STRATEGIES FOR STARTING
AN ELECTRONICS COMPANY:

THE

ENTREPRENEURIAL
ENGINEER

A TALK BY THOMAS M. WHITNEY
Apple Computer Inc.
February 9, 1980
STRATEGIES FOR STARTING AN ELECTRONICS COMPANY:
THE ENTREPRENEURIAL ENGINEER

I. INTRODUCTION
   A. Definition of an Entrepreneur
   B. Overview of Talk
   C. New Product Process
   D. Strategy Flowchart

II. DEFINE A NEED
   A. Importance of Experience
   B. Example Environments
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      2. Factory
      3. Education

III. UNDERSTAND THE CUSTOMER
   A. What is Value
   B. Who is not the Customer
   C. Capitalizing on the Success of Others

IV. APPLY TECHNOLOGY
   A. History: Looking for Characteristics of Failures and Successes
   B. Risk Evaluator
   C. What are the Important New Technologies
      1. VLSI
      2. Interfaces
      3. Machine Intelligence - Computing Power and Software

V. INNOVATE, ENGINEER, AND INTEGRATE
   A. Contribution - What is it?
   B. Focused Energy - Define Objective
   C. Prototypes - Demonstrate and Sell
   D. People
   E. Importance of Support - Financial and Technical

VI. PUTTING IT TOGETHER - Case Study of HP-35 Calculator

VII. SUMMARY: A Strategy for New Product Development

Thomas M. Whitney
February 9, 1980
WHAT CHARACTERIZES THE ENTREPRENEUR

• URGE TO "MAKE THINGS HAPPEN"
  — DESIRE TO BE OWN BOSS AND CONTROL
  — WILLINGNESS TO TAKE RISK

• DESIRE FOR EGO SATISFACTION
  — CHANGE THE WORLD
  — RECOGNITION AND FAME

• DESIRE FOR PERSONAL FORTUNE
  INDEPENDENCE TO MAKE THINGS HAPPEN

• LOVE OF THE PURE JOY OF WINNING
  COMPETITIVE
PIECES OF A NEW VENTURE

PRODUCT OR SERVICE

ADEQUATE FINANCES

MARKETING EXPERTISE

OPERATIONS

NEW VENTURE
MAIN THEME:

SUCCESSFUL NEW PRODUCTS ARE THE RESULT OF THE INNOVATIVE USE OF NEW TECHNOLOGIES TO SATISFY A NEED.
MOMMY, WHERE DO NEW PRODUCTS COME FROM?
NEW PRODUCT PROCESS

TECHNOLOGY 1

TECHNOLOGY 2

NEED

INNOVATION

ENGINEERING

PRODUCT
STRATEGY FLOWCHART

DEFINE A NEED

DEFINE A CUSTOMER

DETERMINE WHAT IS VALUE TO CUSTOMER

INVESTIGATE TECHNOLOGIES

INNOVATE

ENGINEER

INTEGRATE

DEMONSTRATE

START COMPANY
DEFINE A NEED

- UNDERSTAND THE ENVIRONMENT

- TAP YOUR PERSONAL FRUSTRATIONS

- MOST DEADLY KIND OF THINKING -
  "IF IT'S A GOOD IDEA, WHY
  HASN'T IBM (GM, EXXON, HP, ...)
  ALREADY DONE IT?"
DEFINE AND UNDERSTAND THE CUSTOMER

- WHAT IS VALUE TO THIS CUSTOMER?
- HOW WILL THE PRODUCT BE PURCHASED? (WHOSE MONEY, APPROVALS, ETC.)
- WHAT IS THE CUSTOMER'S HISTORY OF READILY ACCEPTING NEW PRODUCTS?
- WILL PRODUCT CHANGE FUNDAMENTAL WAYS OF OPERATING AND THINKING?
SOME ENVIRONMENTS WITH CRITICAL NEEDS

- THE OFFICE
- THE FACTORY
- EDUCATION
## Comparison of Office and Production Workers

<table>
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<tr>
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<th>Annual Productivity Increase</th>
<th>Labor Force</th>
<th>Capital Investment Per Person</th>
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<tbody>
<tr>
<td><strong>Office</strong></td>
<td>0.4%</td>
<td>45M</td>
<td>$2,300</td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td>0.6%</td>
<td>30M</td>
<td>$25,000</td>
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WHAT HAPPENS IN THE OFFICE?

