Session 4: *The International Markets, Networking/Marketing and Selecting the Appropriate Project Delivery System*

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Session 4: *The International Markets, Networking/Marketing and Selecting the Appropriate Project Delivery System*

1. Introduction

In the first three sessions we discussed the broad forces and issues impacting and likely to impact the global AEC field and their implications.

Today we will begin getting into the nitty-gritty details of identifying markets and potential partners, developing appropriate strategies and launching and successfully managing one or more foreign operations or initiatives.

Many AEC managers continue to labor under the mistaken impression that marketing technical, professional and construction services and concessions globally is not really that different from how one does it at home. In the case of the AEC field, you simply mail out some prequalifying material, advertise if you have the resources, make a short visit to introduce the company to prospective clients and then sit by your fax machine or look at your e-mail or website screens. But, opportunities do not come in over the transom any more - even at home - like it used to in the "good ole' days."

2. New Opportunities and Marketing Targets

The Markets

As we discussed in Session 1 and 3, the global AEC marketplace is now far more complex. As late as 1980, it essentially included:

- domestic public and private markets;
- the developed/industrialized (OECD) countries' public and private markets;
- newly industrializing/emerging country markets, essentially multi- or bilateral-funded though host market clients, were increasing in importance;
- the poorer undeveloped nations where the market was limited to multi- or bi-lateral donor-funded assignments or natural resource development;

- the command economies, usually host government or export promotion-funded (export credits, etc.) which, except perhaps for Cuba and North Korea, no longer exist.

While this is the classic definition of the post-World War II markets, what other definitions might now apply and what are the implications?

There currently, unfortunately, is no single all-embracing, all-purpose, one size fits all, market strategy when you operate on the global stage. A bewildering number of new market segments or niches have arisen to confuse and cloud strategies.

These include, in addition to the traditional planning, architectural, engineering and construction services:

- program and investment managers for large initiatives formerly the purview of governments;
- advisory services for the sale, purchase, management and operation of public assets;
- construction management, once essentially limited to private clients and a few public agencies, now widely adopted by both governments and concessionaires;
- independent consulting architects and engineers;
- independent design checkers;
- technical advisors to lenders, governments, concessionaires, etc.;
- loan certification;
- concessionaires;
- concession audit specialists;
- estate and property managers; and
- advisors to real estate and other investors;

… to name but a few.

Furthermore, with the rise of privatization, the private client market once limited to OECD-based clients and third world natural resources exploitation, with few notable exceptions (Taiwan, Brazil and, perhaps Turkey and India), now applies,

as The Berger Group readily knows, to even Mauritania, Mali, Ghana, Jamaica, Ecuador, Laos, Bolivia, Peru, Nepal and Cambodia where numerous privatize initiatives are currently underway. The command economies are no longer significant and, with these market shifts, have come, as noted, a bewildering number of opportunities in addition to traditional planning, design and construction supervision.

Furthermore, each of these discrete opportunities and marketing targets has not simply a need to solve a problem, but often distinctive ideas on how to choose the most appropriate problem solver. To market your or your company's services or investments internationally – to become the approved "problem solver" - requires the same care and insights that you apply in your domestic markets. But, at home you are so thoroughly familiar with a client's likely preferences, prejudices, taboos, business practices, legal, moral and cultural constraints, etc., that you sub-consciously incorporate those constraints and considerations into your marketing strategies. But in a foreign environment, comparable elements are also present and they are additionally impacted as we discussed in earlier sessions by historic, religious, gender and ethnic concerns which will, and should, influence and guide your approach in each particular marketplace.

b. Peacekeeping and Nation Building

From 1944 to 1988, as we know, much of the world was divided into two separate and antagonistic camps – the Soviet Union-led Warsaw Pact and U.S.-led NATO and SEATO pacts. The balance, often called the Third World, watched in fear as these two atomic superpowers confronted each other with terms such as "mutually assured destruction" and "doomsday strategies" loosely thrown around. This fear of a nuclear war, however, often led many observers to overlook the fact that the Cold War was the longest period of peace in Europe's history. While there were a number of peripheral wars, e.g., Korea, Vietnam, Angola, Eritrea, Sudan, Afghanistan, they were often fought by one or more proxies and, in fact, the two major powers never fought each other. But, given the fear of nuclear conflagration, the world approached the end of the Cold War with great optimism, many hoping humankind was now entering a period of sustained peace and prosperity.

However, much to the surprise of many, the anticipated "peace dividend" proved fleeting. The post-Cold War period has been characterized by the re-emergence of a surprising number of communal, regional, religious and ethnic conflicts and strife that had earlier been contained or kept under relative control by the two principal powers.

Such communal/civil strife is arising with increasing frequency and viciousness, often including ethnic cleansing, crimes against humankind, etc., and accompanied by large scale barbarism, e.g., Cambodia, Sierra Leone and Bosnia, producing large numbers of refugees and growing humanitarian concerns.

Andrew Natsios, the USAID Administrator, estimates, "At least two-thirds of the world's population now lives in areas that are unstable or fragile."

The United Nations and the major powers have had to address these concerns and with it, a large and increasingly important activity and market for AEC providers has emerged – that of peacekeeping and nation building – and it's important that you understand as future managers of the Built Environment, the causes and complexities of these communal and civil wars, as well as the opportunities they present for major architects/engineers/contractors under the mantle of nation building.

Typically, these activities and opportunities can be separated into three stages. The first is the immediate post-conflict, or even during the strife, when large scale population movements occur and refugees, food, shelter and supply shortages arise. This is accompanied by great attention, concerns and demands for emergency refugee relief, often sponsored by non-government organizations (NGOs), as well as the United Nations, the Red Cross, and individual international relief and bilateral aid agencies. This period requires construction of emergency camps and sanitary facilities and provision of food, supplies, shelter and other basic human needs.

The initial phase is often followed, and they may overlap, by a rehabilitation and reconstruction period where critical facilities and infrastructure must be rebuilt as quickly as possible. Refugee camps become more permanent and efforts are typically made to return many of the refugees.

Finally, the third, and most important phase, nation building, involves political, social, economic and construction initiatives to support reconstruction while fostering long-term economic developments, improving governance and transparency in government, strengthening critical institutions, encouraging further refugee return and building a new society to, hopefully, avoid or resolve the conflicts that created the earlier difficulties.

In each of these phases, there are increasing opportunities for global AEC providers. During the first or refugee rehabilitation period, camps have to be quickly constructed and supplied; water, sewerage, power, roads and airports established or rehabilitated; supplies transported via truck, rail or air to the area, etc. A number of contractors and consultants are increasingly serving the United Nations and other emergency relief providers in these areas. In addition during this period, there is often a need for peace-making or peace-keeping forces and these are increasingly accompanied by contractors, and consultants e.g., Kellogg Brown & Root, Perini, Fluor, AMEC, CH2M Hill, URS, providing so-called "logcap" or support to the U.S. military, along with the Corps of Engineers and the Seabees, and comparable non-U.S. military construction groups.

During the second phase, as we've seen in Iraq, Afghanistan, El Salvador, Sudan Bosnia, Macedonia, Kosovo and Croatia often large program management-type

contracts to undertake the rehabilitation or reconstruction effort, are issued. Here, critical decisions often have to be made as to speed of reconstruction - the maximum use of foreign equipment and skills vs. cost - use of smaller contractors, breaking contracts down into smaller components, training and strengthening local construction firms, at the very same time when reconstruction is proceeding, etc.

