

[teams, altern roles in class.]
competition

[partially through some stayed cases.

[R-266 as presented to dec-~~mb~~]

? 360/8000

[2^d go round → enrich case design.

lunch Wed
 The Corp in Mod Sol
 Ed. S. Mason.

session on info systems.

15.959



Massachusetts Institute of Technology
Alfred P. Sloan School of Management
50 Memorial Drive
Cambridge, Massachusetts, 02139

December 16, 1966

Mr. C. Thomas Whitehead
Room E53-422
MIT

Dear Tom:

Enclosed is a self-explanatory letter.

I would appreciate your describing the course you are going to offer next semester, indicating areas of research.

Sincerely,

James S. Hekimian
Associate Professor
of Management

JSH:s1
Enc. 1



Massachusetts Institute of Technology
Alfred P. Sloan School of Management
50 Memorial Drive
Cambridge, Massachusetts, 02139

Office of the Dean

December 12, 1966

Professor James S. Hekimian
Room 53-315
M.I.T.

Dear Jim,

Confirming the discussion at the Policy Committee meeting on December second, I would appreciate very much your preparing a memorandum for me and for subsequent discussion by the Policy Committee in which you estimate the significant developments in the field of business policy over the next five years and the impact these developments should have on the teaching and research programs of the School. You understand, of course, that this request in no way limits the degree in which you may want to involve other members of the faculty in this task. If you think I can be of any assistance to you, I would be happy to contribute in any way I can.

I hope we can schedule your leading a discussion of the policy area at a meeting of the Policy Committee shortly after January 1, 1967.

Sincerely yours,

William F. Pounds

WFP:ha

M E M O R A N D U M

15,959

Operations Research at the Policy Level

Meets M W 9-10:30 in 52-160 instead of
T Th 1-2:30

Some students have asked for more information about the nature of the course. It is not a course in O.R. techniques as some have logically inferred from the title, but it does assume a familiarity with mathematical and economic concepts that would result from exposure to 15.092 and 15.012. The basic theme is how to handle large and complex decision problems that are typical of policy-level management. (Robert McNamara's approach to the management of the Defense Department probably is the best-known example.) The objective is to familiarize the student with the current state of the art in this area and to give him a reasonable confidence in attacking this type of decision problem.

We will cover the most useful literature, most of which is not covered in existing courses, including selections from:

Anthony:	Planning and Control Systems
Novick:	Program Budgeting
Simon:	The New Science of Management Decision
Hitch & McKean:	The Economics of Defense in the Nuclear Age
Enthoven:	Operations Research at the National Policy Level
Schelling:	The Strategy of Conflict
Sorenson:	Decision Making in the White House
Schlesinger:	Organizational Structures and Decision Making
Cyert & March:	The Behavioral Theory of the Firm
Braybrooke & Lindblom:	A Strategy of Decision
March:	Handbook on Organizations
Shelly & Bryan:	Human Judgments and Optimality
Mason:	The Corporation in Modern Society

There will be four major and about as many minor cases to provide practice and a focus for the readings. They will deal with major long- and medium-range planning decisions of an organization. We will also read and discuss some actual documents prepared for such decisions and some instances of the success or failure of analytic approaches to decision-making. There will be two or three guest lectures if I can con the right people into it.

I will be at the coffee hour on Wednesday with the rest of the policy group if anyone wants to discuss the course further.

Green, McNamee & ...

what do you do w/ the answer once you have it?

insight in asking right question ~~and~~ & structuring of problem
v. soph models.

→ "solved" cases - are we left and

We are teaching what we best can teach but remember that those other things are there.

But "teaching what you can teach" encourage come on techniques - ins & outs - rather than applic & comb w/ what we can't teach.

Techniques of as basis for intuition. Why can't we teach some of that? Perhaps "solved" cases, some of the syst and "rules".

We grade people on use of tech, not on use of cog and & applic of techn.

Sci models as trap - "soln" is just around the corner
v. use as is as input to decn.

Can't we study & teach the latter?

Don't throw away ^{or ignore} quant frameworks just bec it doesn't offer Nirvana: emph interaction w/ intuition, judgement, orgnl problems, etc to devise better normative processes
[now we have normative ^{oriented} quant tech & descrip oriented orgnl & judgemental theories: Why not joint quant - orgnl normative processes?

Publishing
disturbances O.M. exam?
 my profession

Symposium: objectives / format / success } ^{one year} str. group fall 67

Teaching in general: theory & techniques v. implementation & r.w. ^{consider}

- avoid "common sense": but higher order of common sense
- What will they retain ~~less~~ of what they learn here & ∴
 what can we teach best that they can't get so well outside?
- Specify models, "r.w." agree later
- Its learning to use the techniques & the theory - learning ^{how} to
 translate from theory or tech to realistic soln of a real probl
 that they can learn here & can't so well outside.

Framework on which to hang concepts { ^{hedging - good? bad?}
 invest types
 criteria

Course: OR at the Policy Level -

Role & use of quant OR techniques in policy decn (planning)
 93 as prereq.

- (1) Text for framework (middle of H&M) ^{Willowsky, Lindblom}
- (2) Readings ~~book~~: prog budgeting; Ent OR & natl pol; conflict
- (3) Solved cases
- (4) Case problems [stages] <sup>prob form
model form
use of model results
choice</sup>
- (5)(?) Short homework problems (one-page papers) <sup>some like 712 but more structured
to illustrate
cert pts.</sup>

Thesis (1) M+E: if pans out ^{classified? chns here?} ← go for descrip or go for implications?
 (2) OR in pol & planning - relate orgnl factors ^{+ decn problems} & OR capabil to
 (3) value-fact ^{rational/irrational} - orgnl, decnl (papers) ^{suggest explicitly} role of anal in complex
 decn ^{Bennis "limits of rationality"}

10	0	0	1	1	1	1	1	1	1
5	5	5	5	5	5	5	5	5	5
12	12	12	12	12	12	12	12	12	12
10	10	10	10	10	10	10	10	10	10
69	69	69	69	69	69	69	69	69	69
14	14	14	14	14	14	14	14	14	14
4	4	4	4	4	4	4	4	4	4

~~rather than determine~~
 derive from, the goals & curricula of the school.
~~rather than act as a~~

~~determinant of~~ Admissions policy is ~~but~~
 The admissions policy of a grad school ~~is~~ like
 a self-fulfilling prophecy: the prospective
 students' image of the school, ~~competence &~~
~~ability~~ ~~then~~ affect, who will apply; who
 will be admitted, ^{the character of the student body,} of kind of curriculum they will expect
 and will do well at; and the ~~types of~~ courses

Admissions policy is a major determinant
 of the type of student who will apply ~~to the school~~
 to ~~the school~~. Since the interests & attitudes of the
 student body

Der from goals, not constraint on them
 self-fulfilling prophecy

common
 enough
 in
 applied

Memorandum for: Dean WF Partridge
From: C. T. Whitehead

Comments on the SSM program

You have asked for a view of the ^{SSM} program as a whole, and what I have to offer, ~~is~~ is a series of comments, ~~as~~ ^{which} ~~are~~ ~~opposed~~ ~~to~~ ~~a~~ ~~balanced~~ ~~appraisal~~. I shall try to be reasonably balanced, ~~and~~ I certainly do not offer about to pretend to be rigorous ~~appraisals~~ ^{this as a particularly appraising}.

