# Memory Management in Country and Corporate Survival Decisions:

## Memory Management Disequilibria Dimensions (MD²) Protocol

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### Abstract

Absent Chief Entrepreneur/Intrapreneur (**'Ntrepreneur**) Officer (**CNO**) Churchill's unwavering commitment of significant resources to the unproven radar (**Decision to Dare**) as early as the autumn of 1937, Great Britain would have not survived as a nation: No **country survival.** Absent Watson, Jr.'s unwavering determination to push IBM into computers, launching in 1951 the Defense Calculator, which at $3 million "was by far the most expensive project in IBM history," IBM would not have survived: No **corporate survival.**

From the [rather flimsy] briefing by Dr. R.V. Jones weaving fact and fancy, how did Churchill draw the firm conclusion that radar would be invented; and risk rewriting the entire plans for the air defense of Great Britain around radar?

How did Watson, Jr. dismiss the unanimous recommendation of IBM's 18 best systems experts that magnetic tape had no place at IBM; and launch the most expensive project at IBM to break into the unknown field of computers?

Based on **first-person narratives**, how could the single *input* of relatively flimsy data produce as the *output*, the certain realization of a futuristic technology? The most-cited work on the psychology of decision-making (Kahneman-Tversky) is seen to be inapplicable. Sigmund Freud's Self-Analysis offers a method of systematic introspection/retrospection.

We develop an established sequence of ordered procedures (Protocol) of memory management (**Memory Management Disequilibria Dimensions (MD²) Protocol**) which applies equally well to both the country and corporate survival decisions, and offers some suggestions to improve Memory Management for Decisions to Dare.

## 1. Introduction

In mid-1997 while surfing the Net in the early hours of the morning, I came across a news item. Bill Gates had just named Nathan Myhrvold as the first Chief Technology Officer (CTO) of Microsoft. I was surprised. Why would Gates who, since co-founding Microsoft in 1975 with Paul Allen, had been *de facto* CTO, need to appoint a *de jure* CTO?

Almost instantly, I found myself recalling a sentence on Page 45 of Volume 3 of Winston Churchill's 6-volume World War II Memoirs, saying that he had put all the eggs of air defense of Great Britain into the single basket of radar, then hardly more than a far distant Technological Gleam in the eye of the British Scientists. "The plans for the air defence of Great Britain had, as early as the autumn of 1937, been rewritten round the assumption that the promises made by our scientists for the still unproven radar would be kept."[1] "What if the promises were not kept?" I exclaimed to myself when reading the sentence over four decades earlier in 1955. How could Churchill who had declared: "I know nothing of science,"[2] make a significant commitment to an emerging hitech? He relied on his *de facto* CTO, who could explain to him "in lucid, homely terms, the distant signals from the experts on the far horizon" [of science and technology], Frederick Lindemann.

## 2. Creating a New Profession integrating a news item with a sentence read 42 years earlier

From a news item on the Internet, and an instant recall of a sentence read 42 years earlier, I created a **new profession** called Chief Technology Officer (CTO): *high-tech-centered strategizer of corporate/country survival/success.*[3] in an invited paper (1999),[4] and developed and demonstrated the original **M**anagement **o**f **T**echnology **P**rotocol (MOTEP) in 51 (37 Corporate and 14 Country) Case Studies in the **first CTO Book** (2002)[5].

The CTO research led me to define three years later in 2002 another new profession: CNO: *high-tech-centered, high-risk, high returns investor of significant segment of resources* for *corporate/country survival/success,*[6] and to develop and demonstrate the original **R**esource **C**ommitment to **P**resent/Potential **O**pportunities of **D**isequilibria (RCPOD) Protocol) in 50 (47 Corporate and 3 Country) Case Studies in the **first CNO Book** (2004)[6a] Thus, the news item on Bill Gates appointing a *de jure* CTO led me to develop *101 Case Studies* and *two CTO/CNO Protocols* in two papers and two books.

## 3. Integrating Subsequent Data into Antecedent Data in Survival Decisions

The **101** Case Studies portray **Decisions to Dare:** "high-risk, high-returns decision that commits a significant segment of corporate/country resources to a pre-specified outcome(s)."[7] The Decisions to Dare commit resources

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which are several orders of magnitude bigger than those for the run-of-the-mill business problems (inventory reduction, production scheduling, sales promotion). They focus on the very **survival** of countries and corporations: *country survival/corporate survival*. The CTOs, by virtue of their identifying/ non-identifying future technologies that would make/break the company/country, **wield the power of nothing less than life/death** over countries /corporations.

Had not Churchill acted on CTO Lindemann's "hunch" that the very *country survival* of Great Britain hinged upon radar, Britain would have succumbed to Nazi Blitzkerg, raining terror on London day and night. Again, had not Thomas Watson, Jr. acted on CTO Birkenstock's "hunch" that the very *corporate survival* of IBM hinged upon magnetic tape, IBM would have long been long gone and forgotten. (How many punched card companies are among today's hitech companies?)

Watson, Jr. handpicked 18 of the best systems experts of IBM and asked them if IBM (as CTO Birkenstock was constantly goading Watson, Jr. to do) should plunge into the computer business. After 3 months of study they unanimously concluded that punched cards were the best thing for IBM, and that magnetic tape had "no place" at IBM.

Should Watson set aside the best expert advice from the world's best technology company? Even if Watson, Jr. could dismiss the best technical advice, he knew for sure that his father would throw him out on his ears if he were to tell him that the days of punched cards were numbered.

What should Watson, Jr., then a mere Vice President-not even an Executive VP-do? Take up arms against his father's incontrovertible faith in the future of the punched cards? Reject out of hand the considered, unanimous, opinion based on 3 months of study by the best systems experts that magnetic tape had no place at IBM?

Watson, Jr., says that he had a "gut feeling" that IBM should get into computers. The goading by Birkenstock: Are you going to miss out on all these advances in electronics? fanned the flames of his disposition to improve. He defied his father's firmly-held belief. He rejected the unanimous recommendation of the 18 best, hand-picked experts at IBM.

What was his **mental process** leading Watson, Jr., to decide to embrace the emerging technology of magnetic tape and eschew the established technology of punched cards? The possibilities of the new-fangled magnetic tape were new inputs (fact/fiction/rumor/evidence/data). The actualities of proven punched cards were the old inputs, or **antecedent** elements. The possibilities of the magnetic tape came later, or were **subsequent** elements. How should the subsequent elements be added to/subtracted from the antecedent elements? The 18 experts rejected outright the subsequent elements added to.

Should Watson, Jr. do .likewise? What reason would he have to reject the best technical advice?

The 18 experts did **not integrate** the subsequent elements into the antecedent elements. They rejected the subsequent elements in favor of the antecedent elements. Obviously, Watson, Jr. **integrated** the subsequent elements by rejecting the antecedent elements. What was Watson's method of integration?

The antecedent elements are in the "memory". How is the memory "managed"? Memory Management integrates subsequent elements (emerging technology of magnetic tape) with the antecedent elements (established technology of punched cards). Can we retrospectively reconstruct the Memory Management elements/process of Watson, Jr.; or of Churchill; or of other CTOs/CNOs? Could there be a corpus of Corporate Memory Management which differs from the corpus of Country Memory Management?

Insights into Memory Management by CTOs/CNOs will shed light on how we can train present/potential CTOs/CNOs to wield better, their life/death power over countries/corporations. Before tackling Memory Management by CTOs/CNOs, let us retrospectively reconstruct my creating two new professions and two new protocols demonstrated in 101 Case Studies to see if insights into Memory Management can be codified.

## 4. Retrospective Reconstruction of Conceptual Leaps into Two Professions: MD$^2$ Protocol

When I came across the news item on the new profession (CTO) I jumped onto a higher curve of conceptual/operational value. The *single* instance of a *new* job at *one* company (Microsoft) let me jump to a *new profession*, which had to be *newly defined*, and which applied across *all*/most **companies**/countries. The new profession would determine the survival of more than **corporations** like Microsoft. Intuitively I felt that it would determine the survival of **countries,** like Great Britain during World War II as well. Microsoft had not defined the new profession of CTO; it had merely announced that Nathan Myhrvold was to be the [first] CTO. So I would have to define the new profession covering corporations and countries.