But, these clear trade-offs, often in time vs. cost, must be made at a time those responsible for the reconstruction are typically criticized for delays by observers who often fail to recognize how long it really takes to successfully launch such reconstruction efforts. Here, they need only look at various European and U.S. natural disaster recovery programs (e.g., Katrina) to understand how long such efforts take.

As a result, there is always a tendency to criticize delays and encourage accelerated expenditures. However, such programs can create significant problems and distortions by paying large salaries while the remnants of the former government often either cannot pay salaries or actual wages are lagging after a period of inflation often accompanying warfare. As a result, teachers, government employees and administrators and professors' salaries are quite low and when the rehabilitation and even more important, the reconstruction phase is launched, salaries are quickly bid up and significant shifts in the wealth of the country occur. Taxi drivers earn more than senior government employees and professors, bilingual secretaries earn far more than schoolteachers, staff working in restaurants and bars quickly outpace other traditional and more respected fields, often leading to a loss in esteem for the traditional middle and upper-middle class, while distorting the use of resources and slowing the long-term development effort. But, there is a need to mobilize the most qualified expatriate staff as quickly as possible during these periods and the emergency refugee support and rehabilitation, as well as the reconstruction community, has come to expect excellent services and support.

Furthermore, as noted during the reconstruction period as well as nation building, critical trade-offs have to be made as to the extent we are going to focus on the immediate reconstruction, often making maximum use of an expatriate workforce and equipment vs. the long-term needs to begin developing institutions, etc., e.g., the time-honored choice of giving a hungry person a fish and feed them for a day, or teach them to fish and feed them for a lifetime.

But, all these take time and governments during this period are relatively weak, corruption and cronyism may be a major concern and isolating the leaders who were contributors to or sympathetic to the former regimes is often a difficult (Iraq) exercise and the firms or organizations best equipped to do reconstruction and rehabilitation are not always the best firms to nation build.

Here, priorities become exceedingly important. For example, one must match the public works efforts with the proposed new or emerging government structure.

Are they going to establish a centralized, federal/state or commune-based governmental structure? If the latter, they are likely to give priority to smaller projects often in rural areas – schools, community centers – as was the model in Macedonia and Kosovo vs. a preference for larger projects, the model in Croatia. Thus, the reconstruction efforts should parallel the government organization one envisions.

The new fledgling government and the host country ministries and construction industry are also initially not likely to be able to handle large projects. To encourage their participation and contribution, the projects have to be broken down into smaller packages, possibly initially raising costs and extending schedules, and certainly raising administrative costs for expatriates and the donor/lending agencies dealing with the government.

Donor/lending agencies, at the same time, face a number of problems. For example, many such as the World Bank and Inter-American Development Bank, need an approved government borrower. One of the problems in Bosnia was that such lenders could not initially find a government borrower. Furthermore, donors typically meet in large donor meetings often led by foreign ministries where they make ambitious multi-million dollar commitments. But, each donor has its own schedules and procedures and marches to its own parliamentary and domestic concerns or, for the multi-laterals lending agencies, their boards and operating procedures. Often, these procedures are incompatible and difficult to merge into a single coherent integrated program and a great deal of time must often be spent merely coordinating the donor and lending agencies rather than addressing the host country needs. All of these occur at the same time the fledgling government is making critical decisions as to whether they are going to encourage free markets with minimum regulation which may trigger higher rates of economic growth, e.g., Russia, often accompanied by the rise of early predatory capitalism; encourage a more equitable income distribution at the price of some economic growth (Vietnam), or maintain state enterprises (China) while fostering private investments. Such issues must be decided while, as noted, addressing such critical policy issues as adopting a presidential vs. parliamentary system; a theocratic or secular state; a central, federal or communal political structure, etc. - all with implications for the nation building effort and for the role of the architect/engineer/ contractor.

But, despite these often daunting challenges, nation building is one of the most rewarding and rapidly growing of all the Berger Group's professional opportunities and we have provided assistance to a number of nations emerging from extended periods of civil strife, including Afghanistan, Angola, Bosnia, Cambodia, Croatia, El Salvador, Eritrea, Ethiopia, Ghana, Honduras, Kosovo, Liberia, Macedonia, Mozambique, Nepal, Nicaragua, Nigeria, Philippines, Romania, Sierra Leone, Sri Lanka, Sudan, Tajikistan, Timor-Leste, Uganda and the Democratic Republic of Congo. In these nations, we have the opportunity to help develop vital infrastructure, resettle refugees, and train government and private leaders following the development of new government structures.

Here, a firm can provide a full range of multi-disciplinary skills, including economic and social development; humanitarian aid; management; institution building; finance; environmental; architectural, engineering and construction services for these countries to grow and prosper. This area will be one of the most attractive and rewarding international opportunities for many of you.

To be successful, a nation builder must, as noted, be prepared to work on three different and distinct levels – meeting the immediate humanitarian concerns for food, shelter, health, safety and employment, while addressing longer term development needs – and all within the need to build viable economic, social, political and legal institutions, modern governance and a civil society. Here, the international manager must be guided by the need to carefully balance the immediate humanitarian requirements with those for long-term reconstruction, sustainability and social equity.

c. Natural Disaster Response

Natural disasters seem to be occurring with increasing frequency and severity (tsunamis, Katrina, Rita, etc.) in recent years. This might reflect greater awareness (CNN, etc.) in our global village, increased wealth increasing damage costs, growing population pressure on potentially fragile areas (mountainsides, flood plains, coastal areas, etc.), or a passing phenomenon.

But, it is creating demand for improved pre-planning and emergency response, as well as opportunities for AEC firms. The opportunities closely parallel nation building, though the primary impacts are more focused on the first stage, the emergency relief period; and the second stage, the rehabilitation and reconstruction effort.

Firms with nationwide or regional "open-end" or "standby" contracts with emergency responders (in the U.S. federal and state agencies like FEMA, SEMAs, EPA, the DoD, National and State Guards, DOE and other state and local agencies), as well as NGOs like the Red Cross, are in the best position to identify and successfully pursue such opportunities. But, there are also increasing opportunities for improved planning, monitoring and early warning communications, management, etc., at all levels. Data bases and management systems must be introduced to quickly and efficiently identify and mobilize police and public safety services, potential local responders, transportation providers, warehouses, logistics centers, and storage facilities, as well as critical temporary shelters. Rapidly and properly processing uprooted residents and claims is also essential, while improved coordination between federal responders who can quickly provide supplies and resources, and local responders to:

- Guide and ensure distribution

- Quickly collect the uprooted residents
- Ensure security and safety
- Cordon off or quarantine unsafe areas and services (water, etc.)
- Identify and enforce sacrifice areas (opening dikes, etc.)

…is needed.

And, during the rehabilitation and reconstruction period we must:

- Quickly restore essential services (schools, police, power, telephone, water, sewerage) in approved areas
- Decide which areas are to be rebuilt and to what standards, and which sacrificed or abandoned
- Move residents to more permanent or safer shelter and provide transition services and support
- Establish clear guidelines, standards, advice and supporting finance for the reconstruction and rehabilitation effort

…all demanding and daunting tasks and opportunities for AEC providers.

d. <u>The AEC Providers</u>

As I mentioned briefly in Session 1, until recently, most international architects, engineers and contractors conveniently fell into two categories - general and specialized firms. The general consultants and contractors typically maintained permanent offices abroad offering a wide range of architectural, engineering and construction services. The specialized firms frequently offered services in narrower, highly technical fields such as ports, airports, hydropower design, nuclear power, etc. Specialized firms typically prepare a larger portion of their designs in their home offices, while general firms are likely to execute a larger portion in the host country. But, in recent years, the distinctions are less significant, as most large firms have expanded their range of services to both OECD and emerging country clients and ensure continuity and maintenance of a permanent presence.