My comments fall into ~~three~~ ^{four} general areas: admissions, ~~the Ph.D. program~~, the S.M. program, and the alumni.

~~It seems as though the admissions process I refer to the Master's program~~

My comments fall into ~~three~~ ^{four} general areas: admissions, the Ph.D. program, the S.M. program, and the alumni.

Admissions:

~~It seems as though the admissions process is not adequately related to the goals of the school. Certainly questions of about suitability of applicants & their relation about the curriculum cannot be divorced from admissions should for the most part~~

inquiry, process, ~~collect~~ ~~high order~~

Glenn Scholars
Internships or clerkships
IMR prerogatives

Students

Curriculum - goals v. part

subject
method
PhD. v. SM.

Alumni

Comments v. balanced appraisal - he is balanced, but not particularly rigorous.

1. Quest of goals, curricula, & method of teaching are really from admissions policy - criteria, their common (ways)
2. PhD ^{more} diff from SM than on surf: attitude, type of courses, ident w faculty; compare w/ eng depts; ~~diff~~
3. The SM program goals: ~~type of product?~~ a service? research into what?
The product < ^{subject goals} process goals
4. The philos: prob solving, breadth, role of principles { ^{decision} analysis
5. The substantive courses: reqd? how much substance?
6. The effect: poor integration, ~~techniques~~ the 2 frameworks not separ
7. The product: what is he, what can he do?
Could we
major ideas of SM effectiveness
" source of info for improvement of progr.

Admission:

The type of student attracted ~~to~~ & admitted to SSM is a major ~~determinant~~ influence on the character of the school & the curriculum of the school. ~~Admission policy is inseparable from~~ ~~questions intimately~~ ~~concern~~ Admission policy ^{can} either constrain or help further the goals of the school - implicitly if not explicitly. It strikes me that an uncertain The prospective student forms his ~~impression~~ forms his impression of the school from the brochure & the catalog & from the ~~app data requested on the application~~ ~~prerequisites~~ ~~from~~ ~~through~~ the application, ^{and} from ~~admission~~ ~~miscellaneous~~ ~~reports~~ ~~sources~~.

techniques

teachable

traps

basis for intuition

grading: understanding of

6.43 analogy: ^{what} what size building blocks?

applied math? - OR centers - tactics

generalities & strategy - HBS

Where SSM?

The "answer" from the techniques

what do you do when you have it?

How do you use it?

Sophistication - fitting problem to techniques
o.v.v. asking right questions

Solved cases: SSM visiting committee
Govt esp DOD

H&M²K; readings; term proj; exams

Need for more concrete framework than 712.

①

2/7 Intro; mechanics; goals; Handout read list, bibliog, etc
2/9 Read: Anthony & PPB general in Norwich (2) "Conceptual Framework for the Program Budget"
Discussion → (2) Planning & Control Systems Prog and
Handout PO categories case

②

2/14 Read: Simon, The New Science of Mgt Decn.
Discuss

2/16³:

PO categories presentation
Discussion var readings A & B
Handout Pretty Roads case

③

2/21 Read H & M (1) & (3)
Discuss; refer back to PO cat as links obj & resources
~~Handout Pretty Roads case~~

2/23⁵

Read H & M (7)
~~Discuss~~ Pretty Roads presentation
Discuss var readings A & F

④

2/28⁶

Read Enthoven: OR at Natl/Pol Level
Discuss
Short paper due: what analytic results would help decision in pretty roads case?

3/2 : Read basing summary
Discuss var Enthoven paper
Design paper on basing study

(5) 3/7 : Read H&M (9)
~~Short paper on how would improve basing study structure~~
Discuss

3/9 : Paper on basing study var Enthoven paper
Discuss

(6) Handout ABC case

3/14 : Read H&M (10)
Discuss

3/16 : Read Schelling excerpts
ABC presentations

(7) 3/21 : Read H&M (11) + Fortune on future (1/67)
~~Trade or costs~~
Discuss var ABC
Handout Newton Snow case

3/23 : Read de Jauvernat ~~de~~ & Marshall on effort opim
Discuss var ABC, Apollo
Prelim Newton Snow report

③
4/4 14 Newton Snow ^{analysis} presentation
discuss vav readings

4/6 15 Read Sorenson; ^{chap.} discuss vav Newton Snow choice
~~Lecture on objectives, alternatives,~~
Newton Snow choice due
Handout Imperial Oil case

⑨
4/11 16 ~~Imperial Oil structure due~~
~~Read Sorenson discuss~~
~~lecture on~~
~~discuss vav New Rep~~
Read C&M (3) & (6) + Lindblom "Muddling through"
Discuss

4/13 17 ~~Essay Imperial oil structure due~~
Discuss

⑩
4/18 18 ~~Imperial Oil reports due~~ Imp Oil models due
~~Integration, discussion~~
Read in Shelly & Bryan chap (10)

4/20 19 Imperial Oil sub-Reports due
~~Preparation for presentation~~
Integration

(11) 4/25 ~~Read Wildavsky excerpts JJ~~
~~Read Shelly & Bryson chap (1)~~

(11) 4/25²⁰ Imperial Oil Report due
Preparation for presentation

4/27²¹ Rehash of Imperial Oil var readings etc.

(12) 5/2²² Read Taylor in Handbook on Origin
Discuss var Simon & real world exposure in context
Abundant

5/4²³ Read Graybrooke & Lindblom chap (3) & (5)
Discuss var Taylor.