### 4.1 Quantum Jumps, Not Linear Extensions

It was not a case of *linearly extending* the experience of one corporation to another(s), like saying: Let the **experience** of Corporation 1 inaugurating a new profession be extended to other Corporations 2, 3,…, n. Nor was it saying: Let the **responsibilities** of the new profession be extended to Corporations 2, 3,…,n. Instead of linear extension, there was a quantum jump.

In the tropics, the housewife heats milk to preserve it, the higher/longer the heating process, the longer the life of the milk. The useful life of the

milk is given a **linear extension**, increasing it from a few minutes to more minutes, and even hour(s) (moving along the **same curve** of performance characteristics).

Alternatively, milk can be preserved by refrigeration. When the milk is refrigerated, its life is extended from hours to days and even weeks. The System Performance Characteristics (SPC) of milk makes a **quantum jump** from hours to days (jumps from one curve of System Performance Characteristics to a **higher curve**).

The quantum jump is achieved by refrigeration, which is a different **dimension** from that of heating because no amount of heating will make it refrigeration. Length and breadth are two dimensions because no amount of extension of one (length) would make it another (width). In fact, the principle underlying refrigeration is that of *cooling* (different dimension from *heating*) the milk to such a temperature that the bacteria are made inactive, not killed outright.

### 4.2 Quantum Jumps of Concepts

My thinking process had made 5 quantum jumps of concepts:

- Quantum Jump of Idea [1]: from *de facto* CTO (Gates at Microsoft) in 1975 to *de jure* CTO (Myhrvold) in 1997

- Quantum Jump of Idea [2]: from One Corporation (Microsoft) to [all] Corporations (1997)

- Quantum Jump of Idea [3]: from One Corporation (Microsoft) to [one] Country (UK) (1997)

- Quantum Jump of Idea [4]: of **Survival** [through **yet-to-emerge** technology: **radar**] from One Country (UK) (1937) to [all] Countries (1997)

- Quantum Jump of Idea [5]: of **Survival** from [single country: UK] (1937) to the Idea [5] to **Survival/Success** of **Countries/Corporations** (1997)

In other words, the 5 ideas were catapulted onto a higher curve of value by the respective quantum jumps. For instance, my Memory flashed the fact that since co-founding with Paul Allen in 1975, Gates had been the *de facto* CTO. Why, then, appoint a new *de jure* CTO? I perceived the appointment as signaling a new **dimension**: Technology had become too important to be left to the CEO Gates. Someone else had better monitor emerging technology developments full-time; and he/she had to discern which emerging technology would make/break Microsoft.

My "short-term" Memory **integrated** the news item on the Internet (subsequent idea: Gates appointing a *de jure* CTO) with the antecedent ideas

(Gates who functioned as the *de facto* CTO for 22 years had to be replaced: Why?). Similarly, the other 4 new (subsequent) ideas had to be integrated into antecedent ideas as well.

The integration, in my case, generated a jump onto a higher curve of performance characteristics/values, as when a drab, crawling caterpillar is transformed into a multi-colored, flying butterfly. The quantum jump puts the entity on a new **dimension** (flying) which is discontinuous (**disequilibrium**) from the previous dimension (crawling). Dimension is the discrete/discontinuous jump in the conceptual/operational, qualitative/ quantitative, attribute/ characteristic/factor of individual elements/entities and/or interactive relationships.

**Memory Management** (defined in Section 9.0) should facilitate [the CTO/CNO] embracing the emerging technology in discontinuous disequilibria. Can we develop an **established sequence of ordered procedures (Protocol)** of memory management? If one/more steps of the protocol accounts for the success of the Decisions to Dare, and the absence of one/more steps accounts for their failure, we shall have developed the <u>M</u>emory <u>M</u>anagement <u>D</u>isequilibria <u>D</u>imensions (MD$^2$) Protocol.

## 5. Prior Research in Decision-Making under Uncertainty: Kahneman-Tversky

CTO/CNO Decisions to Dare come under the heading of Decision-Making. Insofar as the pre-specified outcome is unknown/**unknowable,** the CTO/CNO is undertaking a risk. Risk is the occurrence of an outcome other than the one specified.[8] You specify rain; and there is sunshine. Or you specify sunshine, and there is rain. Both outcomes are different from the ones specified. The CTO is betting on the specified outcome(s).

Papers dealing with decision-making under uncertainty, and courses on decision-making, heavily draw upon the work by Kahneman and Tversky, beginning with their paper on judgment under uncertainty.[9] Prof. Daniel Kahneman who received the 2002 Nobel Prize in Economics "for having integrated insights from psychological research into economic science, especially human judgment and decision-making under uncertainty,"[10] says:

"We published the article in *Science* because we thought that the prevalence of systematic biases in intuitive assessments and predictions could possibly be of interest to scholars outside psychology…[T]he *Science* article incorporated questions that were cited verbatim in the text. These questions, I believe, personally engaged the readers and convinced them that we were concerned…with the susceptibility to erroneous intuitions of intelligent, sophisticated, and perceptive individuals such as themselves….

"I am now quick to reject any description of our work as demonstrating human irrationality. When the occasion arises, I carefully explain that **the research on heuristics and biases only refutes an unrealistic conception of rationality, which identifies it as comprehensive coherence** (Emphasis added).

"After publication of our paper on judgment in *Science* in 1974, Amos [Tversky] suggested that we study decision-making together....The task we set for ourselves was to account for observed preferences in the quaintly restricted universe within which the debate about the theory of choice has traditionally been conducted: **monetary gambles with few outcomes (all positive), and definite probabilities.**

"The concept of **loss aversion** was, I believe, **our most useful contribution to the study of decision-making**. [T]he response to losses is consistently much more intense than the response to corresponding gains, with a sharp **kink in the value function** at the reference point....[M]ost will reject a gamble in which they might lose $20, unless they are offered more than $40 if they win (Emphasis added).[11]

### 6. Kahneman-Tversky Research and CTO-CNO Decisions

Kahneman-Tversky research on decision-making under uncertainty addressed [1] observed preferences in [2] monetary gambles [3] with few outcomes and [4] definite probabilities.

When Churchill, sensing the *Gathering Storm* of World War II, caused the plans for the air defense of Great Britain to be rewritten in 1937 round the assumption that the promises made by British scientists for the still-unproven radar would be kept, there were no "few outcomes" with "definite probabilities." It would be presumptuous and counter-productive to represent the survival of the Western Civilization or its annihilation as "monetary gambles". There were no room for "observed preferences" in the "monetary gambles."

Similarly, Thomas Watson, Jr., had to recognize the two mutually exclusive outcomes: either punched cards were the future; or magnetic tape was the future. Either IBM stepped up to the plate and wholeheartedly became a computer company, or it improved punched cards *ad infinitum,* believing as Thomas Watson, Sr. did, that the sun rose and set on punched cards. There were no "few outcomes" with "definite probabilities" in the survival of Western civilization, or its extinction, There were no room for "observed preferences" in the "monetary gambles."

How the CTO/CNO make corporate/country survival/success decisions is not susceptible to analysis under the Kahneman-Tversky schema.

We have to find an alternate approach. We will examine Freud's Self Analysis which yielded his concept of Oedipus Complex.

### 7. Freud's Retrospective Introspection of Creation of Conceptual Leaps

Introspective analysis or analytical introspection has been used by Freud in discovering the Oedipus Complex

#### 7.1 Freud's Discovery of the Oedipus Complex

Confiding in his friend and confidante, Wilhelm Fleiss, Freud says how he discovered the Oedipus Complex:

> "I have found, **in my own case too**, [the phenomenon of] **being in love with my mother and jealous of my father**, and **I now consider it a universal event in early childhood**.

