Bootstrapping Organizations into the 21st Century
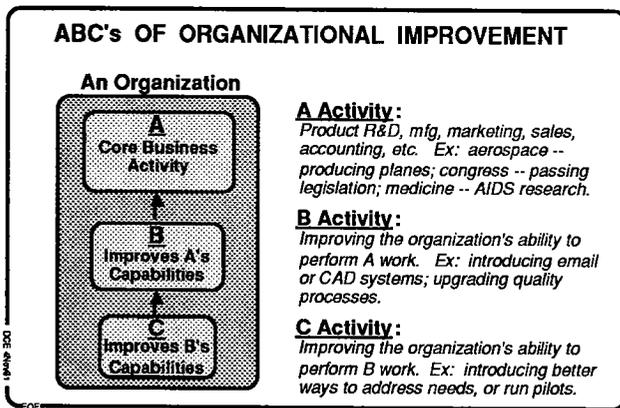# A Strategic Framework

Douglas C. Engelbart
Bootstrap Institute
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Positioning organizations to meet the unprecedented challenges of the 1990's and beyond will require sweeping changes in every facet of organizational life. It will not be a simple matter of replacing our existing work structures, procedures, and technologies. What is required is a *strategy for organizational fitness*, including leveraging limited resources to effect dramatic, rapid, and continuous improvement.

The following outlines a comprehensive strategic framework for *bootstrapping organizations into the 21st century*, and an explicit proposal for launching an exploratory pilot implementation of this strategy.

ABC's of Organizational Improvement

Given the shifting nature of organizations, the increasingly complex and urgent global market forces, and the virtual bombardment of end users by vendors and consultants, organizations must keep getting *faster and smarter* at identifying and integrating improvements into their every day life. Improving this *improvement capability* should be a key element in every organization's improvement strategy:

ABC's OF ORGANIZATIONAL IMPROVEMENT

An Organization

A
Core Business Activity

B
Improves A's Capabilities

C
Improves B's Capabilities

A Activity:
Product R&D, mfg, marketing, sales, accounting, etc. Ex: aerospace -- producing planes; congress -- passing legislation; medicine -- AIDS research.

B Activity:
Improving the organization's ability to perform A work. Ex: introducing email or CAD systems; upgrading quality processes.

C Activity:
Improving the organization's ability to perform B work. Ex: introducing better ways to address needs, or run pilots.

How an organization explicitly improves its improvement capability.

As a minimum, organizations must adopt a permanent and highly-coordinated *B Activity*, responsible for continuously identifying and implementing candidate improvements to the core business activity.

But the current means of developing and transferring improvements are not adequate for the scale and rate of change faced today. Organizations need to learn more effective ways of assimilating dramatic improvements on a continuing basis. They need to get better at understanding requirements, surveying, evaluating, selecting, integrating, developing, testing, and applying the improvements. And they need to

A key to the long-term vitality of an organization -- to get better and better at improving itself.

get better and better at deploying the improvements into rapidly shifting organizational targets -- identifying suitable pilot groups, planning the training program, running and evaluating the pilot results, learning how much to introduce, how quickly, how to overcome cultural barriers, and how to quickly incorporate lessons learned.

To improve this B Activity improvement capability, organizations will need to invest in an explicit ongoing *C Activity*. A key to the long-term vitality and competitive edge for an organization will be to get better and better at improving itself.

Extra "Bootstrapping" Leverage

Ideally the C Activity should focus on improving generic capabilities which boost all three Activities (A, B, and C). For example, a key strategic target early on would be to improve how an organization:

- identifies needs and opportunities;
- plans and deploys solutions;
- incorporates lessons learned.

Since these basic knowledge-work capabilities are central to effective A, B, *and* C work, improving them would boost both the *job capability* and the *improvement capability* simultaneously, thus providing extra compounded investment leverage, or *bootstrapping* leverage.