We discussed in Session 1, the origins of many architect/engineering firms. Here, it might be useful to review again the typical characteristics of an A/E, as well as construction firms in their home markets, the available opportunities and how these may differ from the requirements and demands in the global marketplace, so

we might better understand the challenges and risks that even the most successful domestically-based consultant or contractor face abroad.

In all three of the AEC fields, the most common characteristic in most domestic markets is the relative ease of entry. The markets are not capital-intensive and a start-up enterprise only needs to have some perceived skills, entrepreneurial ambition or vision, a target market – and it can be a mature market, although ideally it should be a new, rapidly growing one. The firm can initially enter the marketplace as a subcontractor where, for example, one or several professionals offer their services to larger firms at a price in between a salaried employee and the full billing rate the larger firm obtains for the services, thus building their Statements of Experience. They may not only be subcontractors to a larger consulting firm, but may work on specialized elements of a project such as soils, foundations, structures and now, security and terrorism threats. They might also test the markets by entering design competitions. Many such firms start while the founders are still at universities, as Dr. Louis Berger was, or even where the founder is working full or part time for large firms (Frank Lloyd Wright). So, there are a variety of ways to enter the field, and with a little luck, a nurturing environment, pluck and hard work, grow into a successful and profitable practice or enterprise.

What is a Nurturing Environment?

As we've discussed in Session 1, ideally you need an environment that encourages independent consultants, small contractors and subcontractors. The more public and private buyers there are, the more likely they are to avoid organizing large specialized internal staffs and turn to outside consultants or contractors. Even in a field dominated by large EPC or design/build contractors, there are attractive opportunities to provide specialized services, acting as the owner's representative, independent engineer or, as noted, an EPC subcontractor.

As important as the need for a varied and competitive market is the need for staff mobility. By its very nature, service organizations, especially A/Es, offer services that a client could provide in-house but would rather hire for their specialized skills, to avoid the ups and downs of maintaining permanent staff or working in non-essential fields where only dead-end or terminal staff positions are available, e.g., the head of facilities for even the largest auto manufacturer is rarely given the opportunity to move into the company's core practice of designing, building and marketing automobiles. Furthermore, with the trend to "virtual" downsized organizations, outsourcing opportunities are increasing in both the public and private sector, as we've noted. But, in order to provide such services, a society and economy must encourage labor mobility and here, the current-day U.S., U.K. and Canadian societies and, to a lesser extent, Holland and Sweden, encourage such mobility, while France, Spain, Italy, Germany and Japan, following older industrial models focused more closely on large enterprises and protecting workers' rights, have discouraged labor mobility; placing serious constraints on the development of modern service sectors.

Another characteristic of the AEC field is "ease of entry." You hear that most consulting firms, for example, have relatively low profit margins and the field is unattractive. However, there are two elements to return on investment. One is the margin of profit or profit as a percent of sales, and the other is the return on capital, with the latter quite sensitive to the amount of times an enterprise is likely to turn over or use its capital and debt (enterprise value). Many small- and medium-sized consulting firms and contractors employ a variety of tools that allow them to turn their enterprise value anywhere from 6 to 14 times annually. So even a modest AEC firm earning 2% on sales turning their capital 10 times is, in fact, annually earning 20% on their capital. This can be accomplished in part through partnership, ESOPs and bonus systems which defer the payment of what is essentially salary until the following year or, in the case of an ESOP – years, allowing the enterprise use of those funds in the interim.

You will often hear, especially from larger firms, of the need for "growth" capital. But, at Berger we have developed a relatively simple model that indicates that until an architect, engineering or construction firm is growing internally in excess of 8-12% a year, if an AEC firm is properly managing its funds, it is unlikely to need additional capital. This, plus the relative ease of initial entry, helps explain why there are over 7000 engineering consulting firms in the U.S. The same applies in the architectural, as well as construction, fields where, as we discussed in Session 3, of the 700,000 construction firms in the United States, 62% employ under 5 people. The modest size, combined with the ability of many construction firms to front-load bids so payments are often received in advance of the actual work performed allows many firms to minimize their capital requirements. The risk, of course, in both cases is that the same high degree of leverage can work negatively, as we've seen, for example, in the case of the Washington Group International, Atkins and IT, one reason the U.S. public capital markets were until recently relatively cautious in valuing AEC firms.

The International AEC Market Characteristics

But are these same skills readily transportable to the international field? Here we are looking at long lead-time marketing, development of relationships and establishing relatively expensive overseas offices and training programs. For example, a senior expatriate's support costs in a place like Hong Kong in the form of car, driver, secretaries, housing allowance, vacations, school education for children, etc., can easily exceed the total salary a firm would pay in a home office for similar services. And, while these costs are not a difficult burden for a large manufacturer that is not particularly technical or managerially labor intensive, e.g., a large international chemical or auto plant may require 3-5 expatriates, it is quite expensive when you are competing for design work against local firms. Further, firms face more extended payment cycles, compounded by difficulties in dealing with varied and, at times, blocked currencies. Thus, in addition to all the cultural, legal and foreign issues and pitfalls we have discussed, managers must accept the fact that the model of turning capital 6 to 14 times in a developed

country with ready access to supplementary bank loans when needed, does not apply, certainly for initial efforts overseas where capital turns can fall as low as 2-3.

In construction, the same limitations apply. Frequently, the successful contractor entering the international field has made its name for technical competence, quick response, ability to identify attractive niches, etc., in their domestic markets, rather than relying on the financial, legal, and diplomatic skills and clout, more critical to success in the international markets. But, the opportunities to enter international markets as a subcontractor are more limited; potential partners, often less than robust financially; with greater difficulties in arranging supplier credits, bonds and guarantees than in OECD countries and with often less efficient banks and service agencies charging more to provide comparable documents or instruments. These constraints all increase costs, but more importantly, increase capital requirements for enterprises that initially prospered by quickly turning over their capital while successfully addressing other issues.

Furthermore, many of the emerging markets have within recent memory a history of colonialization, invasion or subjugation. The colonial period has brought about two, often conflicting, legacies: loyalties to the ex-colonial power because of historic social interaction, shared cultural values, familiarity and often, most importantly, educational, professional or economic opportunities provided in varying degrees to local elites counter-poised with outright rejection, and harbored or open resentment.

A number of these countries, as we have noted in recent years, are also rent by serious internal conflicts, often fueled by ethnic, religious or other perceived differences (in historic Constantinople, two chariot teams provided the excuse for an extended civil war).

What does this have to do with global marketing strategies for technical and professional services? Quite a bit! You cannot know how to properly establish a local presence and team with local or other non-local partners unless you understand how that nation operates.