> "If this is so, we can understand the gripping power of Oedipus Rex, in spite of all the objections that reason raises against the presupposition of fate; and we can understand why the later "drama of fate" was bound to fail so miserably."[12] (Emphasis added)

> [The Greek legend touches upon an urge] "which **everyone recognizes because he senses its existence within himself**. Everyone in the audience was once a budding Oedipus in fantasy and each recoils in horror from the dream fulfillment here transplanted into reality, with the full quantity of repression which separates his infantile state from his present one"[13] (Emphasis added).

Thus, we see that Freud developed his theory of Oedipus Complex from a sample of size $n = 1$: himself. (1) He has a flash of insight into himself "I have found, **in my own case too**, [the phenomenon of] **being in love with my mother and jealous of my father**." (2) From the particular, Freud leaps to the general: **"I now consider it a universal event in early childhood."**

Theory of Statistics makes statement about events and relationships as n, the sample size, tends to infinity. It abhors $n = 1$. On the other hand,. Theory of Psychoanalysis, founded by Sigmund Freud, builds on a postulate when $n = 1$ (which is not at all randomly chosen), and asserts universal validity: **I now consider it a <u>universal event</u> in early childhood.**

The proof of the pudding is in the eating. The proof of the Theory of Oedipus Complex is in its facilitating the psychological healing of the subject as he/she, under the guidance of the psychoanalyst, uncovers gender-based fundamental conflicts, and deals with them.

While to Freud, the unconscious was a vast wasteland, to Carl Jung, the unconscious was a goldmine of psychological insights yielding practical guidance for daily living. Experts in Freudian analysis significantly differ from experts in Jungian analysis. However, the end-result of competent

Freudian or Jungean analysis would be the healing of the patient, through howsoever divergent a diagnosis and prescription.

### 7.2 Freud's Discovery of the Oedipus Complex through Self-analysis

Freud used self-analysis to discover Oedipus Complex as we saw in the preceding section: " I have found, **in my own case too**, [the phenomenon of] being in love with my mother and jealous of my father." Jean Chiriac, President of AROPA, says that Freud's discoveries during his first stage of analysis (1895-1900) have been included in two of his main books: *The Interpretation of Dreams*, and *The Psychopathology of Everyday Life*. In *The Interpretation*, Freud states for the first time that dreams are the disguised fulfillment of unconscious wishes. Freud continued self-analysis right until his death in 1939.

Why is Self Analysis superior to Self Introspection? Because it gives the opportunity of a radical change by rethinking our social values from an external perspective. In fact, Freud says that Self Analysis is only possible "by means of what I learn from the outside."

In his letter of November 14th 1897, Freud wrote to Fleiss: "Self-analysis is impossible in fact. I can only analyze myself **by means of what I learn from the outside** (as if I were another). Were things different, no disease would have been possible otherwise but through projection (Emphasis added).

"Whereas introspection does nothing else but (re)integrate us into the level of our social values, psychoanalytic self-analysis offers us the opportunity of a radical change in our inner and outer being from **the perspective of a reevaluation of these social values.**"[14] (Emphasis added).

## 8.0 Four (MD)$^2$ Elements

How did a news item on the Internet lead me to define a new profession and develop 51 Case Studies? In retrospect, I can identify four critical elements: (1) **Associate** [subsequent ideas with antecedent idea[s]), and (2) **Integrate** the subsequent ideas with antecedent ideas, so that a (3) **trigger** will facilitate the integrated ideas jumping onto a higher curve of performance characteristics/values to [4] **transcend** existing boundaries of thought/action.

### 8.1 (MD)$^2$ Element 1: Associate Subsequent Ideas with Antecedent Ideas

The encounter with the new profession of CTO was totally unexpected. Since I came across the concept of CTO for the very first time in 1997, I could **not** have filed Churchill's single sentence in my long-term memory since 1955 under the heading: CTO. Nor could I have organized a sentence I read in 1955 under headings such as: Management or Technology, or Management of Technology because the word "Technology" itself did not gain currency till

mid-1980s, my own book on *Technology Management: Applications to Corporate Markets and Military Missions* (Praeger, New York) appearing in 1988.

First, I had to have organized the Churchill sentence (**antecedent data**) under some heading which did not include the key words: CTO, Technology or hitech.

Second, a casual/routine surfing of the Web with no pre-planned intent to discover any new concepts, produces the new concept (**subsequent data**) of CTO, which had to be filed under some suitable heading in my short-term memory.

Third, a 1997 news item on the worldwide web [1] triggered my recall of a sentence I read 42 years earlier, [2] abstracting the concept I later [3] defined as CTO: high-tech strategizer of corporate /country survival/success.[15] I had [4] contrasted the corporate [5] *de jure* CTO Myhrvold with the [6] *de facto* [7] country CTO Lindemann, and [8] sensed that the common overriding concern of both the corporate and country CTO, was [9] **survival** of the corporation /country.

How did my Memory Management make it possible for me to define a new profession: CTO? From the starting $(MD)^2$ Element 1, we will go directly to the concluding $(MD)^2$ Element 4 to sketch the story. We will discuss the Elements 2 and 3 after formally defining Memory Management.

### 8.2 $(MD)^2$ Step 4: Disequilibrium Dimensions Transcending the Integration

**[1] The trigger led to transcendence**: From the specific instance of radar, I [1] created a class of technology (emerging, unproven technology), and its [2] *raison d etre*: survival. While in 1997 I did not know why Gates felt compelled to appoint a CTO at Microsoft, I could subsequently postulate convincingly that Gates required the CTO because of the *raison d etre:* survival.

### 9.0 Memory Management

Section 8.0 (1) through (4) are the critical elements of **Memory Management**. Management is Pre-committing scarce resources today for unknown/unknowable results tomorrow.[16]

### 9.1 Defining Memory

On what basis should scarce **resources** be pre-committed **to Memory inputs** today for pre-specified outcome(s) tomorrow? **What is Memory?**

> **Organizing the input of ideas (concept/event/relationship
> /entity) into mental storage (conscious/semi-conscious/**

**unconscious realms of the human mind) today for
effective/efficient output tomorrow in the original/
modified/upgraded form.**

The criterion of resource commitment is the effective/efficient (output/input) ratio. When the input is retrieved in the original form, (output/input) $= 1 = 10^0$, the exponent is zero: R-Zero for Results-Zero. When the output is in modified form, the (output/input) $>1$, say $10 = 10^1$, the exponent is unity: R-Unity for Results-Unity. When the output is in upgraded form, the (output/input) ratio is $>>1$, say $100 = 10^2$, the exponent is Duo: R-Duo for Results-Duo.

### 9.2 Defining Memory Management

R-Duo requires that our input of ideas should promote upgrading them onto a higher curve of value (Discontinuous Jump onto a higher curve of value), usually by abstraction/application/advancement. R-Duo should be an increasing percent of the three outputs combined: R-Zero, R-Unity, and R-Duo; or R-Duo should be a higher percent of the total results than R-Zero and R-Duo combined. **What is Memory Management?**

> **Pre-commit scarce resources today to organize the input of
> ideas (concept/event/relationship/entity) into mental storage
> (conscious/semi-conscious/unconscious realms of the human
> mind) so that (upgraded output/input) retrieval occurs more
> frequently than both (original output/input) retrieval occurs
> and (modified output/input) retrieval combined.**

### 9.3 Defining a Definition

A definition is a statement of what something is, and what something is not.

Einstein's equation $e = mc^2$ is a definition, not because it is mathematical, not because it is an equation. The left-hand-side says that **ALL energy is** $mc^2$. What does the right-hand-side say? To say "ALL $mc^2$ is energy" is a tautology like: six is half a dozen; and half a dozen is six. It does not add anything to knowledge. Since the definition must say what something is not, what is a not-statement about $e$? non-e. What is non-E? non-$mc^2$. We can convert the mathmatical statement ALL non-e is non-$mc^2$ into English as: **ONLY $mc^2$ is energy**

**ALL energy is $mc^2$** and **ONLY $mc^2$ is energy** together constitute the definition of e.[17]

Do we have a definition of Memory Management? We test it by constructing ALL and ONLY statements in two elements: (1) Input-based; and (2) output-based

ALL Memory Management is **Pre-commit[ting] scarce resources today to organize the <u>input</u> of ideas into mental storage.**

ONLY **Pre-commit[ting] scarce resources today to organize the <u>input</u> of ideas into mental storage** is Memory Management.