(13) 5/9²⁴ Read Schmeinger
Discuss var past cases & readings

5/11²⁵ Lecture on uses & limits of analysis
Discussion

(14) 5/16²⁶ Read Berde or (?) on corpora in society
Discuss var goals & objectives & implic for anal

5/18²⁷ ~~then~~ Open

(15) 5/23²⁸ Paper due
Rehash - substance & pedagogy

Readings

BA ~~EF~~
EFDG

- A. Simon : New Science 40pp
- B. Novick : PPB structure 17 pp + Anthony
- C. Taylor : Decn making & prob-solving 34 pp
- D. Enthoven : OR at Nat Pol Level
- E. H & M : (1) Def as econ prob & (3) Resource limits 27 pp.
- F. ^{H & M (??)} Effic in mil dec ~~or~~ 28 pp.
- G. H & M : an illustr example @ basing study 25 pp.
- H. H & M : ⁽⁹⁾ The criterion prob 26 pp.
- I. H & M : (10) Income, uncest, energy 22 pp.
- J. H & M : (11) Prob assoc w/ time 13 pp.
Q made: costing
- K. Fisher or other in PPB ~~substituting~~
- L. Sorenson : Outer limits of decn
- M. { C & M : ↑ (6) Summary of basic ideas 12 pp
~~C & M~~ : ↓ (3) Goal formation 17 pp
- ~~P.~~ Lindblom : Muddling through
- O. Braybrooke & Lindblom : (w C)
- P. ~~Sykes~~ : orgnt structures & dec making
- Q. de Jowenal; Marshall on uses of expert opin
- R. Berle : the corpor.

BA ; EFDG ; HIJ Kq; L M; C O P; ~~R~~ R

1 ~~hand~~ hand out read list & bibling
to gen pol stat on papers

2 A, disc *

3 B, disc

4 ~~hand~~ V

5 E

6 F S

7 D S

8 Go basing + page *

9 ~~H~~ H

10 ~~H~~ H

11 I

12 Scheduling M

13 J

14 Q

15 (K)

16 ~~lect~~ lect on dig Y

17 ~~A~~ (A)

18 ~~L~~ L

19 ~~M~~ M *

20 ~~D~~ (written)

21 ~~present~~ present

22 ~~rehash~~ rehash

23 C } *

24 O } *

25 P ~~hand~~ ↓ *

26 ~~hand~~ ~~hand~~

27 R uses lecture S

28 R

29 rehash & paper due

	PO categories	2
	Pretty roads	2
airport congest →	ABC	1 2
	Newton Snow	# 3+
	Imperial	(6-)
	Stop & Shop	3+

~~PO Holiday~~
Airport congest

My Years at GM O.P. Sloan

- (10) Policy Creation p. 169 (22 pp)
- (23) The Mgt: How it works (7 pp)
- (24) Change & Progress (9 pp)

Spring 1965

READING LIST

15.792

- 2-18-65 Simon, Administrative Behavior, Second Edition.
Read through p. 109 including Introduction.
- Industrial Management Review
Read Theory and Method in the Exploration of Human Decision
Behavior by Clarkson and Pounds, pp. 17-28.
- Simon, The New Science of Management Decision.
- 2-26-65 Taylor, Scientific Management
Read The Principles of Scientific Management.
- Simon, Administrative Behavior
Read pp. 172-192.
- 3-5-65 Churchman, et. al., Introduction to Operations Research
Read pp. 3-135.
- Arnoff, et. al., An Integrated Process Control System at the
Cummins Engine Company (Handout).
- 3-12-65 Forrester, Industrial Dynamics
Read pp. 1-133.
- Delavara, et. al., Waters Manufacturing (Handout).
- 3-19-65 Schlaifer, Introduction to Statistics for Business Decisions
Read Chapters 1, 2, and 4.
- Luce and Raiffa, Games and Decisions
Read Chapters 1, 2, 3, and 13.
- 3-26-65 Cyert and March, A Behavioral Theory of the Firm
Read Chapters 1, 2, and 5.

- 4-9-65 Bowman, Consistency and Optimality in Managerial Decision Making.
(Handout)
- Fox and Kriebel, A Study of a Production Scheduling Decision.
(Handout)
- 4-16-65 Mansfield and Wein, A Study of Decision-Making Within the Firm.
(Handout)
- Cyert and March, A Behavioral Theory of the Firm.
Read Chapter 7.
- 4-23-65 Dutton, Production Scheduling - A Behavioral Model.
(Handout)
- William-Powlett, The Pricing Decision of an Automobile Agency.
(Handout)
- 4-30-65 Cyert and March, The Behavioral Theory of the Firm
Read Chapter 4.
- Muth and Thompson, Industrial Scheduling.
Read Chapter 1, The Scheduling Environment.
- 5-7-65 To be assigned.
- 5-14-65 To be assigned.
- 5-21-65 To be assigned.

Cases for 15.95 X

- x Nuthatch Forest
- β P.O. Holiday
- γ Newton Snow Removal
- δ Pretty Roads
- ~~Media Selection~~
- ε P.O. Automation
- ζ Airport congestion in DC
- η Nike X
- θ NY Times
- ι Oil Tanker Procurement
- κ Comsat on ABC
- λ PO categories
- Ξ Stop & Shop stamps

structure ***
model **
goals ***
choose x

14 + weeks \Rightarrow 29 max
26 min

staged case (x4)

16

Nuthatch; Newton Snow; Oil Tankers;

case : WDC airport congest.

3

Comcast ETV

Nike X-45

PO categories

HW : bearing of stat mobil studies
Education study

2-5

short paper

5

Structure & unstructure ; IDC or DAEC ;

Objectives, goals, programs, ... ; values ; alternatives ;
problems & solutions ;

Criteria ; costs ; incommens ; uncert ;

Orgnl factors & influences

Resource allocation

Mgr as decider

Uses of Anal

Limits of Anal

Periphera : control, info syst, opnl opt,

C & M : Chap 5 Orgul choice (30 pp.)
Chap 6 Summary of Basic Concepts (12 pp.)
Chap 3 Goal formation (17 pp.)

Quade : ~~#~~ Chap 7: Anal & Design of Conflict Systems (46 pp.)
Chap 300: Pitfalls (17 pp.)

Bud for Natl Objectives
Defn of terms } 17 pp.

H & M : 1. Def on an Econ Problem 6 pp.
3. Resource limitations 21 pp.
7. Efficiency in mil decns 28 pp.
8. An Illustrative Example 25 pp.
9. The Criterion problem 26 pp.
10. Incomon, Uncert, & the Enemy 22 pp.
11. Problems are w/ time 13 pp.
12. Mil R & D 22 pp.

