with material replacement percentage of 48-	Eng. Truong T Hoa

		production.	Neutrase in mashing process	80% was set up. 2. 1000-10.000litre production scale with 50% material replacement was tested	
6	1994	Study on flocculation characteristics of bottom fermenting yeast in fermentation	1.Study on flocculent characteristics of beer yeast. 2.Study on influence of some factors on yeast flocculation ability.	1.Several factors influencing on yeast flocculation ability was studied.	Eng.Truong T Hoa
7	1994	Study on application of acidification method for determination of fermenting efficiency of beer yeast	Study on influence of temperature, time on pitching storage life	Determination of fermenting efficiency with acidification method is simple effective, precise one in short time and simple equipments	Eng.Truong T Hoa
8	1999	Study on beer production with typical flavor produced yeast train	1.Determination of yeast characteristics (fermenting ability, flocculent and flavour producing ability) 2.Study on application of new and old yeast strains with suitable rates to beer typical flavour 3. Fermenting in 5000 litre/batch fermentor to determine beer quality and consumer's acceptance	1.New yeast strain has fermenting ability similar to the old one produces more flavourful, largesize, less flocculent ability. 2.Fermenting with old yeast strain improves flocculent, filtration ability, 3.Fermentation kinetics is not so different compared to fermentation with only old one	Eng. Giang Th Viet
9	1997	Study on completion of technology of black beer production	1. Study on selection of yeast strain suitable for black beer production 2. Study on technology of material treatment 3. Study on technology of black beer	- Suitable yeast strain for black beer production was selected - Technology of black malts production with good quality was completed: caramel malt,	Dr. Ngo Tien Hien

			production 4. Study on manufacturing of storage and transport and selling equipment.	melanoidine malt, coffee malt... - Optimal conditions for black beer production was chosen - Complete black beer production technology was set up	Dr. Giang The Binh, Eng Dan Kim Tuyen
10	1994 - 1995	Study on contaminated microöbes in beer fermentation and prevention measures	1. Study on influence of sarcina contamination on diacetyl producing content in beer fermentation 2. Study on influence of some wild yeast on beer flavour	1. Sarcina contamination is very dangerous because they produce great diacetyl content. Cautions should be made in mashing process to avoid the presence of starch in wort 2. Yeast: <i>S. ellipsoideus</i> and <i>Candida utilis</i> produce unpleasant flavour and taste in beer hygiennic condition should be taken	
11	1996	Study on technology of wine and champagne production from domestic fruits	1. Study on selection of suitable yeast strain and incubating condition. 2. Study on setting up of alcoholic fermentation and must treatment procedure into wine	1. Yeast strain TVA with high fermenting good flocculation ability and SLS strain with typical flavour for wine and champagne production were selected	Eng. Dang Ki Tuyen
12	1997	Study on technological and equipment completion for fruit wine and champagne production	1. Study on application of combined TVA and SLS strain to enhance fermenting rate and product flavour 2. Study on application of fruit enzymic treatment to increase juice recovery and reduce aging time. 3. Study on 3000 liter/ batch fermentation and kinetics 4. Study on micro and macro quantity	1. Combined TVA and SLS strain application gives higher quality product compared with separate use. 2. NOVO enzymes such as pectinex 3 XL, pectinex Ultra SPL, Vinoxym, Neutrase are effective in juice treatment and product clarification and in reducing the aging time. 3. High quality carbonated wine or wine made from domestic fruits are	

13	1996	Study on completion of carbonated mulberry production technology	1. Study on selection of high alcohol content producing yeasts 2. Study on completion of new product and economic efficiency assessment	1. Yeast strain <i>Saccharomyces Cerevisiae</i> CNTP-Y-078 for mulberry wine fermentation with good flavour, pleasant taste and high alcohol content producing 14.3% vol was selected. 2. Procedure for mulberry wine production was completed 3. New product was made, marketed, and consumed	consumer-accepted	Dr Ngo Tien Hien
14	1999	Application of enzymes in the production of black rice wine ("Cam" wine)	- Selection of the appropriate concentration of rice powder for liquefaction process. - Selection of the liquefaction enzyme concentration (Termamyl). - Influence of liquefaction time. - Selection of saccharification enzyme - glucoamylase (AMG). - Selection of the appropriate saccharification period. - Assessment of black rice wine quality after fermentation.	The optimal condition for the saccharification process of black rice powder using two kinds of commercial enzymes i.e: - Application of enzymes into production of black rice wine resulted in the improvement of black rice wine. Alcohol content: 12.4% after fermentation without addition of alcohol. The concentration of aldehyde and methanol in the wine produced by enzymatic method has 5 and 10 times lower compare with that of available one on the market.		PhD. Ngo Tien Hien (Subject Branch)