DATA

OFFICE

INFORMATION

COMMUNICATING
COPYING
STORING
RETRIEVING
WHO IS THE CUSTOMER?

- CLERK - TYPIST - SECRETARY
- OFFICE SUPERVISOR
- MANAGERS AT ALL LEVELS
WHAT IS VALUE?

- TIME
- ACCURACY
- COST
- STORAGE SPACE
- AVAILABILITY OF INFORMATION
WHAT ARE THE APPLICABLE NEW TECHNOLOGIES?

- MAN-MACHINE INTERFACE
  SOFTWARE + COMPUTATIONAL POWER +
  LOW COST MEMORY

- ELECTRONIC MAIL - FACSIMILE

- SPEECH RECOGNITION AND GENERATION

- THE LOW-COST, LETTER QUALITY PRINTER
THE FACTORY

PROBLEM: U.S. PRODUCTIVITY IS NOT INCREASING

SOLUTION: INVEST IN MORE CAPITAL EQUIPMENT

YES, BUT WHAT CAPITAL EQUIPMENT?
NEEDS OF THE FACTORY

• REDUCTION OF JOB REPETITIVENESS
• IMPROVED QUALITY CONTROL
• BETTER TRAINING
• INCREASED SAFETY
• ENERGY REDUCTION
WHO IS THE CUSTOMER?

• THE DIRECT LABOR PERSON

WHAT IS THE VALUE?

• JOB INTEREST
• SAFETY
• PRODUCTIVITY
WHAT ARE THE APPLICABLE NEW TECHNOLOGIES?

- ROBOTICS
- VOICE CONTROL
- INTELLIGENT CAMERAS
- MICROCOMPUTERS - GRAPHIC DISPLAYS
  EDUCATION
  PROCESS MONITORING AND DISPLAY
NEEDS OF EDUCATION

• INDIVIDUAL INSTRUCTION

• CREATIVE AND "VISUAL" TEACHING AIDS

• REDUCTION OF ADMINISTRATIVE BURDENS

• TEACHER RE-EDUCATION
WHO IS THE EDUCATION CUSTOMER?

- TEACHER
- ADMINISTRATOR

WHAT IS VALUE?

- EDUCATIONAL EFFECTIVENESS
- SELF-MOTIVATED STUDENTS
- ADMINISTRATIVE PRODUCTIVITY
- ACCESS TO INFORMATION
APPLICABLE NEW TECHNOLOGIES

- ELECTRONIC (TEACHING) GAMES
- PERSONAL COMPUTERS
  - COLOR GRAPHICS
  - SOUND
  - RECORD KEEPING
  - TEACHER RE-EDUCATION
- COMPUTER NETWORKS

THE "LIBRARY OF CONGRESS" AT YOUR FINGERTIPS
APPLYING TECHNOLOGY

• CHARACTERISTICS OF SUCCESSES AND FAILURES

HISTORY OF TECHNOLOGY

PERSONAL EXPERIENCE

INSIGHT BASED ON AVAILABLE DATA

ASK THE "EXPERTS"
BUT USE OWN JUDGEMENT

• EVALUATE THE RISK

LOCAL RISK

GLOBAL RISK
RISK EVALUATION FOR COMPUTER SYSTEM

PRODUCT RISK =

TECHNOLOGY RISK * ARCHITECTURE RISK * SOFTWARE RISK * MARKET RISK
TECHNOLOGY RISK

- NEW PROCESS?
- NEW MATERIALS?
- NEW TESTING METHODS?
- NUMBER OF SUPPLIERS?
- EFFECT OF MARGINAL QUALITY?
- LONG TERM RELIABILITY - LIABILITY IMPACT
- CONTINUING RESEARCH - LONG TERM VIABILITY
- FALL BACK STRATEGY
ARCHITECTURE RISK