Handbook on Orgns

Decn Mng & Prob Solving

34 pp.

Orgnl Dec Mng

30 pp.

Simon : The Shape of Auto.

The New Science

40 pp.

Novick : Program Budgeting

Schlesinger : Orgnl Structures & Planning

Berle on corps.

Enthoven : OR at the Natl Pol Level

Sorenson : Dec Mng in the WH
Outer limits of Decn.

search
with theory.

PPB in Novick

Simon: New Sci
Taylor in March + plans of meta plane

Lecture on objectives, values, ...

H & M: resources & econ & effie.

Criteria & costs.

Incom & uncert & strategy

~~Wahlster in Q mode~~

Fischer in Novick

Enthoven

C & M: goal formation
orgnl choice

plans & meta plans

summary of concepts

Schlesinger: orgnl structures

Sorenson: outer limits in Dec Mfg in WH

Lecture on Berle, et al, on the corpor.

Lecture on uses & limitations; "orgnl" v "efficient."

Lecture on anal in PPB as info syst

Wildavsky excerpts? or in lectures

Expert opinion

17-18 ~~assignments~~ "topics"

13-14 reading assignments

26 - 29 classes

14 - 13 reading ass.

12 - 16 HW assignments.

Schilling

Hitch & McKeon

Wildavsky

March & Simon

Conflict?

Limits on rationality ←

Handbook on Orgns

Taylor: Decn Mkg & Prob Solving 34 pp.

Feldman & Kanter: Orgnl Dec Mkg 30 pp. ?

THE ARLA CHEMICALS COMPANY¹

"If you want to know what our major problems are in 1962, I would say that they all involve some aspect of product planning," commented Mr. Schetty, Commercial Director of The Arla Chemicals Company. "Our business is being squeezed on three sides. For one thing, we are in danger of losing our primary raw material, baurite. Secondly, the market conditions for our most important by-products, the acid group, have been changing, but we are severely hindered by external forces from adapting to this change. Finally, with respect to our other important by-product, ferannal, our customers for this material have been introducing a new process in which no ferannal is required."

Mr. Rybert, President of Arla, commented, "These problems with our suppliers and markets have to be solved. The quickening pace of Europe's economic integration makes the situation more urgent because we expect our competition to increase considerably. I might add that the Company must also consider the possibility of diversifying into new fields of the chemical business."

THE COMPANY

The Arla Chemicals Company was a middle-sized chemical firm producing a number of basic inorganic chemicals,² all-

¹The names of the company, its executives, its raw materials, and some of its products have been disguised.

²Chemical products are often subdivided into two broad categories, organic and inorganic. The inclusion of some hydrocarbon in the molecular structure of a chemical product qualifies it as organic. Most of the organic chemicals are derived from petroleum, coal, or natural gas sources. The better-known basic industrial chemicals, such as soda ash, calcium carbide, ammonia, caustic soda, hydrochloric acid, and sulphuric acid, are inorganic chemicals.

of which were long-established items in industry. The firm had grown with the industry and enjoyed the reputation of being a reliable producer of quality chemicals. Arla was located in one of the European Common Market (ECM) countries and was near the borders of two other ECM nations.

Established shortly after the turn of the century, the Company had sales of 76 million Swiss francs in 1960, employed almost 1,300 persons, and had no significant financial obligations outstanding. Exhibits 1 and 2 show financial data for selected years.

Arla's management had traditionally been proud of the firm's technical competence, and they considered their technical staff to be among the foremost in their sector of the chemical industry. The firm's strength was largely due to low-cost and efficient production processes, which allowed it to sell high-quality chemicals at competitive prices.

Arla also sold their patented processes and equipment through a wholly owned subsidiary. This small engineering company often designed complete plants based on Arla operations. Where it did so, this subsidiary would normally assign its own engineers to supervise the construction of the plant, to start the system in operation, to train the customer's personnel, and to assure successful operation of the plant. By 1962, plants and equipment had been sold in most parts of the world.

ARLA'S PRODUCTS AND MARKETS

Arla's principal product was feran. The Company used the most common process of making feran, in which two valuable by-products, a sulphurous material and ferannal, were also produced. These by-products had to be profitably sold for the successful operation of the overall business.

Originally, Arla simply made sulphuric acid from the sulphurous material and sold it and all of the unprocessed ferannal to industrial customers. Over the years, however, as the production of feran increased, the Company began to introduce new derivative products in order to market the consequently increasing volume of by-products.

All of the Company's major products were grouped into three categories: feran; the acid group, which was originally developed to dispose of the sulphurous content of the baurite; and the ferannal group. Of total 1960 sales, feran accounted for about 66 percent, the acid group of products for about 24 percent, and the ferannal group of products for about 10 percent. Exhibit 3 shows the product and product group sales for 1960 and also shows the product sales volumes for selected years. Exhibit 4 displays the product and process relationships in 1962.

Feran

Company operations centered about the production of feran. (The process is shown by a double line in Exhibit 4.) All of Arla's other products were originally manufactured in order to sell profitably the by-products, which were produced in a fixed relationship to the production of feran.

Feran was a basic inorganic chemical, about half of which was used by the paint industry and the rest by a wide range of other industries. Most of Arla's feran sales were made within the ECM. Because of the industrial applications for this product, the market for feran was strongly affected by the swings of industrial activity, particularly by those of the paint industry.

Certain of Arla's executives expressed the opinion that the feran industry had not been aggressive enough over the years and had consequently lost ground to other products. They felt that more industry research should have been carried out to improve the product, so that it could be better used in current applications and also introduced for new applications. They stated that, while world sales of feran had increased slightly in absolute terms, feran's share of the total market in which it competed was actually decreasing.

The Acid Group

Until 1937, Arla had disposed of all its by-product sulphurous material simply by producing and selling sulphuric acid. The introduction of the fertilizer products at this time was made largely because of adverse conditions in the sulphuric acid market. Since sulphuric

acid had always been difficult to store or transport, other producers had had repeatedly to dump their output in the local market¹ as supply temporarily exceeded demand. Consequently, the price for sulphuric acid traditionally had fluctuated very much. Furthermore, as the world demand for feran increased substantially in the second half of the 1930's, Arla increased its production of feran and found itself faced with greater supply of sulphurous material than ever before. At the same time, the general supply of sulphuric acid had outgrown the demand within the marketable area. Under these circumstances, Arla began to process the sulphuric acid into simple superphosphate fertilizer, phosphoric acid, and triple-superphosphate fertilizer. These new products permitted Arla profitably to dispose of its sulphuric acid excess in new markets and also alleviated the problem of storage. Up to 1962, Arla had been the only feran manufacturer in its geographical area that processed sulphuric acid into derivative products-- in this case, fertilizers.