15	1992	Application of genetic hybridization of wine yeast	1. Research on ability of spore formation of <i>S.cerevisiae</i>. 2. Selection of mutants with appropriate genetic characteristics. 3. Hybridization and selection of yeast spores.	Utilization of spore hybridization technique to produce new wine yeast strains which have fast fermenting ability, high alcohol, low SO ₂ tolerant and acidity concentration, compared with the old wine yeast strains.	Ph. Truong Thi Hoa
16	1997	Research on the utilization of <i>Leuconostoc Oenos</i> bacteria to decompose malic acid in wine fermentation.	1. Collection and selection of bacterial strains with high decomposition activities of malic acid. 2. Determination of effects on bacterial growth and methods for utilizing them in secondary fermentation of wine.	1. Selected 8 <i>Leuconostoc oenoes</i> strains from France, Germany and USA. Preliminary selection of LF01 strain into production. 2. Determined appropriate conditions to produce maximum bacterial biomass and high decomposition activity of malic acid. 3. Pitched <i>Leuco oenos</i> after alcoholic fermentation period resulted in improvement of the decomposition rate of malic acid and reduction of malolactic fermentation period.	PhD. Giang Th Binh. MSc. Dang Ho Anh and Eng. Dang Kim Tuy
17	1998	Research on immobilization of yeast and <i>Leuco.oenos</i> bacteria	1. Setting up appropriate conditions for forming immobilized beads. Comparison of conventional and	1. Cells can be immobilized into Ca-alginate with concentration of 3% w/v, bead diameter of 2 ÷ 3 mm and bacterial	PhD. Giang Th Binh. MSc. Dang Ho

		cells in Ca-alginate for wine production using discontinuous and continuous fermentation methods.	immobilization fermentation methods in terms of fermenting ability and quality of fermented liquid.	cell count of 10^9 to ferment by two above mentioned methods. 2. The rate of wine fermentation and malic acid decomposition can be considerably reduced.	Anh and Eng. Giang The Bin
18	2000	Research on fermentation for rice wine making by new method	1. Determination of complete saccharification ability of rice powder with NOVO enzymes. 2. Fermenting must by utilization of different wine yeasts. 3. Treatment method of fermented liquids by physical and bio chemical methods in order to obtain wine products with branch level quality.	1. Set up procedure for complete saccharification of various rice powders. 2. Set up wine making procedure with products which meet high acceptance of customers. 3. Produced at pilot scale of 3000 litres/batch with good quality products.	PhD. Giang Th Binh
19	1999	Research on the technology for the production of liquor from egg	1. Studied on emulsification of egg protein in the liquor. 2. Researched on the ratio of material and additives. 3. Researched on preservation conditions.	1. Procedure of egg liquor production, preserved products at normal temperature at least 6 months.	PhD. Phan To Nga
20	1999	Research on the production of alcohol	1. Treatment processes of molasse.	1. Selected strains with alcoholic	PhD. Giang Th

		from sugar cane molasse using continuous fermentation process	2. Selection of yeast strains 3. Influence of some aspects on the conversion efficiency from sugar to alcohol and on alcohol concentration in fermented liquid. (the ratio of added yeast , concentration of molasse, dilution rate in fermentation period)	producing ability from 15 to 16% v/v. 2. Combination of acidification and flocculation aid used polymer resin is the appropriate treatment method of molasse. 3. The feeding rate of starter culture and molasse as well as molasse concentration resulted in obtaining the conversion efficiency from sugar to alcohol of 48% and alcohol concentration of 8.5-9% v/v in fermented liquid.	Binh. Eng. Giang Th Viet
21	1990	Research on manufacturing of the soft drink production chains at small and medium scale.	1.Calculation, design and selection of equipments 2.Calculation thermal balance. 3.Calculation freezing carrier. 4. Calculation electrical consumption .	Designed carbonated soft drink production equipments with the capacity of 2000 bottles per shift	Nguyen Tuan Phong Nguyen Van V
22	1998	Research on the process of cocktail from Vietnamese fruits.	1.Selection of technology for the orange syrup production 2.Selection of technology for fruit wine production.	Set up procedure of cocktail production at industrial scale	MSc. Nguyen Loc
23	1998	Completion of technology for the	1.Study on the influence material sizes	1.Determined the appropriate extraction conditions with materials : material sizes,	PhD. Ngo Tien