- AVAILABILITY OF COMPONENTS
- MARGIN OF ERROR IN PERFORMANCE ESTIMATES
- IMPACT ON SERVICE
- PERIPHERAL AVAILABILITY
SOFTWARE RISK

- DEGREE OF COMPATIBILITY
- INTEGRATION AND CHECK OUT TIME
- RELIABILITY
- DOCUMENTATION
- TRAINING
MARKET RISK

- ACCEPTABILITY OF "NEW" IDEA
- AVAILABILITY OF APPLICATION SOFTWARE
- COST OVER-RUNS
- DISTRIBUTION CHANNELS
MAKING THE PRODUCT HAPPEN

• ENGINEER
  NEED FOR "CONCEPTUAL INTEGRITY"
  NEED FOR EXPERIENCE WITH SIMILAR PRODUCTS
  SMALL GROUP
  PLAN FOR ENHANCEMENTS, GROWTH

• INTEGRATE
  ROLE OF ENTREPRENEUR
  FOCUS ON "THE CONTRIBUTION"

• DEMONSTRATE
  SIMULATE
  SEE IT IN THREE DIMENSIONS
  BE OPEN TO CHANGE
  BUILD PROTOTYPES

• REWARD THE PEOPLE
  PSYCHOLOGICAL
  FINANCIAL
  PROFESSIONAL
A CASE STUDY IN BIG COMPANY ENTREPRENEURIALISM:
THE HP-35 CALCULATOR

TIME: 1970

NEED: PORTABLE SCIENTIFIC COMPUTATION - A SLIDE RULE REPLACEMENT

CUSTOMER: 2 MILLION SCIENTISTS AND ENGINEERS (U.S. ONLY)

VALUE: SPEED OF COMPUTATION
ACCURACY
PORTABILITY
DEPENDABILITY
REASONABLE COST (PERSONAL PRODUCT)
HP-35

INNOVATION: A PERSONAL, PORTABLE, SCIENTIFIC 10-DIGIT CALCULATOR

TECHNOLOGY: LOW-THRESHOLD, LOW POWER P-MOS LSI (ION IMPLANTATION)
LIGHT EMITTING DIODE DISPLAY (CUSTOM BIPOLAR DRIVERS)
"OILCAN" KEYBOARD
DECIMAL SCIENTIFIC ALGORITHMS
HP-35 RISK EVALUATION

RISK = TECHNOLOGY * ARCHITECTURE * SOFTWARE * MARKET

TECHNOLOGY - HIGH
ARCHITECTURE - LOW
SOFTWARE - MEDIUM
MARKET - MEDIUM

=> MEDIUM OVERALL RISK, ESPECIALLY FOR A COMPANY SIZE OF H.P.
WHY WAS HP-35 SUCCESSFUL

• Filled a need

• Experienced developers
  - Been through 9100 desk-top calculator
  - Users themselves

• Independent development organization (Corporate Research Laboratories)

• Corporate commitment
  - Financial resources
  - Technical resources

• Clear, unswerving idea of product purpose
MARKET NEEDS - THE COMMON FACTORS

- PERSONALIZATION - EASY-TO-USE PRODUCTS
- COMMUNICATIONS - SYSTEMS VIEWPOINT
- LOW POWER, WEIGHT, SIZE
- RELIABILITY
THE BIG THREE TECHNOLOGIES THAT WILL FILL THESE MARKET NEEDS

1. VLSI
2. "INTERFACE" TECHNOLOGY
3. MACHINE INTELLIGENCE
REQUIREMENTS FOR THE ENTREPRENEUR:
THE PERSON

- HEALTH
  PHYSICAL
  EMOTIONAL

- COMPETENCE
  INFORMATION "GATHERER"
  ANALYTIC
  DECISION MAKER

- MOTIVATION, DEDICATION

- FIRST-HAND EXPERIENCE, KNOWLEDGE

- RESULTS ORIENTED - A "DOER"
NEW PRODUCT PROCESS

TECHNOLOGY 1

TECHNOLOGY 2

NEED

ENGINEERING

INNOVATION

PRODUCT