After World War II, the local pattern of industrial chemical requirements changed, and the demand for sulphuric acid greatly increased until it far exceeded the supply available from feran by-products in the area. Consequently, by 1962 Arla was producing one-third of its sulphuric acid production from free sulphur to meet these needs.

Although the acid group consisted of ten products by 1960, only four of these were sold in any substantial amounts. Of these, sulphuric acid and triple-superphosphate fertilizer accounted for 80 percent of the acid group sales. Simple superphosphate and complex fertilizers represented another 12 percent, while the other six products accounted for the remaining 8 percent. Phosphoric acid, one of these six products, actually was produced in great quantities, but it was primarily used as an internal intermediate product, because no significant demand existed for it outside the Company.

The markets for these products were diverse. The sulphuric acid was sold direct to industrial users within the 100- to 150-kilometer radius mentioned in the footnote below. The fertilizers were sold to farm supply distributors.

¹Transportation costs limit the sulphuric acid market to a radius of about 100 to 150 kilometers from the producer.

Transportation costs limited this market to a radius of 150 kilometers.¹ The other products were normally sold through agents in Europe.

The Ferannal Group

The one constantly strong market for ferannal was the food processing industry, where it was used in the production of a certain expensive food additive. Arla had been selling its ferannal to a number of intermediate product manufacturers who produced additives for the food processing industry. No one customer purchased more than 20 percent of Arla's normal ferannal production.

Starting in 1949, Arla began producing the additive itself and selling it through distributors to food processors. By 1962, the value of the additive sales was about 2.5 times that of ferannal sales.

THE PROBLEMS OF BAURITE SUPPLY

Since 1955, Arla had encountered growing difficulty in obtaining its requirements of baurite at what Company executives considered a reasonable price. As a result, Arla had suffered a baurite cost disadvantage vis-à-vis their competitors, while the baurite market had remained a seller's market. An even more serious problem was that world political moves were threatening further to reduce the free supply of baurite. Arla's management was seriously worried about the long-range possibility that free supplies would become permanently reduced, especially since Arla was the only feran manufacturer in their local area wholly dependent on this supply.

Arla's founders located the firm so as to take advantage of nearby baurite deposits. These sources became uneconomical to work shortly before the First World War, and subsequently, the Company had to import all of its baurite from outside sources at the world commodity price.

¹The 150 kilometers refers to overland transportation. In Arla's case, a seaport lay within this distance, which permitted bulk distribution of fertilizer overseas. Sulphuric acid, on the other hand, was not commonly transported overseas because of the difficulty and expense of handling and storing this chemical on board ocean vessels.

Arla typically purchased baurite from a number of suppliers in normal shipment amounts. The price for baurite was determined on the commodity exchange market in Paris.

Two unusual conditions caused the baurite world commodity market to be very volatile. First, the United States' tariffs effectively segregated this large supply and demand sector from the world market. Second, many of the large baurite users outside the United States owned or controlled their own sources; these users came in and out of the baurite market only to meet fluctuations in their requirements. By purchasing baurite when the demand for feran was high¹ and dumping baurite when the overall demand for feran was low, these firms applied an adverse pressure to the baurite market, which caused wide fluctuations in the price.

Arla was subject to the full swing of these prices for their complete supply of baurite. On the other hand, its large competitors, who met most of their requirements from their own sources, were subject to these swings only for their marginal needs. Up to 1962, Arla had been able to offset its baurite cost disadvantage by means of production savings and the profitable sale of its feran by-products.

Arla's management was worried, however, that the recent advantageous position of the baurite sellers in the free market was becoming a permanent condition. If this were so, Arla would find itself at an even greater disadvantage than in the past, since there would no longer be those periods of excess baurite supplies during which Arla could favorably negotiate purchase agreements. A factor which contributed to this pessimism was that a large percentage of the better baurite sources² were located in the under-developed and politically unstable areas of the world. There was pressure within most of these countries to appropriate the mining operations and to nationalize them. As Mr. Schetty explained: "If they (the inhabitants of these countries) ever seize the source facilities, they will not stop there. Then they will want to produce the chemicals themselves rather than sell the

¹The only major use for baurite was for the production of feran.

²Deposits of baurite exist in most parts of the world.

baurite on the world market, more as a matter of prestige than of good economics. What is even more worrisome is that they will damage or destroy the baurite facilities in their ignorance of these facilities' economic value to their nations. In either event, there will be less baurite in the free market."

Arla's top management had not yet attempted to study the economics of this problem. As one member said: "We have a number of major choices. We can continue our present method of purchasing baurite and take our chances. There will always be some baurite available at a price. Or we can invest in baurite facilities, either on our own or with others. However, this is a new business to us, and the source facilities can involve enormous investments. Then there is always the possibility of arranging long-term supply contracts, but it is going to be expensive to interest the suppliers at this time because of the present seller's market. And, of course, with the political situation as it is, we are not certain that we can rely on the performance of such a contract in the future. First, we shall have to select a course of action. Then, if we select any joint ventures, we must also decide what kind of partner we want."

THE PROBLEMS OF THE ACID GROUP

Changing requirements in the fertilizer market had confronted Arla with two major problems. First, there was a technical problem in that the Company's fertilizers no longer met the new specifications. Then, there was the business problem of obtaining suppliers for any new raw materials which would be needed. The success or failure with which these problems were met would clearly affect the whole product balance within this group.

Traditionally, farm supply distributors had purchased the necessary ingredients for compound fertilizers and mechanically mixed these for the farmer according to his required proportions. One of the most common inorganic compound fertilizers contained potash, superphosphate, ammonia sulphate, and ammonia nitrate. This mixture was referred to as a "three-element" fertilizer, since the latter two chemicals served to provide nitrogen in the two different forms required by plants. In the late 1950's, farmers began increasingly to favor a chemically integrated

single-pellet fertilizer because of its technical advantage over the former multi-pellet mixture.

To meet this new demand pattern, Arla had devised a chemical process to combine phosphoric acid, ammonia nitrate, and ammonia sulphate into a complex fertilizer with two of the major components. The potash would then be mechanically mixed in and the final combination formed into individual pellets. The new complex fertilizer was expected fully to meet the new requirements of the market.