Patience, honesty, shared values and respect must be four key qualities in your marketing approach. You cannot rush the process. You have to keep your commitments and promises and you have to show the same respect to your local partners, prospective clients, counterparts and staff that you do in your domestic market. This takes a considerable investment in human and financial resources and a willingness to forego short term advantages for long term gain. For example, in a market where your firm lacks continuity, you should try to cultivate a single local partner who values you as an important and reliable partner. But this prospective partner might have limited resources, lack expertise or, worse yet, might fall out of favor or other firms subsequently look more attractive. All too often (Berger in Malaysia, Kazakhstan, the Caribbean) foreign firms switch partners and damage ties. Alternately, the most attractive potential partner may

want to play the field. "I spent 20 years looking for the perfect marriage partner. Unfortunately, when I found one, he/she was also looking for the perfect partner." But, a newcomer unfamiliar with, and not well known in, the market is best served by initially developing cordial long-term relations with a single firm or group of professionals.

The Enterprise Cycle

The natural cycle of individual AEC enterprises can further complicate an objective evaluation of international opportunities. Consulting and service organizations have, or are subject to, a "natural cycle." When an enterprise or organization is launched, the founders are often important contributors to a new movement, idea, or concern, e.g., the environment, construction management, big box retailing, shipping centers, enterprise software, websites, etc. They may be research professors or graduate students at universities such as MIT; self-educated entrepreneurs or investors, former government employees who wrote the very rules and regulations the new services or industries must address. Many such issues and concerns are often accompanied by extensive discussions and a flurry of publications. A number of large consultancies were originally founded by authors of textbooks (Hazen & Sawyer, TAMS, Metcalf and Eddy, STV, etc.). So, the energy, initiatives and skills of the firm ideally reflect the founders' interests, avocations and the needs of that period. These are what I call natural consultancies or construction firms.

Alas, all too often we find 10-20 years later that such problems or concerns are successfully solved, viewed as intractable and unlikely to ever be solved, or in fact, never were a problem (Y2K). Hence, enterprises created in response to an era's concerns must reinvent themselves if they are to retain their vitality or very existence, and Battele Labs, Booz Allen, A.D. Little, Bechtel and PB are examples of this cycle, although the times finally caught up with ADL. This is a much more difficult bar, since many of the principal founders/senior managers now find themselves dealing with subjects they are less familiar with, less concerned about or less competent or comfortable with. This is also typically paralleled by a product or a service maturity cycle accompanied by declining prices and increased competition. This is a process we experience more and more in the new global economy as industries, practices and fields quickly mature and converge, testing the skills and commitment of even the most dedicated entrepreneurs and is probably the biggest single reason why even very successful enterprises lose momentum and direction, e.g., consultants specializing in various elements of the energy field, United, Delta and American Airlines, DEC, Compaq, etc. In response to a maturing domestic product or service line, many firms, often flush with cash, possessing a strong and well known brand, with skilled and proven staff and management yet flattening revenues, have looked longingly abroad at international work, encouraging maturing enterprises or consultancies to seek "greener" opportunities abroad by trying to replicate earlier domestic successes while utilizing surplus staff or resources.

3. Appropriate Policies and Strategies to Adopt in Order to Enter Overseas Markets

According to one knowledgeable senior manager, Les Buck of Halcrow Group Ltd., a leading United Kingdom engineering consultancy,

> "You need to decide either to be a domestic player or an international plus domestic player. The latter costs a lot more in investment and running costs, and in the short time is likely to be less focused and less profitable unless the management effort is greater, but it tends to avoid the worst effects of the peaks and troughs of the domestic economy. Other constraints of a domestic-only approach can be:
>
> - Increasing trend for clients to be global and want you there with them
>
> - Potential for staff shortages in domestic environment when economy is buoyant . . .
>
> Other market forces are in play and are affecting the way we are moving. The trend is toward
>
> - fewer, larger consulting firms (or alliances to create the benefits of larger resource bases and geographic coverage),
>
> - clients using fewer suppliers who receive a larger share of bigger projects.
>
> - Bigger firms can usually respond faster to the investment needs created by these market changes.
>
> Halcrow is aiming for 60% domestic, 40% international, with most of the growth in the next four years planned to be outside the UK.
>
> Has anyone cracked the 'Global Challenge yet?' The $64,000 question is, assuming you need a matrix organization, 'is your dominant axis geographic or market sector/discipline?'"

Clearly, Halcrow is giving a good deal of strategic thought to international markets. But, all too often, a construction or consulting firm initially entering the international field does so on an anecdotal or opportunistic basis - someone contacts a principal of a firm, a former employee or student mentions an opportunity, a trade mission contacts the management or increasingly, a foreign agent contacts the firm or finds your website. But, such "casual" contacts frequently lead to disappointment. My recommendation for a new entrant is to:

a. Evaluate your Strengths and Weaknesses

Know who you are, your strengths, warts and weaknesses –

- Do you offer unique services or a service in growing global demand?
- Do you have a proven "in-house" champion interested and with sufficient time to pursue overseas work?
- Is there demand for your services (e.g., do you have a transportable brand or practice, are you already receiving inquiries)?
- Do you have staff interested in and able (multi-lingual, etc.) to work abroad?
- Do you have the financial resources for the long haul?
- Do you have sufficient throw-weight in your domestic markets and are they transferable to international markets?

b. Develop a clear Strategy

Once you have analyzed your own skills and weaknesses, decide whether:

- you will market a narrow technical skill or a single client,
- target a narrow geographic area,
- prepare a broad-scale marketing or investment effort.

c. Know your Marketing Target

- Where is your market located?
- What is the sector, project or program you propose to pursue?
- Who is the client or clients?
- Who is your competition?
- Who are the lenders or investors?
- What are the client's historic preferences and favored consultants, contractors, property managers and providers?
- What are the barriers – legal, financial, technical, political, social, etc.?

d. Define your Marketing Effort

How will you market?

- Use existing full or part time staff,
- seek out former employees, students, etc.,
- recruit an experienced expatriate or national marketer
- hire an agent or representative (either an individual or firm)
- look for one or more local partners, and/or
- buy into all of one or more local firms?

Each of the above has their advantages and disadvantages.

e. Carefully Define the Target Project or Program

Is it:

- Design
- Design/build
- Construction management
- Advisory services
- EPC
- Own/operate/transfer
- Construct/maintain
- Outsourcing
- Real estate development, investment or management services
- Reconstruction and/or nation building

or a combination

f. Who are the Competition

- Local/well connected
- Multinational with strong financial capabilities

g. Who are the Prospective Clients

- Host country agencies
- Private international or local banks, investors or developers
- Pension funds
- Private international or local owners
- Multinational lenders (e.g., World Bank, Asian/African/Caribbean, European or Inter-American Development Banks)
- A bilateral lender
- An entire industrial or financial sector (locally financed, internationally, or both)

h. What are the supporting Financial Institutions

- Private or public banks
- International donors and/or financial institutions (World Bank, ADB, IFAD, UN, etc.)
- Investors
- Infrastructure funds
- Insurers
- Local or international mutual and/or pension funds
- Bilateral lending or export agencies
- Public financial markets

i. Potential networks

John Naisbitt in Chapter 1 *From Nation to Network* in his book Megatrends Asia – The Eight Asian Megatrends That Are Changing the World claims, "the Chinese network is a network; just like internet that bundles 25,000 networks

and the network is always expanding. For example, Chinese parents send their sons and daughters to western prestigious universities where they promote friendly relationships with the elite from all over the world."