WHY are resources pre-committed to organize the **input** into mental storage? So that (upgraded **output**/input) constitutes the highest percentage of total outputs.

ALL Memory Management is Pre-commit[ting] scarce resources today to organize the <u>input</u> of ideas into mental storage **so that (upgraded <u>output</u>/input) occurs more frequently than both (original output/input) retrieval and (modified output/input) retrieval combined.**

**ONLY** the pre-committing of scarce resources today to organize the input of ideas into mental storage **so that (upgraded <u>output</u>/input) retrieval occurs more frequently than both (original output/input) retrieval and (modified output/input) retrieval combined** is Memory Management.

Yes, we have defined Memory Management: Organize the input so that the (1) The Upgraded outputs should exceed (2) modified outputs and/or (3) original inputs.

## 9.4 Defining Protocol

Protocol is an established sequence of ordereded procedures. It specifies what comes before (antecedence), and what comes after (subsequence). Diplomatic Protocol deals with **courtesies:** the Prime Minister walks ahead of the Deputy Prime Minister. Medical Protocol deals with **cures:** anesthesia before surgery (not the other way around!). The Protocol embodies the best collective wisdom of the profession. Therefore, if the medical personnel carries out the medical protocol and are sued for the delay/deficiency in patient recovery or even patient death, the medical personnel are indemnified (held harmless) by the medical protocol.

Memory Management Discontinuous Dimensions **(MD)$^2$ Protocol** specifies (1) what the CNO should do (2) in what order, so that the commitment of significant corporate /country segments of resources to the emerging technologies (**Decision to Dare**) will improve the probability of country/corporate survival/success.

## 10. COUNTRY APPLICATION 1: (MD)$^2$ in Creating a New Technology-*Churchill Betting on Unproven Radar*, 1937

What kind of Memory Management produced the Discontinuous Dimension of Churchill's resource commitment to radar? He had to have a basic understanding (HOW?) of the distant technology (radar). He had to know what the

distant technology could do (WHAT?) (defend by detection: enable people to escape German bombing by hiding in the underground shelter).

### 10.1 (MD)$^2$ Protocol Step 1: CNO Will to Win

How did he add/associate the subsequent knowledge with the antecedent knowledge? It depends on Churchill's **mental model** of how things would work in the military. The inter-war years of British demobilization in the face of what Churchill called *The Gathering Storm* would have been enough to demoralize most men. But Churchill had the **will to win.** Absent the **will to win**, the most promising technological development can be dismissed as a pipe dream. But with the indomitable **will to win**, the CNO can find convincing reasons to commit significant segment of corporate/country resources to even a tenuously emerging technology. In formalizing the (MD)$^2$ Protocol, we should make it the first step. **(MD)$^2$ Protocol Step 1: The Will to Win**.

### 10.2 Hannibal's Mental Model: "We will either find a way or we will make one"

Churchill had to find a way where there was none.

He could draw inspiration from a famous Carthaginian General, Hannibal. He whipped the Roman Army in 217 B.C. by hauling 40,000 troops and a contingent of elephants across the Alps during winter with the motto: "We will either find a way, or we will make one."[18]

Hannibal had to *discover* a way or *develop* a way to cross the Alps with the elephants in the winter "in 15 days, beset by snowstorms, landslides, and the attacks of hostile mountainous tribes." He had to find a way to replenish more than a third of his army-15,000 men lost in the long march-from among the friendly Insubres, a Gallic people of northern Italy. "He subjugated the Taurini, a tribe hostile to the Insubres [in 218 BC and] vanquished the Romans under Scipio Africanus the Elder in the battles of Ticinus and Trebia. In the following year, 217 BC, Hannibal inflicted a crushing defeat on the Roman consul Gaius Flamminius at Lake Trasmiene. After his victory Hannibal crossed the Apennines and invaded the Roman provinces of Picenum and Apulia, recrossing then to the fertile Campania, which he ravaged."[19]

### 10.3 (MD)$^2$ Protocol Step 2: Antecedent Negative ideas

Perhaps the most powerful antecedent negative idea on British air defense was Prime Minister Baldwin's speech to the Parliament: "The Bomber will always get through." Writes Churchill:

"Early in 1935, an Air Ministry Committee composed of scientists was set up and instructed to explore the future. We remembered that it was upon the advice of the Air Ministry that [Prime Minister] Baldwin had made the speech which produced so great an impression when he said that there

was really [1] **no defence. "The bomber will always get through."** We had, therefore, [2] no confidence in any Air Ministry departmental committee, and thought the subject should be [3] transferred from the Air Ministry to the Committee of Imperial Defence, where the heads of the Government, [4] the most powerful politicians in the country, would be able to supervise and superintend its actions and also to [5] **make sure that the necessary funds were not denied"** [20] (Emphasis added).

Churchill knew that World War II would be won/lost not on the ground, but in the air. While Hitler steadily built up Nazi air power, Britain languished under ardent demobilization. The Air Ministry considered the bomber unstoppable, as declared by the Prime Minister: "the bomber will always get through."

## 10.4 (MD)² Protocol Step 3: Authority of Countervailing Ideas

With enough nay-sayers around (beginning with Prime Minister Baldwin himself), where would Churchill go to find solid new ideas about promising technology? The ideas had to be credible to him, a non-scientist, although the distant possibility would have sounded too good to be true. He had to have a scientist who would tell him what would be plausible and what was not.

Lindemann could "decipher the signals from the experts on the far horizon and explain to me in lucid, homely terms what the issues were. What I had to grasp were the practical results." [21] Lindemann was the *de facto* CTO; Churchill was the *de facto* CNO (Chief 'Ntrepreneur (combining Entrepreneur and Intrapreneur) Officer. Churchill defines his CNO role:

"[J]ust as Lindemann gave me his views for all it was worth in the field, so I made sure by **turning on my power relay**, that some at least of these terrible and incomprehensible truths emerged in executive decisions."[22] **[ensuring ample funds, equipment and personnel]** (Emphasis added). In other words, CTO Lindemann provided the technology vision; CNO Churchill provided the funds to pursue the vision.

## 10.5 (MD)² Protocol Step 4: Subsequent Positive Ideas

Because of his firm belief in the capability and commitment of British scientists, Churchill would jump at the tiniest Technological Gleam in the eye of the British scientists.

On February 12, 1935, there came the Technological Gleam. Watson-Watt proposed to combine results from two ongoing research topics: [1] the **range**-finding of ionospheric layers and [2] the **direction-**finding techniques previously used to detect thunderstorms. Range and Direction define **RA**dio **D**etection **A**nd **R**anging (RADAR).

Radio antenna concentrates the radio waves into a shaped beam pointed in the desired direction. When these strike an object, a billionth of a

billionth of the total radio energy is reflected from the object as an echo signal. The antenna delivers that energy contained in the echo signal to the receiver which produces a signal, which can be made visual on a computer. Four years later, Henry Boot and biophysicist John T. Randall invented an electron tube, **resonant-cavity magnetron,** which could generate high-frequency radio pulses with large amounts of power.

### 10.6 (MD)² Step 5: Integrating Subsequent Ideas with Antecedent ideas

Churchill's mental model of the Air Ministry is clear: "We had, therefore, [2] **no confidence in any Air Ministry departmental committee,** and thought the subject should be [3] transferred from the Air Ministry to the **Committee of Imperial Defence**" (Emphasis added). But he had immense faith in British Scientists:

> "It is concerned with the methods which **can be invented or adopted or discovered** [*3. Developing impossible/non-existent solutions*] to **enable the earth to control the air** to enable defence from ground to exercise control–indeed domination-upon airplanes high above the surface [*1. The Required Result*], …My experience is that in these matters, when **the need is fully explained** by military and political authorities [*2. Customer Communication of The Requirement*], **science is always able to provide something**" [23] (Emphasis added).