Having solved the technological problem of producing a competitive complex fertilizer, Arla then encountered the problem of obtaining the required ammonia nitrate supply. Both the phosphate- and the nitrogen-product manufacturers were competing for the new complex fertilizer market. The nitrate manufacturers, on the one hand, could either purchase or manufacture the needed phosphates without any trouble. On the other hand, Arla had encountered serious resistance in obtaining the necessary nitrates for a sufficient production of complex fertilizer, and it was unable by itself to manufacture the nitrates economically.

Mr. Schetty summarized the nitrate-purchase problem in these words: "We simply cannot buy the needed ammonia nitrate under reasonable conditions. The only price that they (the nitrogen-product manufacturers) will quote is designed to discourage us from competing with them in the complex fertilizer market. Their terms of sale, which positively exclude us from a large portion of our natural market, pose an even more serious problem. The nitrogen suppliers allege that agreements among the nitrogen-product manufacturers discourage the sale of nitrates to a customer if the resulting end products are to be exported to another West-European country. This means that if we want to produce a complex fertilizer containing their ammonia nitrate, we cannot market this fertilizer in our neighboring countries. These countries now purchase over 35 percent of our fertilizer production and could represent a much higher share in the future. If we should lose our overseas markets as a result of the establishment of fertilizer-producing plants in the under-developed countries, we would have to turn to our ECM market in order to offset these sales losses, since the home market within our distribution range is nearly saturated. Under the most severe export losses, we would have to expand our sales in neighboring countries by close to 50 percent of their current level in order to maintain overall sales."

In discussing the nitrate-manufacture problem, Mr. Schetty said: "Engineering studies have shown that the smallest economical plant would provide substantially more ammonia nitrate than we could use. And, of course, there is no market in which to sell the excess, since the nitrogen-product manufacturers fully control the nitrate market. Besides, the production of the nitrate is technically difficult, and we are not anxious to contend with these problems."

It appeared to the researcher that two reasons dominated the arguments in favor of actively pursuing the fertilizer market. First, the line of products had been profitable and promised to remain so. Second, Arla's executives were concerned about an expected deterioration of the general sulphuric acid market over the next ten years¹ and were anxious to maintain a marketing outlet which could absorb the firm's future excess sulphuric acid supply.

Concerning the course of action to be followed, Mr. Schetty stated: "We studied the possibility of fighting the unfair restriction imposed on us by the nitrogen-product manufacturers by requesting relief from our government or from the ECM authorities. Another possible solution would be to try to form a joint operation to manufacture the complex fertilizer with one of the small nitrogen-product manufacturers in this area who is not prepared to enter the complex fertilizer market by himself. Although this type of firm might be a party to any existing agreements, we do have one point of bargaining leverage; namely, that the ECM authorities will probably disallow such agreements on the grounds that they violate the covenants of the Treaty of Rome. The small nitrogen-product firm knows that the eventual breakdown of the industrial agreements will leave him much less protected than ever before, and we are offering him a long-term relation in a profitable business."

THE PROBLEMS OF THE FERANNAL GROUP

The well established food additive market for ferannal became unsettled in the late 1950's when a new process was

¹In the past, the manufacture of ammonia sulphate required a large quantity of sulphuric acid. Mr. Schetty estimated that the need would lessen because of technological developments.

discovered which permitted the production of the same additive more cheaply without the use of ferannal. Two factors worked against Arla's defensive move of increasing its own production of the food additive: a raw material problem and a market saturation problem.

While Arla could recycle ferannal in its main process so as to obtain feran, a much greater marginal profit could be realized by using the ferannal itself to produce the food additive. As for the firm's competitive position, management determined that Arla could produce the additive at the same cost or even at a slightly lower total cost than the manufacturers using the new process. This was possible because Arla would not have to pay for the costly transportation of ferannal.

In order to produce the food additive, Arla required another raw chemical, with the trade name Huzon, which was available from only one manufacturer. Despite a concerted effort to arrange for the favorable supply of Huzon on a long-term basis, the supplier continued to demand a price which Arla executives considered about 30 percent too high.

In the face of this unacceptable situation, Arla's management investigated the possibility of producing its own Huzon. It was determined that the smallest economic plant would produce about twice the Huzon needed to process the ferannal resulting from Arla's feran production. In the process of making Huzon, a by-product chemical was also produced. According to Mr. Schetty, no market existed for either Huzon or its by-product in the local region because of the tight control held by the aforementioned manufacturer. There was a possibility of selling these chemicals to distant manufacturers, but even there the competition would be very severe. Mr. Schetty finally commented: "If we could find one or two customers who would purchase 80 percent of our Huzon by-product on a long-range basis, we would go ahead with the plant."

Should Arla solve the Huzon supply problem, a number of officers pointed out, there still remained the problem that the additive market was already tight. In view of the substantial additional facilities Arla would introduce, the industry's production capacity for food additive would far exceed the normal demand.

THE PROBLEMS OF DIVERSIFICATION

A number of the less senior members of top management felt strongly that Arla had to consider diversifying into new areas of the chemical industry in face of the long-term trends. During the course of the field study, however, the researcher noted in this group traces of an opinion that the top executives would be very reluctant to allow Arla to enter fields with which they were not technically acquainted.

Many arguments were advanced in favor of diversification. Diversification was said to be indispensable in order to:

1. Reduce the dangers of an increasing difficulty in obtaining baurite.
2. Compensate for the cyclical behavior of the feran market.
3. Anticipate the long-term threat of a vanishing market for feran, especially in light of the possible entry of new manufacturers at the sources.
4. Move into areas with greater growth prospects than the inorganic chemicals area in which Arla had been active.

Organic chemical products, especially the more elaborate organic fertilizers, were of most interest to the Arla management. It was recognized, however, that the Company's executives did not have the breadth of technical and business knowledge to ensure, by themselves, the success of diversification into this area. Consideration was, therefore, given to the relative advantages of (1) hiring qualified people to start new operations, (2) setting up a joint operation with a company in the organic chemical field, or (3) merging with such a company.

Discussing the steps taken to diversify, a plant manager remarked that inquiries about opportunities were being made by the Company's officers through their personal and professional acquaintances, and that the Company was doing some new product research. Mr. Parmi, who was in charge of research, mentioned: "New product research is largely confined to areas related to our present products.

Neither I nor my staff are properly qualified to investigate fully the possibilities in organic chemicals." Another executive added that some general exploration into possible joint ventures was being done also by the engineering subsidiary.