24	1999	production of soft drinks from herbs	on the extracts (table 1) 2.The ratio between material and water, temperature and extraction time. 3.Research on conditions of extraction process to obtain the second extract. 4.The extraction composition 5.The preparation formulae of soft drink from herbs 6.Study on the composition of mixture 7. Assessment of the nutritious value of Thanh Nhiet soft drink.	the ratio between material and water, extraction temperature, the conditions for extraction: boiling- boiling cease- boiling, extraction time for different kind of materials 2.The extraction composition and main extracted substance with each kind of materials 3.Analysed the composition of mixture by using ultraviolet spectrum.	Hien
		Selection of lactic acid strain and application into production of Kvass soft drink	1..Selection and utilization of some lactic acid bacteria for production of Kvass soft drink 2.Classification and identification of lactic acid bacteria 3.Study on physiological and biochemical, set up characteristics of these bacteria .	1.Isolated 24 lactic acid bacteria strains from two natural sources i.e from fermented liquid of pickled cabbage and cucumber. 2.Selected BC 5.1 lactic acid bacteria strain which is suitable for Kvass soft drink production	PhD. Nguyen Anh (Subject branc

			the procedure of Kavass soft drink production	Identified its scientific name <i>Lactobacillus plantarum</i> 3. Determined some physiological characteristics of BC 5.1 ie: suitable temperature of growth and fermentation at 25-30° C and its alcoholic tolerance led to set up the fermentation procedure of Kvass soft drink	
25	1999	Research on technology for the production of high quality dissolved beverage using enzymatic method from malt and cereal	- Determination of the used raw material ratio. - Determination of the ratio of malt extract - Study on the influence of enzymes on the production of beverage from cereal - Assessment of quality products using microbiological method	1) Determined stable raw materials for the production process, ie: malt, rice, starch, cassava powder, milk powder, sugar, edible oil, salt, additives...and the appropriate ratio of raw materials. 2) Selected the suitable technological procedure. 3) Selected the appropriate technological equipments with easy mechanization, high productivity. 4) Designed suitable package sample	
26	1997	Research on technology for the production of soft drink from vegetables and fruit for children and old persons	Studies on the processes of blanch, mill, preparation formula, ratio of preservatives and pasteurized conditions	Determined technology of soft drink production from tomato, carrot and papaya	Eng. Dam Thanh Binh
27	1999	Research on beverage the production from the mixture of different	Studies on the conditions of treatment, blanching, pressing, recovery of vegetable extracts ratio of ingredients, pasteurized and preservation	Set up the technological procedure of beverage production from extracts of 8 kinds of Vietnamese vegetable (two preparation formulae the winter and 2	PhD. Phan To Nga

		kinds of vegetable (V8)	conditions	formulae in the summer with the same quality of V8 soft drink in the USA)	
28	1999	Study on the utilization of engymes in production of apricot fuice	1. Utilization of NOVO enzymes to increase the recovery efficiency of extracts and to clarify extracts 2. Recovery and application of B- glucosidase from the apricot seeds to eliminate the bitter taste of appicot fuice	1. Determined the suitable ratio of pectinex SPL and 3XL enzymes. 2. Set up the recovery procedure of β - glucosidase and applied it in production at experimental scale.	Eng.Dang Ki Tuyen
29	1993	Research on the production of beverage rich in nutrition using lactic fermentation	1. Study on the saccharification process of rice powder 2. Study on the lactic fermentation process 3. Study on characteristics of products 4. Assessment of product quality .	1. Determined the optimal conditions for the liquefaction process of rice powder using α -amylase and glucoamilase 2. Determined conditions for the lactic fermentation	Dr Nguyen Va Viet
30	1995	Upgrading the quality of soymilk	1. Improvement of casein recovery efficiency in production of soymilk 2. Increase of the sensory quality of soymilk 3. Studied pasteurized methods of soymilk (using chemicals, pressure...)	1. Improved recovery efficiency of casein :11-16%. 2. Eliminated beany flavour, astringent and some toxins 3. Determined the optimal preservation conditions 4. Set up technological procedure to produce bottled soymilk which can be	Eng. Truong Dinh Tri