Concurrent Knowledge Work

As complexity and urgency increase, the need for highly effective knowledge-work capabilities will become increasingly urgent. Increasing pressure for reduced product cycle time, and for more and more work to be done concurrently, is forcing unprecedented coordination across project functions and organizational boundaries. Yet most organizations do not have a comprehensive picture of what knowledge work is, and which aspects would be most profitable to improve.
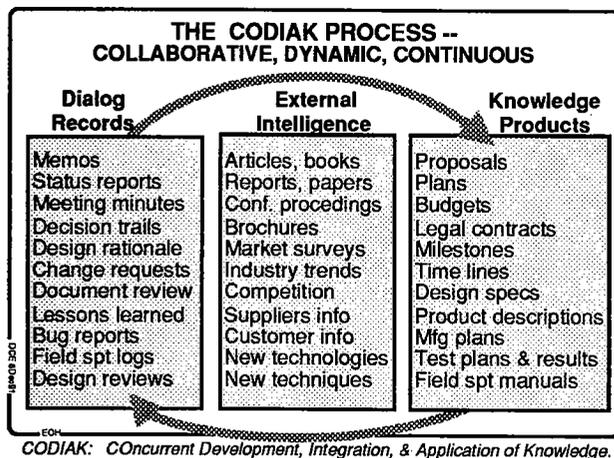
The objective of most knowledge work is to determine and describe what needs to be done, and how and when it will be accomplished -- i.e. to identify needs and opportunities, plan and deploy solutions, and incorporate lessons learned.

Identifying Needs and Opportunities: An alert project group, whether classified as an A, B, or C Activity, always keeps a watchful eye on its external environment, actively surveying, ingesting, and interacting with it. The resulting *intelligence* is integrated with other project knowledge on an ongoing basis to identify problems, needs, and opportunities which might require attention or action.

Planning and Deploying Solutions: Responding effectively to needs and opportunities involves a high degree of coordination and *dialog* within and across project groups. The resulting plans provide a comprehensive picture of the project at hand -- e.g. new products and services, improvements to existing products and services, or solutions to a specific problem situation. These plans, which are iteratively and collaboratively developed, represent the *knowledge products* of the project team, and constitute a roadmap for implementation and deployment.

Incorporating Lessons Learned: The planning process is rarely a one-shot effort. Lessons learned, as well as intelligence and dialog, must be constantly analyzed, digested, and integrated into the planning documents throughout the life cycle of the project.

For lack of a better term, I call this basic knowledge-work process a *CODIAK* process, for the COncurrent Development, Integration, and Application of Knowledge. The resulting operational knowledge base, consisting of intelligence, dialog records, and knowledge products, is continuously updated, used, and re-used by many players, concurrently and over time:

THE CODIAK PROCESS --
COLLABORATIVE, DYNAMIC, CONTINUOUS

Dialog Records	External Intelligence	Knowledge Products
Memos	Articles, books	Proposals
Status reports	Reports, papers	Plans
Meeting minutes	Conf. procedings	Budgets
Decision trails	Brochures	Legal contracts
Design rationale	Market surveys	Milestones
Change requests	Industry trends	Time lines
Document review	Competition	Design specs
Lessons learned	Suppliers info	Product descriptions
Bug reports	Customer info	Mfg plans
Field spt logs	New technologies	Test plans & results
Design reviews	New techniques	Field spt manuals

CODIAK: COncurrent Development, Integration, & Application of Knowledge.
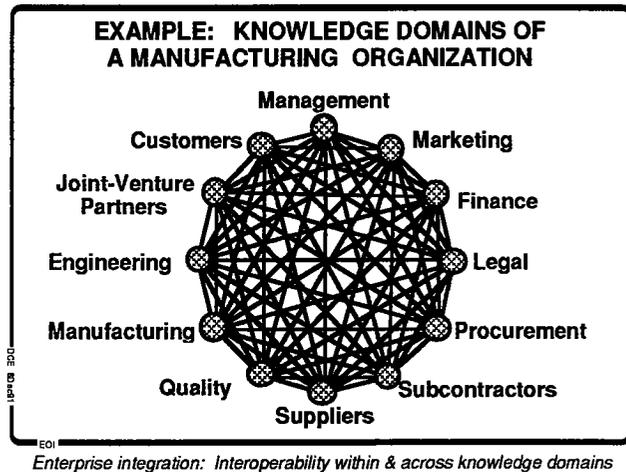
This knowledge base represents a valuable corporate asset. And yet, many of its crucial elements, such as decision trails and intelligence collections, are generally *not* recorded. Even minor inadequacies in the CODIAK process can be extremely costly in terms of:

- slip-ups in version control;
- lapses in project "memory" (e.g. design rationale);
- delayed access to important intelligence;
- non-optimal collaboration on design decisions.

> *This knowledge process is the driving force of the organization, and the resulting body of knowledge represents a valuable corporate asset.*

The Concurrent, Integrated Enterprise

Almost every effort in the organization is immersed in, or impacted by, an ongoing CODIAK process. And each organizational unit's knowledge process and knowledge products -- whether individual, project team, functional unit, program, department, division, task force -- are part of a larger effort within and even outside of the organization:

EXAMPLE: KNOWLEDGE DOMAINS OF
A MANUFACTURING ORGANIZATION

Management
Customers — Marketing
Joint-Venture Partners — Finance
Engineering — Legal
Manufacturing — Procurement
Quality — Subcontractors
Suppliers

Enterprise integration: Interoperability within & across knowledge domains

This nested web of concurrent knowledge-work is especially evident in complex R&D and manufacturing environments, where close coordination via concurrent engineering, or total quality management, is increasingly critical. And in the case of joint ventures, each knowledge domain must integrate its CODIAK work within, and also across, organizations.

The CODIAK process is the driving force of the organization, providing direction and momentum for new or renewed organizational efforts. Giving knowledge workers new capabilities for coordinating their work concurrently, with instant access to the correct document, and all the supporting intelligence and dialog trails which led to key decisions, could dramatically reduce product-cycle time and improve first-time quality. Significantly improved CODIAK capabilities, applied within the C, B, and A Activities of an organization, offer powerful bootstrapping leverage for improving overall effectiveness, productivity, and fitness.

An Open Hyperdocument System (OHS)

As more and more of the CODIAK process work moves *online*, and more of the work is done concurrently using a hodgepodge of workstations, networks, application packages, and utilities, organizations will be faced with a whole new set of challenges for coordinating the enterprise knowledge work.

A strategic solution to these challenges begins with a *hyperdocument system*. The *hyperdocument* refers to multimedia files which support many object types, including hypertext links, hyperdocument e-mail, and online hyperdocument publishing (library) with automated cataloging and version control. Links should be easily created, human-readable, and printable. Files should have structure, and objects should be independently addressable within a file, with zooming in and out and other on-the-fly custom views. Personal signature encryption and suitable privacy provisions should also be supported.

A hyperdocument system should enable flexible collaborative development, integration, application, study, and re-use of CODIAK knowledge *online:*

**AN OPEN HYPERDOC SYSTEM:
SHARING FILES & SHARING SCREENS**
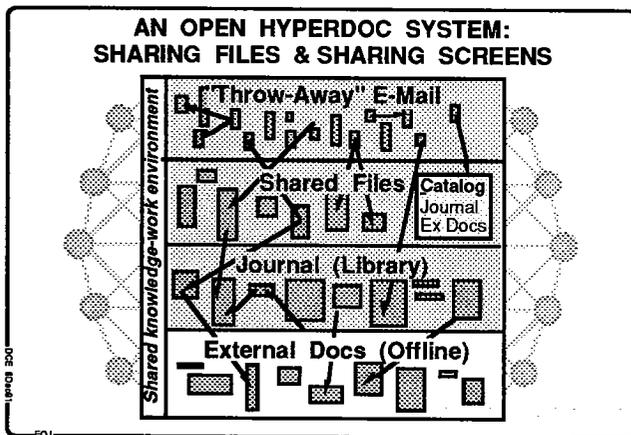
*"Hyperdoc" provides flexible linkages to any object in any multi-media file;
"Open" provides vendor-independent access within and across work groups.*

Ultimately, the hyperdocument system will need to be an *open hyperdocument system* (OHS), allowing for an integrated "seamless" multi-vendor architecture where distributed diverse knowledge workers can share hyperdocument files, and share screens, regardless of each worker's particular hardware/software configuration.