Potential networking may include:

- Family
- Friends
- Professional colleagues
- This very classroom though quite limited this year
- Former students or employees
- Everyone that you meet
- Meetings, conferences and conventions

Partnering

Do you collaborate, and if so, with whom?

- Your competition
- Your client
- A local firm or investors
- Non-AEC groups
    - Trading or Commercial Houses
    - Financiers, Venture Capitalists, Banks or Pension funds
    - Lawyers
    - Auditors
    - Insurers
    - Management Consultants
- Owner/operators

- Vendors and/or suppliers

j. Contacts

How do you expand your potential contacts? Your focus can include:

- Associations
  - Meetings, conferences and conventions
  - Memberships
  - Speeches and papers addressed to such groups
- Government Agencies
- Your country's Foreign Service Units
- Your current bank's foreign offices, branches or correspondents

4. Tradition and Future Approaches to Partnering

a. Introduction

Partnering, simply stated, is an agreement to work together. If there is one single key to success in the international arena – and we know that there are many – it is the ability to create and nurture successful partnering arrangements.

Partnering is a "covenant of good faith" among the project parties. They agree to operate on the basis of shared goals rather than separate organizational agendas for one or a number of projects and assignments.

In a July 8, 1998, article published in the Wall Street Journal, John Carter who was then the Regional President of Bechtel's European, African and Middle Eastern operation is quoted as follows:

> "Bechtel used to be a large U.S. company that did some business abroad. Today close to two-thirds of our business is outside the U.S." And he stressed that "The key to the company's development in the region will be its ability to join forces with firms already on the ground. Ten or 15 years ago, we would never have used a local partner, but today it is absolutely imperative, because of the cost of moving expatriate workers around the world." And Bechtel had always prided itself in going it alone.

But, before you decide to partner, you must first:

- Understand, as noted, the strengths and weaknesses your firm or organization brings to the international arena. These might include:

  - a recognized brand of growing international demand (e.g. Information Techology, Data Processing, etc.);

  - highly qualified managers and/or employees;

  - outstanding or unique technology or skills

  - higher productivity or lower costs;

  - outstanding professional contacts via professional associations, ex-employees, trainees, classmates, former students, etc.; and/or

  - domestic clients investing abroad.

- Ascertain how frequently you have been contacted in the past by foreign firms or potential clients, and how to best evaluate and respond to such contacts.

- Decide whether to focus initially on a country, region or single service line (e.g., aviation, commercial property, hospitals).

- Decide, as we previously discussed, how you should initially organize and launch your proposed initiative:

  - formal marketing through professional contacts - friends, classmates, current or former staff;

  - formal marketing by principals;

  - recruit a full-time, experienced international marketer;

  - rely on agents and/or prospective partners.

- Analyze the likely impact of one or more project wins or successful investments on the firm's overall practice and decide whether the firm should:

  - proceed on a project-by-project basis;

  - set up or buy a local wholly- or partially-owned company or branch office;

- establish a permanent joint venture or rely on "ad hoc" project-by-project partnering arrangements.

b. Forms of Partnering

International partnering in the traditional sense takes several basic forms in the AEC field and your strategy should follow from the above analysis of your own firm's strengths and weaknesses and goals.

The options will most likely include, as noted, one or more of the following:

- host country firms (which might be a requirement)
- competitors
- specialized technical firms
- international firms with a local presence
- law firms, auditors, insurers or management consultants
- construction contractors if an A/E or an A/E firm if a contractor
- real estate developers or service groups
- suppliers and vendors
- operators/owners/clients
- global or local estate or property managers or developers
- trading or commercial houses
- a government agency or entity
- financiers, investors, banks, pension funds or venture capitalists

What are the advantages and disadvantages of the principal options?

Host country firms or government entities

Pros

- minimize start-up costs

- access to superior local professional and marketing staff, as well as government and professional contacts
- facilitate local professional introductions. licensing and registrations
- better guidance on both formal and informal legal, accounting, property taxation and banking issues
- better access to local funding
- often can provide office, administrative and logistic support staff
- better understanding of regional and local sensitivities
- local participation is often required or preferred by host country clients

Cons

- potentially differing professional and commercial cultures
- need to establish equitable fee structures and division of responsibilities, work and costs
- less control of project finances, location of work, local staff, field office, logistics, client interface, etc.
- need to install stronger QA/QC controls and possibly staff training programs
- less technical and managerial control and possibly no overhead and profit from local staff, an increasingly important source of income and growth for international AEC providers
- likely investments in technology upgrades and training for the partner and partner's staff prior to deciding on the duration (will it be a single project, multi-project or a permanent joint venture) of the relationship

Competitors

Pros

- shared risk
- shared responsibilities and less risk of rapid staffing peaks and valleys

- better staff fit (pick and choose from each firm's staffing cadres)
- reducing the short list or competition

Cons

- rival, and often competing, company cultures
- they/us mentality
- exposing your marketing, management and financial strategies, partners, contacts, technologies and staff to competitors (e.g., Bechtel/PB in mass transit)
- strengthening a competitor in your target market

Specialized technical firms

Pros

- introducing unique, more appropriate or current technologies and strategies
- better technical and marketing insights
- better vender relations and often more favorable vender and supplier pricing, access to priority deliveries, service and warranties, etc.
- improved contacts with technically-oriented clients and lenders

Cons

- rival, and often conflicting cultures (e.g., agreeing on marketing, staffing, scope of work, etc.)
- potential pricing conflicts
- differing approaches to work, location of work (home office vs. field) and commitment and responsibilities to clients

International firms with a local presence

Pros

- reduced staff transfer and start-up costs

- lower local staff and other support costs
- better knowledge of legal, accounting, professional registration, taxation and banking issues
- easier access to government and professional contacts
- likely provision of better administrative and logistic support staff
- better understanding of regional and local sensitivities

Cons

- rivals and competitors
- they/us mentality
- risk of exposing your contacts, marketing, investment and financial strategies, partners, technologies, work methods and staff to a current or potential competitor

Construction contractors and/or architect/engineers

Pros

- essential for design/build or most BOT-type procurements
- expands construction management or A/E skills
- provides additional scheduling/cost control/constructability design skills
- provides bonding and surety requirements for an A/E if needed
- provides broader insurance and risk distribution

Cons

- need to establish appropriate fee and/or profit sharing structure, e.g., is the A/E a partner, subcontractor? Is there a success fee, as well as management and control structures? Who can commit? Who can pull out?

- unbalanced front end costs which may be 70% AE-related in preparing the tender, while the AE may only be responsible for 5-10% of the entire project

- if a partner there is increased risk for the AE, e.g., a partner for the entire project while providing only 5-10% of the effort

- need for bid or surety bonds vs. professional design insurance

- differing professional cultures

Suppliers and vendors

Pros

- provides broader financial base (e.g., a stronger balance sheet, better opportunities for export or project finance, etc.)

- provides additional technical skills and insight

- provides a broader procurement network

- ensures more reliable delivery schedules (priority deliveries)

- improved systems integration, warranties, guarantees, commissioning, etc.

- may provide broader insurance coverage and risk distribution and superior product updates

Cons

- need to establish appropriate fee structure, e.g., is the supplier a partner or supplier? Who can commit? Who can pull out?

- costs – how do you establish arms-length costs?