				preserved at the normal temperature during 3 months	
31	1999	Research on production fruit flavour beverage from soymilk	1. Study on formula process 2. Study on homogenization process 3. Study on pasteurization and preservation conditions	1. Studied on the optimal technical conditions into formula, pasteurization and preservation processes 2. Determined technical procedure in production beverage with fruit flavours from soymilk. The products were bottled with good quality, preserved more than 3 months at normal conditions	
32	1999	Research on production yoghurt from soymilk	1. Selection of the appropriate lactic bacteria 2. Degradation methods of beany flavour 3. Determined procedure of yoghurt fermentation from soymilk and assessed the effects of products on habitus of 6-24 month children	1. Selected appropriate lactic acid bacteria 2. Set up procedure for off-flavour and beany flavour degradation and procedure of suitable fermentation 3. Utilized soymilk yoghurt for malnutrition children resulted in the considerable increase of weight and decrease of diarrhoea	MSc Nguyen Viet San
33	1999	Research on lactic	1. Isolation of strains with high	1. Selected the strain with synthesis	Dr. Giang The

	acid production from sugar cane molasses for the beverage industry	production ability of lactic acid from the starch powder and sugar production sites 2. Determination of some biological characteristics of the strain with highest activity 3. Fermentation of lactic acid production at the laboratory	capacity of 50-70 gram lactic acid/ litre from liquefaction liquid of starch and molasse medium. 2. Extracted lactic acid from fermented liquids by ion exchange method with the recovery efficiency of 50-55 %.	Binh, Eng. Tra Thi Dinh, Eng Nguyen Than Thuy.
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III. Summary of Technological and Beverage Equipment Transfer Results Since 1990

No	Year	Technological Transfer Themes (technology or technology and equipment)	Place of Technological Transfer	Result Comments
1	1992	Reduced-time brewing procedure (including yeast strains)	Thanh Hoa Brewery Factory Dong Ha Brewery Factory, Quang Tri	Good result, reduced fermentation period to 10-12 days
2	1993	Yeast strain, Reduced-time brewing procedure, mashing procedure with ratio between rice and malt is 40%.	Quang Ninh Brewery Factory	Capacity of factory was raised 2.5 times. After 6 years of extension, capacity was raised 20 times. Annually, billions VND are submitted for state budget.
		Yeast strain, technology and equipment brewery production with capacity from 1000-3000 litre/ day	- Chi Linh- Hai Hung Vocational School - Van Diem Sugar Cane Factory - Dong Anh Food Processing Factory - Institute of Biotechnology and Food (Ha Noi University of Technology) - Hue Food Processing Enterprise	Good quality beer. Well-operated
4	1995	Technology and equipment brewery production with capacity from 3000 litre/ day	Lang Son Manufacture and Oil Processing Company, Lang Son Town	Good result, Well-operated
5	1996	Reduced-time brewing procedure	Food Export Company in Son Tay	Good result, Well-operated

6		(Fresh beer and bottle beer)	Town, Ha Tay.	
1999	Reduced-time brewing procedure	Li Nhan Brewery Pilot, Ha Nam	Good result, Well-operated	
7	Technological and Equipment Transfer on Brewery production	Pharmaceutical combination Enterprise, Tuyen Quang	- Assembly equipment production chain - Technological transfer on yeast propagation - Technological transfer on brewery production, stable production	
8	Technological transfer on brewery production	Cam Pha Brewery Factory, Quang Ninh	- Technological transfer on brewery production, stable production	
9	Technological and Equipment Transfer on Brewery production	Materials, Transportation and Coal Processing Enterprise, Domestic Coal Company, Viet nam Coporation of Coal in Dong Anh, Ha Noi.	- Assembly equipment production chain - Technological transfer on yeast propagation - Technological transfer on brewery production, stable production	
10	Technological and Equipment Transfer on Brewery production	Ha Tay Minaral Water Company	- Assembly equipment production chain - Technological transfer on yeast propagation - Technological transfer on brewery production, stable production	
11	Technological and Equipment Transfer on Brewery production	Ong Company, Hung Yen	- Assembly equipment production chain - Technological transfer on	