This interoperability must extend across departments and across organizations to include customers, suppliers, and joint-venture partners. Furthermore, within the integrated enterprise of tomorrow, standard provisions must exist for links between OHS documents and objects within other enterprise data forms (e..g. data bases, CAD models). An OHS should provide totally interoperable CODIAK support for a truly concurrent, integrated enterprise.

The Co-Evolution Approach

An OHS would go a long way toward providing much needed improvements to the CODIAK process. However, most capabilities are improved, or *augmented*, by many interdependent technical and non-technical elements, of which tools make up only a small part:

AUGMENTATION SYSTEM
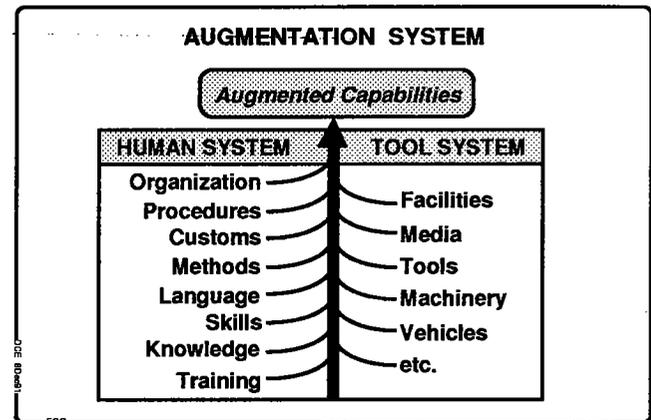
Augmentation: Continuous co-evolution of human-tool capabilities.

Until recently, we got by with improving selected elements of the Augmentation System in isolation, assuming that the other elements would eventually adapt "on their own".

But with the recent computer revolution, many organizations' Augmentation Systems are now heavily weighted with point-solution technology, seriously overpowering the human-system elements. Tools are being introduced to automate methods that evolved around now-obsolete tools, and vice versa. Many tools are not being harnessed effectively for lack of appropriate, well-evolved methods.

As the complexity and urgency of our improvement programs increase, this tactically-limited trend will prove to be very costly. Until we significantly stretch our perception of the scale and pervasiveness of change-opportunities in the human-system side of the equation, the organizational stresses from unbalanced Augmentation Systems will worsen, and the truly significant improvements in organizational capability will be forestalled.

The OHS requirements described above are based on 20 years of experience with an early OHS prototype used in large pilot trials in government and aerospace organizations. These requirements are recommended as a baseline starting point only. There is *much* more to be learned about the rigorous use of an OHS in a wide-area, distributed CODIAK process. The human-system elements -- all the methods, procedures, conventions, skills, etc. -- must be highly developed, in close association with the continuing evolution of OHS requirements.

Exploratory Pilots

To intensify and *accelerate* the human-tool co-evolution process, intensive pilot environments must be established by the C and B Activities. The C Activity should operate as the first pilot *outpost* of the organization, evolving the advanced methods and system prototypes to support its own intensive CODIAK process, and paving the way for subsequent pilot operations. Flexibly evolving OHS research prototypes will be required to support the advanced pilot exploration in a wide variety of application areas (e.g. CASE, concurrent engineering, total quality, CSCW). The resulting experience will feed the requirements definition for future prototypes, for products and services, and for the standards that will ultimately be required to support a truly integrated and interoperable OHS architecture. The experience will also serve to maximize the relevance, applicability, and transferability of the resulting products and services, rendering increased cost-effectiveness for end-user organizations and vendors alike.