- the need to avoid discouraging other vendors/suppliers from bidding

- bonding

- debt guarantees

- differing professional cultures

- unbalanced front-end costs which may, as noted, be 70% A/E in preparing the tender, while the A/E may only be responsible for 5-10% of the actual project

Operators, owners and clients

For major private infrastructure initiatives, A/Es and contractors must increasingly team with an owner and/or operator or client to successfully execute a concession, BOT, BOOT, DBOM, etc.

Pros

- better understanding of the project and life cycle costs
- a better practical understanding of equipment, suppliers, operating and system integration needs
- better supplier relations and access to more favorable pricing and delivery schedules
- often a stronger balance sheet

Cons

In the infrastructure privatization field, an operator, often in great demand, may not want to be the/an owner, or may only want to own a small share, and here, the different concerns, perspectives and orientation must be properly understood. The most important are:

- Difference in perspectives – The designer and contractors are, typically, in and out in 18-36 months. The initial consortium, if contractor-controlled, may want to sell and exit the successful concession as rapidly as possible, while an operator is committed for 20-30 years.
- The operator and long-term owner concerned with the life cycle costs discussed in Session 2, including ease of maintenance and operability, will more readily accept or suggest changes to further improve long-term reliability or reduce operating and maintenance costs. And most importantly,
- a lower willingness to accept risks than the designer/contractor since they have far longer exit periods and are often state-owned or controlled.

In such arrangements, a public client may also become a partner. Such participation falls into two broad categories – government agencies venturing abroad or outside their own host country franchise (e.g., a port authority or airport, airline or railroad participating in a foreign concession as an investor and/or operator) and public/private partnerships that are extensions of their host country franchise and/or authority. There was once great enthusiasm for such "true" public/private partnerships, but increasingly, these have proven difficult and impractical, given the different perspectives, risk profiles, needs, concerns and modus operandi of public agencies and private entrepreneurs. Where public/private partnerships arise, despite much ballyhoo, the public partner's role, with the notable exception of airport privatization, is increasingly limited to that of a passive investor/regulator/subsidizer/or protector of the public's interests in the public partner's own country.

But, developed, as well as developing, countries are seeing the benefits of establishing such public/private partnerships to:

- Provide government financial and legal support (lower borrowing rates, right of eminent domain, environmental permits and approvals, etc.) or subsidies where necessary, and

- Provide needed facilities while reducing pressures on the public purse

The incentive for such partnering is often a government's lack of capital, limited expertise, or the perception of lower productivity or service satisfaction in the public sector.

Furthermore, the growing economic globalization has encouraged, as discussed in Session 2, increased financial mobility while reducing government opportunities and ability to raise taxes and other revenues. Technological, IT and financial innovations have reduced the importance of place and the ability of governments to legislate, regulate and tax. If a nation state in frustration threatens these new communities with increased intellectual, political, social and financial regulations it further loosens their loyalties and bonds to existing political structures. Such actions, all too often, as Thomas Friedman discusses, encourage increased migration from environments that are restrictive or less nurturing, to habitats with so-called "open" societies and/or governments offering lower costs, taxes, and other, less restrictive, structures (i.e., the U.S. Sunbelt, Monaco, Bermuda, Hong Kong, the Cayman Islands, the Bahamas, Mauritius, etc.). And, these migrations further limit the options available to traditional governments.

c. <u>Partnering and Privatization</u>

As noted, we often describe many initiatives as public/private partnerships that, in fact, are "privatizations" with relatively passive, though significant,

public roles (subsidies and grants, eminent domain, guarantees, access to low-cost loans, etc.). Privatization, defined broadly, is:

- The use of the private sector to provide services usually regarded as in the public sector domain or responsibility.

- The sale and upgrading of existing and/or creation of new facilities with little or no tax-based financing, paid by a "user- or access-fee" revenue stream that, hopefully, provides adequate returns on investment.

Why are governments promoting privatization and turning to the private sector to construct and operate facilities instead of providing traditional funding for new projects? The reasons, as we noted in Session 2, are financial, political, and practical.

The first is that traditional sources of funding are declining because:

- there is growing public resistance to tax increases;

- many governments are being downsized; and

- in many areas, limitations on public or parastatal debt have cut off or diminished the possibilities of raising money through borrowing although these borrowing limitations can sometimes be circumvented by introducing innovative off-balance sheet financing via the private sector.

A second reason for growing privatization is that the private sector can frequently construct new facilities more efficiently, more expeditiously and at a lower cost because they bring specialized management experience, focus, and are subject to fewer constraints.

As a result, a large number of infrastructure investment funds were established in the '90s in response to these opportunities by investment banking houses (Normura, Macquarie), insurance companies (AIG, Hancock), well financed developers (Gordon Wu, Vivendi), equipment suppliers (ABB, Lockheed) and non-traditional financial sources (Soros).

Comparative Advantages

The key to the success of such privatization initiatives is the ability to take maximum advantage of each participant/stakeholder's skills:

- AEC firms with the technical skills and credibility based on their history of meeting budgets and schedules.

- Financiers or developers with the ingenuity and resources needed to put together financing packages advantageous to all concerned.

- Owner/operators with the understanding, experience, and skills to profitably and successfully operate and maintain the facility, and

- the public sector which may own the land, infrastructure or facilities rights and enjoys special privileges, e.g., eminent domain, access to low cost capital, etc.

As a result, there are now privatization opportunities for the creative in almost every sector.

- Water supply and distribution
- Wastewater collection and treatment
- Solid waste disposal
- Highways and bridges
- Power generation (IPP's) and distribution
- Telecommunications
- Rail and mass transit
- Aviation
- Ports
- Correction facilities
- Schools
- Office space and facilities

But, there are several strategic issues that you as a manager of an AEC or firm must address before entering the world of concessions and privatizations.

First, do you want to be a pioneer and develop one or more concepts or provide support for pre-targeted sponsors and clients; that is, to be a sponsor or choose to respond to requests for assignments that typically come out once concessions are being prepared by another sponsor? Furthermore, for the latter, you must decide what your firm wants to market - program or construction management, technical and environmental planning, design

and/or construction services, etc., and to whom - the proposed concessionaire, investors, owners/ operators, design/build contractors, governments, one or more lenders, or all.

In all cases, it is important as an initial step to ascertain what the targeted client really wants or hopes to develop. Is the client seeking an innovative approach such as outsourcing or a unique form of concession, or only trying to replace a short fall in funding.

All these become important first steps in seeking higher value markets, while avoiding commoditized price-sensitive service areas. But, you must always keep in mind that functioning within a loose laissez-faire regulatory framework, the private sector is always vulnerable to rapid boom/bust cycles. Frenetic overbuilding and demand for design and construction services during boom periods can prove exceedingly wasteful and counterproductive, while opportunistic investment strategies are likely to neglect the poor by discouraging large-scale, long-term investments in socially attractive, but less profitable, goods and services such as low-cost housing, universal health and subsidized public services. As a result, the public/private pendulum will continue to swing back and forth during your careers.

Outsourcing

Two other increasingly popular privatization approaches involve:

- "Contracting out" - The maintenance, operation, staffing and renovation of facilities where the private sector operator assembles teams of engineers, operators, maintenance specialists, equipment manufacturers, etc., to provide a service which may have been previously provided by a public or private sector owner.

- The preferred provider, hopefully, on an exclusive basis (a master service contract), to meet a client's needs worldwide in "strategic partnerships." The preferred provider is most often used in the private sector and may include purchasing or hiring the client's outsourced department or staff (EDS in IT services, Bechtel and others in the water sector, Deloitte in Telcom, etc.) but is becoming popular in the public (e.g., Indefinite Quantity Contracts, Kellogg, Brown & Root, in support of U.S. peace keeping efforts, Berger for U.S. State Department overseas facilities, etc.).