				yeast propagation - Technological transfer on brewery production, stable production - Assembly equipment production chain - Technological transfer on yeast propagation - Technological transfer on brewery production, stable production
12	1996	Technological and Equipment Transfer on Brewery production	Bac Nam Volatile Oil Complex, Soc Son, Ha Noi	
13	1990	Technological transfer on brewery production	Nam Dinh Food Stuffs Processing and Trading Enterprise	
14	1990	Technological transfer on brewery production	Ha Tay Food Combination	
15	1990	Technological transfer on brewery production	Kim Bai Food Stuffs Processing and Trading Enterprise, Ha Tay	
16	1990	Technological transfer on brewery production	Hai Phong Brewery Factory	
17	1991	Technological transfer on brewery production	Hoa Binh Food Stuffs Processing and Trading Enterprise	
18	1991	Technological transfer on brewery production	Hai Duong Agricultural Product Processing Enterprise	
19	1992	Technological transfer on brewery production	Z- 127 Unit	
20	1993	Technological transfer on brewery production	Son La Brewery Factory	
21	1993	Technological transfer on brewery production	Ninh Binh Rice Mill	

22	1994	production Technological transfer on brewery production	Viet Tri Food Secondary Vocational School	
23	1990	Technological transfer on fermented beverage production	Cao Bang Tobacco Enterprise	
24	1993	Technological transfer on draught brewery production (fermented bottle)	Phu Yen Food Processing Enterprise, Son La	
25	1992	Technological transfer on carbonated beverage production	Kim Bai Food Stuff's Processing and Trading Enterprise, Ha Tay	
26	1993	Technological transfer on carbonated beverage production	Z/- 127 Unit Thai Nguyen	
27	1994	Technological transfer on carbonated mineral water production	Tuyen Quang Food Processing Enterprise	
28	1999	Technology of wine clarification	Tan Thinh Service and Production Company	Good result
29	2000	Fermentation technology for fruit wine making	- Quang Ninh Brewery Factory - Huong Lan Brewery Factory, Hai Phong - Tan Thinh Brewery Factory, Ha Tay	Going on, good result

IV. Summary of Research Plans for Beverage Technology Since 2001 - 2100

No	Title of Project or Themes	Main Content	Reasons for Research	Result Gain
1	Complete technology for brewing by local raw materials	1. Utilization of suitable enzymes to sacchrify rice and little malt making wort solution equivalent malt saccharification. 2. Selection and improvement of suitable yeast strain for typical flavour beer 3. Production procedure on equipment with capacity 5000 litre/ batch	1. Malt import is very expensive, spent a lot of currency foreign. 2. Domestic rice is very cheap, price is only equal 50% malt price 3. Reducing beer price suitable for poor people 4. Competition with existing brewery firms in order to assist Institute's beer for long term development	Producing typical flavour beer with price is only 70% market price, to make advantages for farmers using
2	Complete technology increasing beer quality, various beer products	- Research on increasing stable beer - Research on untivirus in brewing with small and intermediate scale - Reseach on yeast strain in brewery, optimum condition in brewing - Completing black beer technology	- Market demand requirement - Increasing quality	- Having new strains - Having new products, bottled black beer - Increasing beer quality - Lasting preservation period.
3	Research on brewery technology with low alcohol	1. Selection of yeast strains 2. Determination of appropriate technology procedure	Number of people using motorized vehicles increasing day by day and a lot of women using beer with low alcohol during hot days for working	Having brewery technology with low alcohol