If Arla should decide to diversify by means of partnership or merger, it could offer a prospective participant a large plot of excellently located property on which the new operations could be constructed. It could also offer any potential non-European partner its general know-how of operating in Europe. It could not, however, offer a ready marketing organization for the new products. First, because Arla's marketing experience was restricted to a narrow line of inorganic chemicals. Second, because management recognized that it had, to some extent, neglected marketing over the years, and that this area would require further development before it could be considered an asset in negotiation.

In recognition of the difficult marketing problems that diversification would entail, one executive remarked: "We must be prepared to merge with or, preferably, to absorb another company which will provide us with an entrée into new fields. Our engineering company has gained us world-wide renown in our industry. We should capitalize on that renown. Any possible merger must take into account the possible extension of our commercial organization in such a way as to replace our now dominant technical orientation with a marketing outlook."

Mr. Klare, Executive Vice President, summed up his thoughts on the subject with this comment: "Any expansion should be based on our technical strengths, which center about certain inorganic chemical processes. The organic chemical industry, about which we know relatively little, technically or otherwise, is rapidly growing, and changes take place quickly. This means that you have to be very careful in selecting an area to enter, because by the time you build the plant and start producing, the technologies involved can change so that you no longer have a market."

Exhibit 1

THE ARLA CHEMICALS COMPANY

Balance Sheet Before Distribution of Profits, 1958-1960
(In Thousands of Swiss Francs)

	<u>1958</u>	<u>1959</u>	<u>1960</u>
Current Assets			
Cash	3,032	4,153	3,317
Notes Receivable	1,593	1,933	2,063
Accounts Receivable	3,441	7,852	3,313
Govt. Securities	4,220	615	2,521
Investments	7,176	7,117	7,037
Inventory	<u>12,037</u>	<u>10,809</u>	<u>11,626</u>
Total	31,499	32,484	34,877
Fixed Assets			
Equipment and Buildings	44,646	46,107	51,992
Reserve for Depreciation	<u>36,325</u>	<u>39,206</u>	<u>41,652</u>
Net Equipment and Buildings	3,321	6,901	10,340
Land	260	235	235
Patents and Good Will	---	---	---
Total	<u>3,531</u>	<u>7,136</u>	<u>10,575</u>
TOTAL DEBITS	<u>40,080</u>	<u>39,620</u>	<u>45,452</u>
Current Liabilities			
Accounts Payable	7,824	7,543	9,008
Provision for Taxes	2,363	1,976	2,766
Matured Coupons	57	63	42
Total	10,244	9,587	11,816
Fixed Liabilities			
Debenture	164	32	---
Total	164	32	---
Capital Reserves and Profits for Distribution			
Common Stock	17,000	17,000	17,000
Legal Reserve	1,700	1,700	1,700
Capital Surplus	300	300	300
Equipment Replacement Reserve	4,100	4,100	6,200
Reserve for Inventory Valuation	1,000	1,000	1,000
Employee Welfare Reserve	3,150	3,430	4,560
Profits for Distribution	<u>2,422</u>	<u>2,421</u>	<u>2,876</u>
Total	<u>29,672</u>	<u>29,951</u>	<u>33,636</u>
TOTAL CREDITS	<u>40,080</u>	<u>39,620</u>	<u>45,452</u>

Source: Company records.

Exhibit 2

THE ARLA CHEMICALS COMPANY

Profit and Loss Statement and Distribution of Profits Statement
1953 - 1960
(In Thousands of Swiss Francs)

	1953	1959	1960
<u>PROFIT AND LOSS STATEMENT</u>			
<u>CREDIT</u>			
Operating Income less Operating Expenses	2,594	2,434	4,342
Financial Revenues from Investments and Accounts Receivable	827	1,020	1,133
Carryover from Preceding Year	1	2	1
Total	<u>3,422</u>	<u>3,456</u>	<u>5,476</u>
<u>DEBIT</u>			
Provision for Corporate Taxes	750	750	1,600
Charitable Funds and Grants	250	235	1,000
Profits for Current Distribution	<u>2,422</u>	<u>2,421</u>	<u>2,876</u>
Total	<u>3,422</u>	<u>3,456</u>	<u>5,476</u>
<u>DISTRIBUTION OF PROFITS STATEMENT</u>			
Taxes Withheld on Dividends	750	750	900
Statutory Share (Directors' Compensation)	170	170	200
Cash Dividends Paid to Stockholders	1,500	1,500	1,750
Carried Over to Following Year	2	1	26
Total	<u>2,422</u>	<u>2,421</u>	<u>2,876</u>

¹Arla carried accounts receivable for their customers at the bank rates of interest for comparable loans.

Source: Company records.