> Churchill had no doubts about the capability or the commitment of British scientists to invent the most improbable solutions to any military imperative. Tell the scientists what the military needed (**Invent** a way to defeat the enemy air power); they will invent it.

> In other words, Churchill believed in **Market-Pull** of the customer, the military.

### 10.7 (MD)² Step 6: Quantum Jump of Integrated Ideas

Churchill had to visualize two disparate projects-one on *ionospheric* range-finding and another on completely different *thunderstorm* detection-somehow creating the synergy that was RADAR.

> Joseph P. Martino, U.S. Air Force (Office of Scientific Research) who invited me to participate in an Air Force Conference on Long-Range Forecasting Methodology in 1968, has been an ardent student of technology critical to defense. I am most grateful to him for his illuminating comments on Churchill's gamble in putting all defence eggs in the radar basket:

> "In the case of radar, the situation was not unprecedented. The U.S. Navy had demonstrated radio range finding in the 1920s and the US Army had an **operating radar** at Pearl Harbor prior to December 1941, which had been developed independently of the British and **did not use the cavity mag-**

**netron** (unfortunately no one was paying attention on the morning of Sunday, December 7). The **Germans had likewise developed operational radar** prior to WWII, again without cavity magnetron. These "precursor events" showed that radar was feasible. The **question for Churchill** was whether to count on deploying operational radar in a hurry, **developing the procedures for radar-controlled air intercepts**, and **training both pilots** and the **radar operators** in these procedures. That's where most of the gamble lay" (Emphasis added)

### 10.8 (MD)$^2$ Step 7: CNO Decision to Dare

What was the CNO's Decision to Dare?

Within two years of the seminal memo from Watson-Watt that if the two projects, one on range-finding in the ionosphere, and another on direction-finding in thunderstorms, were combined, it could conceivably lead to Radar, "the plans for the air defence of Great Britain had, as early as the autumn of 1937, been rewritten round the assumption that the promises made by our scientists for the still unproven radar would be kept."[24] "**Rewriting the plans for the air defence**" is as sweeping a statement as one could make: CNO Churchill was betting the very survival of Great Britain on the "still unproven radar."

"[J]ust as Lindemann gave me his views for all it was worth in the field, so I made sure by **turning on my power relay**, that some at least of these terrible and incomprehensible truths emerged in executive decisions."[25](Emphasis added}.

In brief, the emerging technology of radar was fully funded.

### 10.9 (MD)$^2$ Step 8: Memory Management Improvement

From CNO Churchill's decision-making on the emerging technology of radar, can we deduce steps to improve Memory Management?

### 10.9.1 MEASURE OF BETTER MEMORY MANAGEMENT: R-DUO

We defined Memory Management: Pre-commit scarce resources today to organize the input of ideas (concept/event/relationship/entity) into mental storage (conscious/semi-conscious/unconscious realms of the human mind) so that (upgraded output/input) retrival occurs more frequently than both (original output/input) retrival and (modified output/input) retrival combined.

OR, **invest in inputting** ideas into mental storage to increase **upgraded outputs.**

The criterion of resource commitment (Section 9.1) is the effective/efficient (output/input) ratio. When the input is retrieved in the original form, (output/input) $= 1 = 10^0$, the exponent is zero: R-Zero for Results-Zero.

**Memory Management in Country and Corporate Survival Decisions**

When the output is in modified form, the (output/input) >1, say $10 = 10^1$, the exponent is unity: R-Unity for Results-Unity. When the output is in upgraded form, the (output/input) ratio is >>1, say $100 = 10^2$, the exponent is Duo: **R-Duo** for Results-Duo.

Memory Management is improved when more than 50% of the "outputs" are in upgraded form. To achieve a higher ratio of upgraded outputs, (1) how should the inputs be organized, and (2) how should they be processed?

Inputs are the content; **CNO value system** is the context. If the CNO does not wholeheartedly believe in the emerging technology, the inputs would be viewed with skepticism, and even rejected out of hand. Therefore, power should be vested in the hands of those who are pro-emerging technology if resources are to be committed to give the CNO vision a chance to be pursued. Churchill had "no confidence in any Air Ministry departmental committee, and thought the subject should be **transferred** from the Air Ministry **to the Committee of Imperial Defence,** where the heads of the Government, the most powerful politicians in the country" could take a positive attitude toward fostering radar. CNO Churchill's value system would then be shared by the Board of Directors of the Defense Establishment.

### 10.9.2 CNO VALUE SYSTEM

Absent the CNO's determination to succeed in the emerging technology enterprise, he will be swayed by the inevitable negative ideas which deny that anything new can succeed. Since most CNOs are not technologists, the CNO must have absolute faith in the CTO's technology vision.

**Value System Requirement 1: CNO Will to Win**: Absent the 'will to win" of the CNO, all bets are off. There are bound to be negatives in the antecedent data: "It can't be done." These have to be decisively countered.

**Value System Requirement 2: CNO's Absolute Faith in the Emerging Technology**: The authority of the advocate of the emerging technology is decisive. Churchill trusted Lindemann's authority so much that he could override the nay-saying by none other than the British Prime Minister himself, who acted on the recommendation of the Royal Air Force.

### 10.9.2 INPUT CONTENT IMPROVEMENT

**Input Content Improvement 1. "Precursor Events" supporting Feasibility:** Both the US and Germany had developed operational radar. Major Joseph P. Martino says: These "precursor events" showed that radar was feasible. The CNO had to have reliable, up-to-date data on the experience with the emerging technology of both allies and antagonists.

**Input Content Improvement 2. Framing of Feasible Operational Events**: "The **question for Churchill** was whether to count on [1] deploying opera-

tional radar in a hurry, **developing the [2] procedures for radar-controlled air intercepts**, and [3] **training both pilots** and the [4] **radar operators** in these procedures. That's where most of the gamble lay." In other words, the CNO has to operationalize the use of the emerging technology.

## 10.9.3 OUTPUT CONTENT IMPROVEMENT

**Output Content Improvement 1. Time-line of (Results/Resources)**: Churchill says that, as early as the autumn of 1937, the entire air defense plan of Great Britain was rewritten round the assumption that the promises made by the British scientists for the "still unproven radar" would be kept. What was the yardstick that Churchill should use to judge the progress of radar?

Major Martino says that the question that Churchill faced was how fast the "procedures for radar-controlled air intercepts" could be used by both pilots and radar operators. The result would be (1) **"radar-controlled intercepts"** which would score 1 if successful, 0 if not. Anti-aircraft guns could fire at the approaching enemy aircraft. Sounding air raid alarm would warn the people to take shelter. With a beefed-up Royal Air Force, the radar-controlled air intercepts would be the signal for British aircraft to scramble. **(2) The number of enemy aircraft kills** would be another operational measure of success of radar operations.

Both the operational measures could be plotted against time. The number of radar-controlled intercept and the number of enemy aircraft kills can be divided by their respective cost to give **cost-effectiveness** of the emerging technology.

**Output Content Improvement 2. Resources Commitment:** Cost Effectiveness was introduced into the US Department of Defense (DOD) in 1961 by Assistant Secretary of Defense, Charles J. Hitch. The DOD directive of July 1, 1965 made "cost-effectiveness" an essential element in planning and executing large systems.

What should be the budget for the emerging technology of radar? It would be another quarter of a century before DOD would mandate Cost-Effectiveness. "Just as Lindemann gave me his views for all it was worth in the field, so I made sure by **turning on my power relay**, that some at least of these terrible and incomprehensible truths emerged in executive decision" (Emphasis added). Churchill felt that he had to grasp the practical significance of the emerging technology and commit the required resources to make it happen.