4	Research on traditional fermentation technological improvement in order to make rice wine, fruit wine	1. Research on selection, creation suitable yeast strains 2. Using enzymes to eliminate waste substance in secondary fermentation 3. Fermenting procedure for brewery firms with small and intermediate scale	1. There are a lot of fruit and rice which are processed into rich nutritial beverage in Viet nam 2. Need reduced time processing to make the price down for mass people who can be able to pay for products, distribution of products import competition	Having production procedure on making Rice, Nep, Nep Cam, Grape, Cider, Pineapple, Mulberry, Litchée carbonated or non carbonated wine. Production period less not 3 months.
5	Research on processing of functional beverages from fruit juices, vegetable juices, coconut pulp, lotus seeds, and herbs	1. Application of enzymic preparations for fruit juice clarification and juice recovery improvement 2. Recovery and application of debitting enzymes to remove bitterness of apricot juice, orange juice... 3. Research on supplemetation of essential substances for consumer strength and beauty enhancement 4. Research on preparation of clear, cloudy fruit juice. Lotus drink, pine apple juice... 5. Research on preparation of low alcool, lactic acid content fruit and vegetable juices.	1. In Viet Nam, there is a variety of vegetable and fruits which can be processed into tonic drinks. 2. Economic development makes consumers diverse demand increased, especially women and young people. 3. Many people are interested in disease- treating and preventing diets.	Functional beverage procedures in accordance to all people's consumption demand requirement such as Vitamins lactic rich drinks, lotus drink, coconut drink ... were set up
6	Research on processing of functional	- Selection and extraction raw materials - Determination of appropriate	- Serving for whom are mal-digestible, bad intake-ability to enhance their strength.	- Making products according to objective

	beverages for children, women and old people	- Analyzing chemical composition and functional composition - Experiments on community	- Overcome the children's malnutrition.	- Undertaking production in some places
7	Researching diet beverage for obese people	- Selection and extraction raw materials - Determination of appropriate technology - Analyzing chemical composition and functional composition - Experiments on community	- Serving for whom are mal-digestible, bad intake-ability to enhance their strength - Overcome the children's malnutrition	- Making products according to objective - Undertaking production in some places
8	Research on application of high technology of biotechnology in order to produce some kinds of beverages	1. Application of cell hybridization technique or genetic transference to improve the yeast strains. 2. Application of cell immobilized technology in the production of alcohol, wine, beer and lactic acid	Setting up the precondition for beverage production using continuous fermentation in order to reduce the product cost	Achievement of some experiences in the application of high technology in the field of biotechnology
9	Collection, isolation, selection, improvement of microbiological strain quality to produce new beverage products from fresh fruits and other agro food raw materials	- Import of new microbiological strains - Application of genetic technique, PCR, study on optimal conditions - Study on technology, equipments with small scale production	- Application on research, training, pre-production, technological transfer - Assurance of hygienic conditions and safe food	- Selection of microbiological strains - Application into production at small and medium scale - Production of new products i.e: Kvass, Cider, fruit juices, black rice wine, beer

10	Researching enhance alcohol fermentation efficiency from sugar cane industrial subproducts according to continuous fermentation	1. Microbiological strain improvement to produce the strains with high alcohol content tolerance, low organic acidic synthesis, high conversion efficiency 2. Methods for increase of alcohol content in fermented wort as well as re-use of yeast. Increase the condition for the contact of yeast with medium	1. There are a lot of subproducts which can be prepared to alcohol (from sugar cane molasse) 2. Supplement of alcohol with petrol to save petrol and reduce environmental pollution 3. Utilization of purified alcohol to prepare spirits and liquors	Obtain microbiological strains and continuous fermentation technology to achieve high conversion efficiency and alcohol content in fermented wort more than 16%
11	Study on technology for the production of whisky	1. Selection of yeast strains and raw materials 2. Determination of technological procedure	Because of expensive imported whisky, there is a need of domestic products with good quality and buying orders from private companies Great demand on lactic acid in production of function beverages	Obtain the production procedure to have products with product cost less than half of imported product
12	Research on fermentation process to produce lactic acid using in beverage industry	1. Determine fermentation methods to gain high fermentation efficiency 2. Recover lactic acid by ion exchange or dialysis method in order to archive recovery efficiency more than 70%		Set up the procedure of lactic acid production and purification at scale of 400 kg/ batch and beverage products with lactic acid supplement

V/ Human resource Development Training

1. Involving teaching beverage technology at University
2. Supervising 5 master degree and 33 students for their thesis in the field of beverage technology
3. Training 380 workers in the field of beverage technology from enterprises
4. Attending International workshop in Singapore, Germany and Ha Noi