Exhibit 3

THE ARLA CHEMICALS COMPANY

Production and Sales, Selected Years, 1926 - 1960

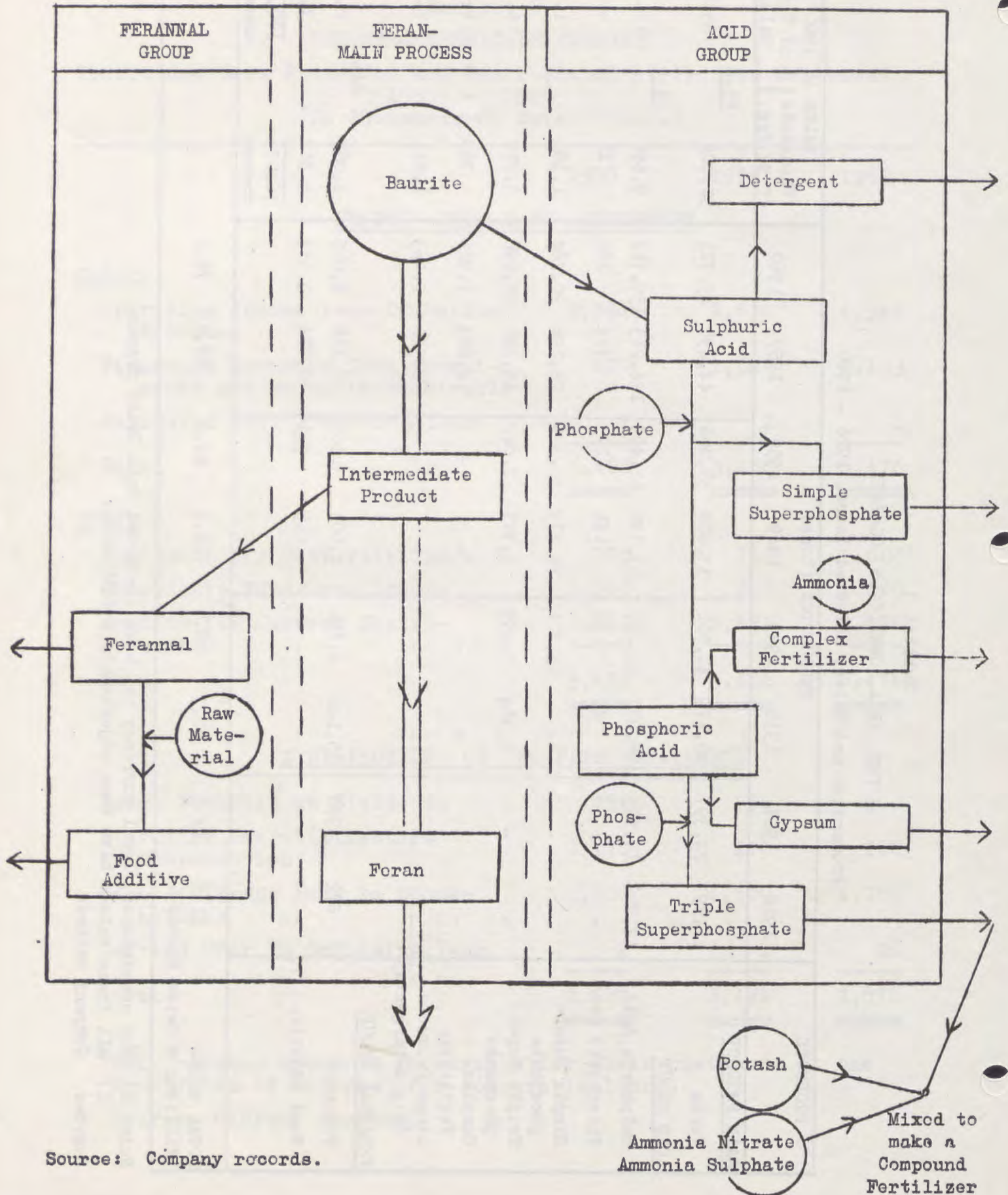
PRODUCTS	PRODUCTION (Tons)							SALES IN 1960			
	1926	1927	1938	1939	1949	1950	1959	1960	Thousands cf Sw.Frs.	% of Total Sales	
<u>MAIN PRODUCT</u>											
Feran	21,593	24,397	43,179	40,501	33,408	35,006	44,498	45,722	50,008	<u>65.8</u>	65.8
<u>ACID GROUP</u>											
Sulphuric Acid	17,702	17,575	58,007	55,076	57,030	51,489	126,213	159,712	9,691	<u>24.5</u>	12.7
Phosphoric Acid	-	-	45	56	191	175	724	299	21		-
Simple Super-phosphate	-	-	-	13,701	76,279	32,326	26,198	20,284	1,380		1.8
Triple Super-phosphate	-	-	6,384	3,699	3,307	2,822	15,310	26,098	5,224		6.9
Complex Fertilizer	-	-	-	-	-	-	2,083	1,922	769		1.0
Other Products (e.g.detergents)	-	-	-	-	-	-	2,526	2,263	1,611		2.1
<u>FERANAL GROUP</u>											
Ferannal	672	700	5,142	4,891	4,001	3,460	5,158	6,025	2,002	<u>9.7</u>	2.6
Food Additive	-	-	-	-	19	339	2,774	3,953	5,367		7.1
TOTAL SALES (Millions of Swiss Francs)	21.8	24.5	50.7	48.8	46.2	44.2	69.6	76.1	<u>76,073</u>	<u>9.7</u>	<u>100.0</u>

Note: 1) For convenience, local currency has been converted into Swiss francs.

2) All franc values have been adjusted to a 1960 base.

Source: Company records

Product and Process Relationships



Source: Company records.

MEMORANDUM

January 9, 1967

TO: Course 15 Graduate Students

FROM: Professor J. D. Nyhart

I would like to offer a course on Public Policy and the Manager this spring, rather than the usual spring offering of 15.661, the American Legal System, if there is sufficient interest. The proposed session by session outline is as shown below.

If you are interested, on a no commitment basis, please indicate by signing below. I will be glad to talk with anyone about the contents of this course.

Please sign and return to Mrs. Broome in 52-443.

I am interested in a course on Public Policy and the Manager.

PUBLIC POLICY AND THE MANAGER

J. D. Nyhart

Tuesday and Thursday 1 - 2:30

Tomorrow's managers will spend a large portion of their time dealing with the government -- selling goods and services to it; pursuing new business opportunities arising from its programs; joining with it in research and operating programs; being financed by it and regulated by it.

This course surveys the most important mechanics and processes of the government/business interface and analyzes the issues arising there from. In addition, the student is expected to apply his managerial skills in a research project on a selected problem in this area.

I. Sources of Federal Power

- Feb. 7 The Commerce Clause -- early history
- Feb. 9 The Commerce Clause -- today
- Feb. 14 Substantive due process and other constitutional attempts to limit federal power

II. Organization of the Federal Government

- Feb. 16 Traditional government organizations
- Feb. 21 New organizations to meet new needs: science and technology, joint public-private entities as examples
- Feb. 23 Organizing for urban renewal -- a case study. Outside speaker
- Feb. 28 Organizing for urban renewal -- further exploration

III. Federal Policy for Programs Involving Private Industry

- Mar. 2 Management of the program cycle: initiation, planning and development of federal programs
- Mar. 7 Management of the budget process
- Mar. 9 Evolution of new oceanology programs -- a case study. Outside Speaker
- Mar. 14 Business' participation in the formulation of new programs
- Mar. 16 Impact of changing Federal/State relationships
- Mar. 21 Improving program formulation and initiation

IV. Federal Regulation of the Business Community

- Mar. 23 The regulatory agencies and processes; other traditional governmental mechanisms for changing the social-economic environment
Apr. 4 Formal v. informal regulation; business' role in making regulatory policy
Apr. 6 Case study in regulatory area
Apr. 11 Improving the regulatory process

V. Operational Considerations in Doing Business with the Government

- Apr. 13 The contracting and procurement processes
Apr. 18 Federal contracting requirements in equal opportunity, use of managerial tools and other areas
Apr. 20 Identifying new areas of corporate opportunity
Apr. 25 Impact on corporate planning
Apr. 27 RCA -- a case study in ongoing government contracting. Outside speaker

VI. Student Research Presentation and Analysis

- May 2 Presentation of research problem analysis
4
9
16
May 11 Boeing -- a case study in corporate planning focussed on government programs
May 18 Summary of issues and/or examination.