Now, who will be responsible for this exploratory work? Vendors? End-user organizations? Universities? Government?
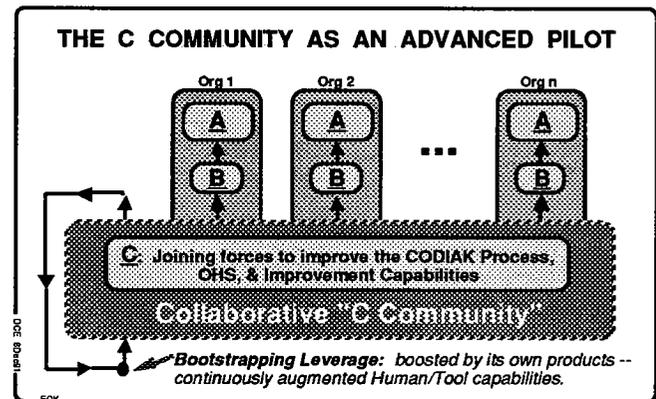
C Activities Joining Forces

Ultimately, C Activities from a wide range of enterprises will need to join forces in a cooperative *C Community* to collaborate on common activities. This is feasible because most C Activity is generic, not proprietary. It is highly desirable because creating a vibrant pilot environment to support this work will be very costly. By pooling resources, members can spread the risk and spend less to get more -- including attracting resources that would otherwise not be available -- thus freeing up more internal resources to further invest in their proprietary B and A Activities.

Joining forces is also *necessary* for dealing appropriately with the increasingly complex interoperability requirements between enterprises. For instance, understanding the requirements for an OHS, developing a procurement approach for OHS prototypes to support planned pilot usage among Community Members, coordinating the planning and operation of such pilots, and integrating the lessons learned seems the most promising way to yield the desired results. And coordinating the standards requirements for interfacing or integrating applications software and utilities can only be accomplished by extensive cooperation among user organizations and vendors.

Such a *Bootstrap Initiative* would provide a common focus for user organizations, vendors, consultants, government agencies, and universities. Operating as an advanced pilot, or living prototype of its work, its results would be directly transferable to member organizations:

THE C COMMUNITY AS AN ADVANCED PILOT

Bootstrapping Leverage: boosted by its own products -- continuously augmented Human/Tool capabilities.

A *Bootstrap Initiative* offers the most direct, high-leverage, cost-effective path for bootstrapping organizations. But individual organizations *can* get started on their own, even before an Initiative is formally launched. They can begin by forming an explicit C Activity, headed by a responsible high-level executive, and staffed and advised by stakeholders from representative B Activities, to integrate the bootstrap strategy with their own strategic planning efforts. They can start planning for selected exploratory pilots, using off-the-shelf hyperdocument systems, and begin to test out the concepts and strategies described here.

The sooner organizations launch on a strategic path toward high-performance organizational fitness, the sooner the benefits can be achieved. Where does *your* organization stand?

"I would encourage you to take part in the Bootstrap Initiative."
(Patricia Seybold, PS, April '90)

About the Author. Dr. Douglas C. Engelbart has a 30-year track record as a visionary and pioneer of integrated information systems and organizational augmentation. Well-known contributions include the mouse, display editing, windows, outline/idea processing, hypermedia, and groupware, with early prototypes in full operation under the NLS/AUGMENT system by 1968. In the last decade, thousands of industrial knowledge workers have benefited from its unique team support capabilities, more recently in internal pilots within McDonnell Douglas. Dr. Engelbart is currently Director of the Bootstrap Institute in Palo Alto, CA, dedicated to launching the Bootstrap Initiative. He is also an associate at Stanford University's Center for Design Research, where he runs the 3-day management seminar "Bootstrapping Organizations into the 21st Century". Engelbart has received several awards for outstanding lifetime achievement and ingenuity.