But, both of these should more accurately be characterized as outsourcing.

5. Project Delivery

Once you have won a major assignment or made a significant investment, you must decide the amount of technical, managerial and sales work you want to undertake in your home office; to what degree do you want to rely on, train and often supervise your local partner to develop their skills; or use the project as a vehicle to establish a permanent local joint venture or wholly-owned office, staff that office with predominantly local professionals and encourage their technical development as discussed earlier.

a. The Local Office

While my company, The Berger Group, has been one of the most successful exponents of local presence, despite its many supporters this is not a panacea for all problems.

- In the ecstasy of winning a coveted assignment or investment, local and senior management all too often confuse a project office with a permanent office. But, experience has taught me they are quite different. A project office need only be managed by a project manager; the facilities are temporary and may even share a partner's office; expensive support staff is minimal; errors in hiring or leasing space (rental payment, staff social security and severance expenses, etc.) are limited by the project's defined schedule; there is far less need for expensive outside legal, tax and auditing services; and critical elements such as local support staff, vehicles and office budgets and expatriate living allowances, etc., are defined by the project contract, reducing both the pressure on the project manager and the temptation for the project manager to adopt a more salubrious life style.

- In contrast, permanent offices must address all of the above. In addition, such offices are more obvious and attractive targets for tax collectors and local lawsuits. Permanent offices require a country director/manager with far greater skills than a project manager; he/she should typically be a well-tested permanent employee with 5-10 years of company experience, some in middle-to-high-middle management and preferably:

  - speak the local language if other than English,
  - be able to appraise and recruit talented staff,
  - understand finance, risk, local currency management, labor and tax laws,
  - have both technical and managerial skills;

… not an easy job description to fill and typically, such candidates, when they emerge, are quickly incorporated into management-short-home operations.

Furthermore, U.S. management, in selecting overseas managers, is all too likely to focus on 1950-1960 cultural concerns, e.g., language and people skills, desire to live abroad, at the expense of more appropriate current priorities such as prior management experience with the company, financial, technical and increasingly important IT skills, etc. When faced with intimidating local tax and labor authorities, and lacking the protection of a contract or, often even the right to reside full time in the country, the culturally- and people-sensitive manager can all too easily produce disastrous results, e.g., a $100,000 salary plus car, housing and education allowance can be taxed locally at $80-$100,000, and well-meaning but poorly planned reimbursement programs for taxes can lead to a never-ending spiral of local taxation, all managed by the recently appointed multi-lingual, culturally sensitive and well connected, if financially inept, country director.

b. Other Concerns

But, this is only the beginning of one's concerns. A project pie is only so large and how is it best cut up? Decisions have to be made on:

- whether to establish a joint venture company with your then-project partner, and here, such issues as inter-company billing, overhead charges and even use of the company name can have serious consequences (Deleuw Cather);

- tax exposure of expatriate staff, as Union Carbide found in Bhopal, can encourage expatriate management withdrawal (e.g., Coke & IBM vs. Union Carbide & Goodyear in India);

- procedures to monitor staff downtime and provide "full time" local staff with external work during such downtimes;

- the provision of technical support staff from other offices – at what billing rate, who will benefit, who will pay taxes, living allowances, etc.

As we will discuss in more detail in Session 10, such decisions are not easy to make and can have long term implications for a firm's future in that country and, even more importantly, for overseas work, in general. The decision framework must include:

- size of the market – will it justify a permanent office?

- Technical and quality concerns – is the assignment or investment too difficult technically to manage and/or complete with local staff? If this is a concern, can a gradually-phased transfer be introduced and will repetitive projects be available for the newly trained staff?

- Alternately, can such staff, once trained, be transferred to similar assignments or investments in other countries?

- Is your local partner an appropriate long-term partner?

- Can we control our name, e.g., Deleuw Cather, a then-leading engineering consultancy now part of Parsons, lost control of their name in Thailand, Ireland and Canada (Delcan) when they exited these partnerships, and quality, e.g., will major clients be disappointed with the quality of the work or services produced by a start-up?

- Can you legally and professionally monitor and control the work done locally, (e.g., Union Carbide's loss of external technical control in Bhopal)?

- Where can the work be done most profitably in the short-term? Long-term?

Hopefully, the local office once established should prove competitive and successful in their own markets. At the same time, they can provide the presence, core resources and outsourcing opportunities for winning and executing other significant commissions. In other words, you "*go global by going local.*"

Clearly, however, gearing up for projects in uncharted territory can be formidable. There are, as noted, new cultures to adapt to, new ways of doing business, new standards and procedures, new regulatory regimes, etc. Furthermore, staffing up for projects in foreign countries is one thing, but building a successful, self-sustaining local office and operation and integrating it into your global organization is quite another. Berger typically has 70-80 local offices at any given time but only 20-30 stand the test of time (10 years or more).

Once you decide to open a permanent office and decide whether or not to have a local partner (often a legal requirement), you must also consider two other issues if it is an engineering or architecture office:

- Will the office focus on planning, design, program management or advisory services and, if design, will it offer a full range of services?

- Architectural
- Structural
- Sanitary
- Environmental
- Mechanical or electrical, or
- Rely on subcontractors

In construction, similar decisions must be made.

- Will it be a construction management office,
- a general contractor,
- EPC, or
- Will the office rely on a network of subcontractors or provide its own field staff, etc?

c. Staff Loyalty

Your continuing success will also depend to a great extent on gaining, keeping and maintaining the loyalties of local staff, as well as developing their managerial and technical skills. Full-time employees of the local companies should be eligible for all your normal company benefits, including areas such as key employee stock options. If you are not prepared to ensure the local staffs, especially the local management team, feel a sense of belonging and are a part of your team, then your initial marketing successes will be short-lived and you will rarely achieve longevity. If you don't share the rewards and your special skills and technologies through training and technical transfers, you will soon be categorized as a colonialist, or worse, an exploiter simply trying to enrich yourself at the expense of the local community.

Furthermore, local managers and professionals are an increasingly important component of global professional practices. With the growing globalization of technical and managerial education distinctions in quality, if they ever were significant, have virtually disappeared. Elite technical schools have arisen in almost every corner of the world and, as many of you demonstrate, graduate education is increasingly global. With the rise of the internet and web and distance learning, any such distinctions will further disappear. With often less employment competition (e.g., investment banking, IT, etc.), locally trained architects and engineers are also likely to represent a higher intellectual cross-

section of students than in OECD countries and, as noted in Session 3, since more new construction is occurring in the developing world, they often have the opportunity to participate in more technically advanced projects. Given the above and the continued, though declining, wage differentials, international firms are increasingly drawing on their local staff to organize and staff new international teams or even more importantly, Global Design Centers. In addition, given the intense price competition in many international markets, such staff, which often in the past was provided at little or not profit or hired from a local partner to support the higher-priced international staff, is now often a principal source of profit for the major international AEC providers.