## 10.9.4 (MD)$^2$ PROTOCOL STEPS

We list in Table 1 the 8 (MD)$^2$ Protocol Steps

| Table 1: Protocol Steps | |
|---|---|
| $(MD)^2$ Step 1. | CNO will to win |
| $(MD)^2$ Step 2. | Antecedence of Negative ideas |
| $(MD)^2$ Step 3. | Authority of Countervailing Ideas |
| $(MD)^2$ Step 4. | Subsequent Positive ideas |
| $(MD)^2$ Step 5. | Integrating Subsequent Ideas with Antecedent Ideas |
| $(MD)^2$ Step 6. | Quantum Jump of Integrated Ideas |
| $(MD)^2$ Step 7. | CNO Decision to Dare |
| $(MD)^2$ Step 8. | Memory Management Improvement |

## 11.0 CORPORATE APPLICATION 1: $(MD)^2$ in Creating a New Industry-*Watson, Jr. Betting on Untried Integrated Chips*, 1948

From **Country** Survival, we turn to **Corporate** Survival.

Had not Churchill in 1937 put all the defense eggs of Great Britain into the single basket of the emerging technology of radar, Britain simply would have been defeated in World War II and would not have survived. Similarly, had not Thomas Watson, Jr. in 1948 put IBM into the computer business, it would not have survived as a punched cards company.

### 11.1 $(MD)^2$ Protocol Step 1: CNO Will to Win

In his autobiography, *Father, Son & Co.: My Life at IBM and Beyond*, Watson, Jr. repeatedly affirms his unquestioned belief in IBM's capacity to meet any challenge. Perhaps the best declaration of the CNO Will to Win is when he talks about the System/360 decision:

"The only solution was to get System/360 out the door fast…*Fortune* magazine christened this project "IBM's $5,000,000,000 Gamble", and billed it as 'the most crucial and portentous-as well as perhaps the riskiest-business judgment of recent times.'…It was the biggest, riskiest decision I ever made, and I agonized over it for weeks, **but deep down I believed there was nothing IBM couldn't do**" [26]Emphasis added).

The System/360 decision that he agonized over for weeks was made in 1964 when Watson, Jr. was CEO for 8 years already. But the decision to take IBM from the punched cards business into the computer business was made in 1948 when Watson, Jr. was just a Vice President, not yet an Executive Vice President.

What was Watson Jr.'s value system in 1948?

His sphere of action was circumscribed by Watson, Sr.'s unbounded faith in the punched cards and utter skepticism of electronics:

"My father initially thought the **electronic computer would have no impact** on the way IBM did business, because to him punch-card machines and giant computers belonged in totally separate realms….I don't mean to say that Dad totally ignored the challenge that computers posed. He believed that **no one could beat IBM** when it came to building giant calculators for science, which is all **he thought** the new computers were, and he set out to prove it…by **build[ing]** a machine that worked: Selective Sequence Electronic Calculator, or SSEC…. The SSEC marked the end of an era at IBM…[The] talented group of inventors who had spent their lives working for Dad,…had produced one of the most advanced machines ever. But even though they reached the threshold of the **computer age**, *few of them stepped across*"[27] (Emphasis added)

## *11.2 (MD)²  Protocol Step 2: Antecedent Negative ideas*

Contrasted with Churchill's Will to Win with respect to Country Survival, we find in the case of Corporate Survival, Watson Sr.,'s unassailable belief that the sun rose and set on punched cards. Watson, Jr. felt in his guts that IBM's survival depended on getting into the computer business: "**I knew in my gut** that we had to get into computers and magnetic tape"[28] (Emphasis added).

But how would he convince his father?

"I didn't think it would be prudent to run to Dad with the idea that punch cards were dying. He'd have thrown me out of his office. Instead I used a systematic approach that I knew would make sense to the old man. In 1949 I organized **[1]** a **task force of eighteen of our best systems engineers** to study whether we should add magnetic tape to our product line…

"The task force studied the magnetic tape issue for three months. When they came back, their answer was that **punch cards were the best thing in the world for accounting jobs**, and that **magnetic tape had no place at IBM**. I tried again, **[2]** bringing in **top salesmen** and describing what magnetic tapes could do, but they all ended up saying no, it's better to use punch cards[29] (Emphasis added).

Thus, the Antecedent Negative Ideas were: (1) Watson, Sr.'s abiding faith in the punch cards, and (2) conviction that electronic computers were giant scientific calculators which had no impact on IBM's business. The best technical advice from the top team of 18 systems experts was that (3) punch cards were the best for IBM, and (4) there was no place for magnetic tape at

IBM. (5) The top salesmen whom Watson, Jr. tried to convince about the superiority of magnetic tape, said it was better to use punch cards.

### 11.3 (MD)$^2$ Protocol Step 3: Authority of Countervailing Ideas

What empowered Watson, Jr. to stand up against both the unanimous technical advice of hand-picked experts, and the unanimous judgment of the top salesmen? Watson, Jr. relied on his "gut feeling" that IBM should get into computers. He feels that "gut feeling" is the deciding factor; not cerebral reasoning, or analytical prowess.

"I was beginning to learn that the majority, **even the majority of top performers, are never the ones to ask** when you need to make a move. You've got to feel what's going on in the world and then make the move yourself. *It is purely visceral*. I didn't trust myself enough yet to insist, but I knew *in my gut* **that we had to get into computers and magnetic tape**. To my great surprise, this was echoed by one man at the headquarters who kept prodding me to act: Kirk's old crony [James] Birkenstock... *Birkenstock did more to put IBM into the computer business than any other man....*He was no engineer himself, but he had a natural understanding of technical matters and an ability to articulate them.

"Birkenstock was constantly telling me that the **punch card was doomed, and so were we** unless we woke up. Customers wanted more speed, and we were reaching the limit of how fast our machines could go. When we pushed our high-speed sorter up from 600 cards a minute to 800, the cards themselves started getting ripped to shreds. He was constantly goading me, calling my attention to **all the activity in electronics, and asking if I really wanted to miss out**. This was nerve-wracking to listen to all the time because I didn't know how I'd convince my father. But I knew I would be a fool to close my ears"[30](Emphasis added)

In Lindemann, Churchill had an "authority." Churchill could take whatever Lindemann told him about the emerging technology, even over the distant horizon, as authoritative. Churchill could assume that the distant possibilities would emerge as facts in time. He needed to grasp the practical significance of Lindemann's emerging technologies.

Birkenstock was no scientist, no engineer. But to Watson what Birkenstock said was compelling. It was compelling enough for Watson, Jr., to **reject** the best expert advice IBM could command.

Even though Birkenstock was not a scientist or engineer, he could understand and articulate "technical matters" in a way that Watson could be persuaded.

## 11.4 (MD)² Protocol Step 4: Subsequent Positive Ideas

Watson, Jr. had urged his father to put 603 Electronic Multiplier on the market. The small team of electronics engineers at Poughkeepsie was working on an improved version, 604. The tremendous demand for 604 convinced Watson, Jr. that electronics would take off. But 604 was designed by a maverick group of electronic engineers, operating away from Watson, Sr.,'s bunch of "seven inventors," none of whom understood electronics. Watson, Jr. felt that IBM should hire electronic engineers "in quantity" by the thousands. Controller Williams found out that IBM was spending 25% less on R&D than competitors: Which fact spurred Watson, Sr. to action.

"It was the **success of the 604 Electronic Calculator** that **[1] convinced me** that **electronics was going to grow much faster** than anyone had anticipated….Ralph Palmer, [head of Poughkeepsie Laboratory who had worked on top-secret electronic circuit projects for what later became the National Security Agency] and his men had produced an amazingly elegant design [for 604] that made it easy to cope with the vacuum tubes [by mounting] each tube and its supporting circuits in a standard plug-in unit [allowing easy replacement].

"But Palmer's operation was an anomaly. I did a complete review of all our development projects once I became executive vice president in 1949, and decided that **IBM was still in the Dark Ages**. I finally told Dad we needed something different…and said to him, "All you've got up there [Endicott Research Laboratory] is a bunch of monkey-wrench engineers. Don't you see? The time for hacking machines out of metal is gone. Now you're getting into a field where **[2] you have to use oscilloscopes and understand the theory of electron streams and scanning beams** inside the tubes…Unfortunately, none of Dad's inventors understood electronics.**[3] You've got to hire engineering graduates-a lot of them**.

"Al Williams [Controller] did a study comparing IBM's **research-and development spending** with that of RCA, General Electric, and other successful companies [where] **three dollars** out of every hundred dollars in sales [were] flowing back into R and D. **[4] We were spending about two dollars and a quarter**"[31](Emphasis added).

Watson, Jr. was gathering ammunition to wage war on the entrenched position of the punch cards. In 1948 he got a letter from a friend, Red La Motte, who found out from the man he assigned to track significant computer projects under way that **[5]** there were 19 such programs. Shouldn't IBM actively participate in the emerging field?

Big Customers were warning Watson, Jr. as well. Jim Madden, a Vice President of Metropolitan Life told Watson, Jr. "Tom, **[6] you are going to lose your business with us** because we already have three floors of this

building filled with punch cards and it's getting worse. We just **can't afford
to pay for that kind of storage space**. And I'm told we can put our records
on magnetic tape.

"Roy Larsen, the president of Time, Inc said much the same thing.
Time Inc. was using IBM equipment to handle the mailing lists of [millions of
readers each week] while the news was still hot. [E]ach subscription required
three punch cards...[7] **If you can't promise us something new, we're go-
ing to have to start moving some other way**"[32] (Emphasis added)

From the perspective of the decision maker, Watson, Jr., the fact that
IBM was ploughing 25% less of the Sales revenue into R&D than its compet-
itors is a "Positive Idea" insofar as it spurred Watson, Sr. to action despite his
conviction that IBM had the finest research organization in the world. Again,
the existence of 19 significant computer projects was a "Positive Idea" which
spurred IBM to action, even though in self-defense. Major customers like
Time, Inc., and Metropolitan Life Insurance, told Watson, Jr., that unless
IBM came up with a viable alternative to punch cards, they would have to
find technical solutions elsewhere: Which was also a "Positive Idea," but-
tressing Watson, Jr.'s conviction that IBM had to get into computers.

The most important "Positive Idea" that enabled Watson, Jr. to sell
Watson, Sr., on the idea of IBM entering the field of computers was customer
orders for the Defense Calculator, which at $3 million "was by far the **most
expensive project** in IBM history: **ten times the size** of Dad's SSEC [which]
marked the end of an era at IBM.

"After years of pushing, I'd finally come to the moment of truth...I
didn't want to ask the advice of our sales or market research people, because
they would howl the minute they saw what we wanted to do. And it was not a
decision that I could discuss in any detail with Dad-I only had a rudimentary
understanding myself and would never be able to answer the questions he
was sure to raise.

"**So I was on my own.** I had a roomful of talented technical men who
were enthusiastic and wanted to try-[Controller] **Williams and I were the
only nontechnical men** there-but it was **a three-million dollar gamble**-a
sum **as big as IBM's entire research budget** two years before. So I said to
[CTO] Birkenstock, "Let's go ahead. But I'd like you to do me a favor.

"Take these plans, clean them up, and you and [Cuthbert] Hurd, [a
mathematician who had joined us in 1949 from the Atomic Energy Commis-
sion's laboratory at Oak Ridge] see whether we can get any orders for this
machine-a general-purpose scientific computer to work in *all* the defense ap-
plications they'd studied.

"[At] a rental rate of $8,000 a month, [c]ustomers jumped at the idea;
in less than two months, we found **11 takers for the Defense Calculator and**

**10 more prospective ones**. With orders in hand, Williams and I presented the project to Dad, who approved it without a single question"[33](Emphasis added).

### 11.5 (MD)² Step 5: Integrating Subsequent Ideas with Antecedent ideas

The Subsequent Positive Ideas so overwhelmed the Antecedent Negative ideas that what took place was more an overriding of the antecedent by the subsequent than an integration of the two.

The first hurdle that the Subsequent Ideas had to overcome was Watson, Sr.'s image of IBM's R&D as the best in the world. However, the report from Controller Williams, showing that IBM was spending 25% less in R&D as percent of sales than its nearest competitors, made Watson, Sr. change his mind on R&D. The next day he called a meeting of the executives and said: "I want you to build this research up." Now Watson, Jr. wanted to remove the vice president of engineering, and appoint the head of Endicott Lab, Wally McDowell, as head of research. In May 1950 Watson appointed Wally as director of engineering with a mandate to hire "**engineers in quantity**." He hired well **over 4,000** in the space of 6 years.

The second major hurdle was risking $3 million, the equivalent of the entire R&D Budget of IBM on an **unproven** technology-based product, the Defense Calculator. With 11 actual orders for the future product, Watson, Sr. did not raise a single question on the biggest IBM Project.

### 11.6 (MD)² Step 6: Quantum Jump of Integrated Ideas

With respect to punch cards, magnetic tape was a quantum jump. Magnetic tape was the emerging technology to embrace which IBM simply had to abandon the existing, established technology of punch cards. The "integrated idea" was to enter the world of computers, abandoning the world of punch cards.

### 11.7 (MD)² Step 7: CNO Decision to Dare

What was the CNO's Decision to Dare?

Launching IBM into the world of computers was the biggest project of its time. The $3 million gamble was 10 times the size of the largest previous project: SSEC. Watson Sr.,'s monument to the punch card-based calculator.

Watson Jr. was convinced that IBM should hire electronic engineers "in quantity". He got Watson, Sr.'s approval to appoint Wally McDowell as director of engineering in 1950 who launched an aggressive recruiting effort, recruiting over 4,000 electronic engineers in 6 years.

In brief, the emerging technology of computers was fully funded and manned.

## 11.8 (MD)² Step 8: Memory Management Improvement

From CNO Watson Jr.'s decision-making on the emerging technology of radar, can we deduce steps to improve Memory Management?

### 11.8.1 CNO VALUE SYSTEM

Absent the CNO's determination to succeed in the emerging technology enterprise, he will be swayed by the inevitable negative ideas which deny that anything new can succeed. Since most CNOs are not technologists, the CNO must have absolute faith in the CTO's technology vision.

**Value System Requirement 1: CNO Will to Win**: Absent the 'will to win" of the CNO, all bets are off. There are bound to be negatives in the antecedent data: "It can't be done." Watson, Sr. firmly believed that IBM's future lay in the punch cards, and that computers were exclusively for scientific computing. Watson, Jr., felt in his "gut" that IBM should enter the world of computers.

**Value System Requirement 2: CNO's Absolute Faith in the Emerging Technology**: The authority of the advocate of the emerging technology is decisive. Watson, Jr. trusted the authority of CTO Birkenstock (who was no engineer or scientist) so much that he could override the unanimous recommendation of the hand-picked 18 Systems Experts.

### 11.8.2 INPUT CONTENT IMPROVEMENT

**Input Content Improvement 1. "Precursor Events" supporting Feasibility:** Eckert and Mauchly developed the ENIAC at University of Pennsylvania in 1946. Next year, they left the University and set up a company of their own:

"[B]efore long it was clear that they were good salesmen as well as brilliant engineers. They named their new machine the Universal Automatic Computer, or UNIVAC, and claimed it was going to be useful in both the laboratory *and* the accounting office.

"I knew what was upsetting Dad the most about the UNIVAC design. He felt it was an insult to our main selling proposition: the IBM card itself. Eckert and Mauchly were saying that **punch cards** were **not appropriate** for use with modern electronic equipment. Instead, the UNIVAC was going to store data on the new [still largely unproven] medium of **magnetic tape**"[34]

**Input Content Improvement 2. Framing of Feasible Operational Events**: "The first UNIVAC wasn't due to be ready for years, but with nothing more than a paper description Eckert and Mauchly won financial backing from **two**

**of our ten biggest customers**-the Census Bureau and Prudential Insur-ance-and at least one other insurer besides. When Dad found out about that, his skepticism turned into fury.

"*It is **an indictment against IBM** to have these two fellows backed by those insurance companies*!" shouted Watson Sr. to Frank Hamilton, one of the senior engineers. [A week later] Hamilton presented an ambitious plan for a machine to go up against UNIVAC [costing] $750,000 to build (vice the average installation cost of $20,000). Frank Hamilton's design died on the ta-ble while **Dad told the marketing men to call on Prudential** and persuade them that the UNIVAC idea was not sound"[35](Emphasis added).

## 11.8.3 OUTPUT CONTENT IMPROVEMENT

**Output Content Improvement 1. Time-line of (Results/Resources)**: When the average IBM system cost $20,000, Watson, Jr. authorized a $3,000,0000 gamble on the Defense Calculator. What was the yardstick that would measure the output of the $3 million investment?

The Industrial Sales of Defense Calculator were a resounding success. It told IBM that the largest project in its history was well worth the risk, be-cause it established a new market for a quantum jump technology-based new product

**Output Content Improvement 2. Resources Commitment:**

What should be the budget for the emerging technology of computers, repre-sented by the Defense Calculator?

"How much is this going to cost?" I [Watson, Jr.] said. "For the design and a prototype, three million dollars," he [Birkenstock] said. "For the whole program, three or four times that."

"What he was talking about was by far the **most expensive project in IBM history**: ten times the size of Dad's SSEC.

"We had the money... **I was on my own** [with respect to] a three-mil-lion gamble-a sum as big as IBM's entire research budget two year before. So I said to Birkenstock: "Let's go ahead."[36]

## 12. Concluding Observations

How should the CTO/CNO pursue his/her memory management? Can we retrospectively reconstruct the Memory Management elements/process of Watson, Jr.; or of Churchill; or of other CTOs/CNOs? Could there be a cor-pus of Corporate Memory Management which differs from the corpus of Country Memory Management?

**Memory
Management in
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Decisions**

Before tackling Memory Management by CTOs/CNOs, we retrospectively reconstructed my creating two new professions and two new protocols demonstrated in 101 Case Studies. How did a news item on the Internet lead me to define a new profession and develop 51 Case Studies?

In retrospect, I identified four critical elements: (1) **Associate** [subsequent ideas with antecedent idea[s]), and (2) **Integrate** the subsequent ideas with antecedent ideas, so that a (3) **trigger** will facilitate the integrated ideas jumping onto a higher curve of performance characteristics/values to [4] **transcend** existing boundaries of thought/action.

The integration, in my case, generated a jump onto a higher curve of performance characteristics/values, as when a drab, crawling caterpillar is transformed into a multi-colored flying butterfly. The quantum jump puts the entity on a new **dimension** (flying) which is discontinuous (**disequilibrium**) from the previous dimension (crawling). Dimension is the discreat/discontinuous jump in the conceptual/operational, qualitative/quantitative attribute/characteristic/factor of individual elements/entities and/or interactive relationships.

We developed an **established sequence of ordered procedures (Protocol)** of memory management. We found that the 4 critical elements developed into 8 <u>**M**</u>emory <u>**M**</u>anagement <u>**D**</u>isequilibria <u>**D**</u>imensions $(MD)^2$ **Protocol:**

| | |
|---|---|
| $(MD)^2$ Step 1 | CNO will to win |
| $(MD)^2$ Step 2 | Antecedence of Negative ideas |
| $(MD)^2$ Step 3 | Authority of Countervailing Ideas |
| $(MD)^2$ Step 4 | Subsequent Positive ideas |
| $(MD)^2$ Step 5 | Integrating Subsequent Ideas with Antecedent Ideas |
| $(MD)^2$ Step 6 | Quantum Jump of Integrated Ideas |
| $(MD)^2$ Step 7 | CNO Decision to Dare |
| $(MD)^2$ Step 8 | Memory Management Improvement |

These 8 $(MD)^2$ Steps helped explain a **Country Survival Decision** (Churchill betting on yet unproven British Radar in 1937), and a **Corporate Survival Decision** (Watson, Jr. betting on yet unproven computer industry in 1948). Had the CNO not made the Decision to Dare that he did, and had he not committed a significant segment of the resources of the Country/Corporation, Great Britain would have most probably been defeated and would have ceased to exist as a Sovereign Country, and IBM would have been a long-forgotten footnote to history.

1. Both the country survival decision and the corporate survival decision were based on the CNO committing significant resources to **quantum jumps**

in technology. Radar Detection of approaching enemy aircraft was definitely a quantum jump over volunteer "spotters" peering into the sky from roof-tops. Magnetic tape permitting **re-writing** was a quantum jump over punched cards **writing** in fixed fields.

2. Both quantum jumps were **operationally unproven** when the CNO had to risk substantial resources. Churchill rewrote the entire plans for the air defense of Great Britain round the assumption that the promises for radar made by British scientists would be kept. Watson, Jr. felt in his gut that IBM should get into computers-a visceral compulsion-when the promises made by the inventors for the computer would be years away from fulfillment.

3. "The **most expensive project** in IBM history" was how Watson, Jr. characterized the size of the $3 million commitment to the Defense Calculator. Churchill does not specify the radar budget, but says: "I made sure by **turning on my power relay**, that some at least of these terrible and incomprehensible truths emerged in executive decisions." [ensuring ample funds, equipment and personnel].

4. Retrospectively, how did Churchill/Watson, Jr. run his Memory Management so that he would make the quantum jumps in technology with the sparsest of evidence?

Both CNOs had abiding **faith in** their respective **organizations**. Watson knew deep down that there was nothing that IBM couldn't do. Churchill knew that when the military and political needs are explained, science would always come up with something: "**My experience** is that in these matters, when **the need is fully explained** by military and political authorities, **science is always able to provide something**"

Says Watson, Jr: "It was the biggest, riskiest decision I ever made, and I agonized over it for weeks, **but deep down I believed there was nothing IBM couldn't do.'**

5. Both CNOs had the **will to win**. At the beginning of World War II even when Britain had hardly a handful of aircraft, and Germany had a mighty armada of Luftwaffe, Churchill was talking about "the methods which **can be invented or adopted or discovered** to **enable the earth to control the air.**"

IBM was king of the punch cards when Watson, Jr. felt in his gut that IBM should abandon the safe harbor of punch cards and venture into the unknown, rough seas of the computer. Eight years later, IBM was king of the vacuum tube computers, enjoying 80% of the world market, when Watson, Jr. felt that IBM should obsolete the $2^{nd}$ generation computer systems which were generating steady revenue and solid profit, and dive head first into the unknown, turbulent seas of the $3^{rd}$ generation computer systems. Watson was determined to win the market.

6. Both CNOs, figuratively speaking, "**knew their enemy**-"the "enemy" of the quantum jumps they earnestly hoped and prayed for. Prime Minister Baldwin said openly that there was no defense against the bomber which will always get through. Churchill's reaction was that decision-making should be removed from the hands of the enemy: The Air Ministry and the Prime Minister. It should be placed under broader political oversight where Churchill could wield power

To Watson, Jr., the staunchest "enemy" of IBM entry into computers was Watson. Sr.'s adamant belief in the invincibility of punch cards and the superiority of IBM research. Knowing the enemy, Watson, Jr. carefully crafted his strategy of attack—not directly, but through supportive evidence. While Controller Williams had not consulted Watson, Jr., Williams' disclosure to Watson, Senior that IBM was investing 25% less in R&D than its competitors served as a decisive turning point. Again, Watson, Jr. presented the biggest IBM project with 11 orders in hand for the new product and 10 prospects. Know your enemy so that you can counter the Antecedent Negative ideas.

7. Both Churchill and Watson stored inputs into [longer-term] memory so that they could be instantly accessed to elevate strands of data in [short-term] memory into quantum jumps in distant technology.

Dr. R.V. Jones' briefing Churchill on radar sounded to the Prime Minister as weaving fact and fancy. Nevertheless, Churchill's [long-term memory] input about the dependability of science to always meet/beat the politico-military needs put the [short-term memory input] into the most optimistic light possible.

Says Watson, Jr: "It was the **success of the 604 Electronic Calculator** that **convinced me** that **electronics was going to grow much faster** than anyone had anticipated."

The [short-term memory input] was transmuted into the affirmation of a quantum jump into computers because his [long-term memory] said that there was nothing IBM couldn't do.

Indomitably optimistic long-term memory overrides most short-term memory negatives.

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