Thus, as a matter of enlightened policy, you should encourage, develop and build local staff loyalty supported by well-planned technology and management skill transfer programs. Your client can also become part of the technology transfer equation. Thus, a major challenge is to plan and execute your work to take maximum advantage of local staff assigned by your clients, partners or your own local offices so that they learn new skills to apply in the future on similar projects while meeting quality and performance targets. This approach not only creates a better product, but develops a reservoir of expertise, as well as goodwill, which will pay off handsomely in the continued marketing and delivery of your technical and professional services.

Then spread the good word about your efforts by attending and participating in the growing number of local and regional conferences, seminars and other forums. In presenting papers highlighting your local successes - authored or, at a minimum, coauthored by local professionals- you gain considerable credibility and reinforce your original claims of commitment. The General Manager of our 22-year-old successful China joint venture, Mr. Xie Shoazhang, was named China's Professional Engineer of the Year in 2001 and is a member of FIDIC's worldwide Board of Directors.

d. Initial Entry

In addition to existing clients, you must never overlook the many other tools that are available to enable you to initially develop your local presence. Those tools are often funding mechanisms such as your own country's export credits, insurance or aid programs and various international lending agency programs. It is extremely useful to market those agencies since their projects can ideally be your "foot-in-the-door," the all-important starter project and often involve teaming with local companies, which gives you the opportunity to learn their capabilities.

Don't overlook your in-house staff with origins in your targeted countries who may have interesting family, school and professional contacts that they have maintained over the years. They can certainly help on language and provide your temporary or permanent staff transfers with informal briefings or even formal training and useful social and professional introductions.

In summary, marketing architectural, engineering, construction and real estate services globally is challenging and should also be rewarding. But, you must be patient, you must demonstrate your commitment and you must show respect for host country culture and professionalism. Flexibility, tolerance and a good sense of humor will ease the way.

6. Class Discussion

"Underestimating Costs in Public Works Projects – Error or Lie"

- Do you agree or disagree with the findings of the three authors?
- How widespread do you think the tendencies to underestimate project costs are? What are the risks for different stake holders, an architect/engineer, a financier, the owner (public or private) and a construction firm?
- Why the difference in accuracy between fixed link projects and roads?
- What are risks for the internal operations of a construction company? How would you protect your firm?
- Why do rail projects seem to be the highest overruns of the three areas studied and tunnels more difficult to estimate than bridges?
- How do you think water and sewage or aviation projects would compare with the three categories analyzed?
- Do you agree with the first paragraph on page 285?
- Besides the authors' view that costs were purposely understated, what other facts may have contributed to the significant underestimation of cost and what actions can we take to correct these tendencies?
- Do you agree with paragraph two of page 288 that underestimating costs may save public funds?
- What if any is the "obligation to truth in the democratic process," page 288?
- How does the "regulatory engineer" issue that we discussed in Session 1 have any bearing on this article?

- What are the implications of this article for privately financed public works projects?

- What are your comments on the four causes: technical, economic, psychological and political, identified by the authors?

- Do you think the writers' recommendations on:

  - increased transparency,

  - the use of performance specifications,

  - explicit formulation of the regulatory regimes that apply to project development and implementation, and the involvement of private risk capital, even in public projects,

…would alleviate or reduce the problem.

Please read in *"The Lexus and the Olive Tree,"* Chapter 5, *Microchip Immune Deficiency*, pps. 71-97; Chapter 6, *The Golden Straightjacket*, pps. 99-107; Chapter 7, *The Electronic Herd*, pps. 109-137, and be prepared to discuss:

- The difference between Treaty and Deal

- The difference between Superpower and Supermarket

- Whether Globalization is only a political phenomenon

- How can nations preserve their identity?

- How is finance, technology and information impacting democratization?

- What is MID?

- What does Thomas Friedman mean by the Electronic Herd? Is it only a financial phenomenon?

- Does the Electronic Herd encourage democracy and how does increased democracy influence corruption?

- Did Malaysia's former Prime Minister, Dr. Mahathir Mohamad, have a choice on globalization (Did he succeed?)

- Who starts the stampedes?

- Will increased financial transparency help or hurt?

- What are the implications for the AEC fields?

During the U.S.-Canadian NAFTA negotiations, George Schultz said he could understand why the Canadian AFL-CIO might oppose the agreement. He also could understand why the U.S. AFL opposed it. But, he couldn't fathom how they both could at the same time!

Who are the foes? Why do these foes include such varied groups as religious fundamentalists, the disenfranchised, greens, rich, intellectuals, supporters of the slow food movement (Italy), opponents of GMO? Why are they protesting? Are the opponents reasonable?

How is the *Olive Tree* striking back, e.g., the "anti-globalization backlash we have seen in Seattle;" Genoa, the rise of religious funtamentalism; and the attacks on the World Trade Center and Pentagon, etc. What caused it? As noted, Ellen Frost, Senior search Fellow at the Institute of International Economics, claims that "globalization has clearly been both oversold and demonized and globalization becomes a scapegoat for things that would have happened anyway. Those who believe in the value of globalization must be cautious not to claim for it more benefits than it provides."

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Who are the foes? Why do these foes include such varied groups as religious fundamentalists, the disenfranchised, greens, rich, intellectuals, supporters of the slow food movement (Italy), opponents of GMO? Why are they protesting? Are the opponents reasonable?

7. **<u>Session 5:</u>** The Impact of Globalization of the Financial Market on the Construction Industry will be taught by Professor Moavenzadeh.

Underestimating Costs in Public Works Projects

Error or Lie?

Bent Flyvbjerg, Mette Skamris Holm, and Søren Buhl

This article presents results from the first statistically significant study of cost escalation in transportation infrastructure projects. Based on a sample of 258 transportation infrastructure projects worth US$90 billion and representing different project types, geographical regions, and historical periods, it is found with overwhelming statistical significance that the cost estimates used to decide whether such projects should be built are highly and systematically misleading. Underestimation cannot be explained by error and is best explained by strategic misrepresentation, that is, lying. The policy implications are clear: legislators, administrators, investors, media representatives, and members of the public who value honest numbers should not trust cost estimates and cost-benefit analyses produced by project promoters and their analysts.

Flyvbjerg is a professor of planning with the Department of Development and Planning, Aalborg University, Denmark. He is founder and director of the university's research program on transportation infrastructure planning and was twice a Visiting Fulbright Scholar to the U.S. His latest books are *Rationality and Power* (University of Chicago Press, 1998) and *Making Social Science Matter* (Cambridge University Press, 2001). He is currently working on a book about megaprojects and risk (Cambridge University Press). **Holm** is an assistant professor of planning with the Department of Development and Planning, Aalborg University, and a research associate with the university's research program on transportation infrastructure planning. Her main interest is economic appraisal of projects. **Buhl** is an associate professor with the Department of Mathematics, Aalborg University, and an associate statistician with the university's research program on transportation infrastructure planning.

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Comparative studies of actual and estimated costs in transportation infrastructure development are few. Where such studies exist, they are typically single-case studies or they cover a sample of projects too small to allow systematic, statistical analyses (Bruzelius et al., 1998; Fouracre et al., 1990; Hall, 1980; Nijkamp & Ubbels, 1999; Pickrell, 1990; Skamris & Flyvbjerg, 1997; Szyliowicz & Goetz, 1995; Walmsley & Pickett, 1992). To our knowledge, only one study exists that, with a sample of 66 transportation projects, approaches a large-sample study and takes a first step toward valid statistical analysis (Merewitz, 1973a, 1973b).[1] Despite their many merits in other respects, these studies have not produced statistically valid answers regarding the question of whether one can trust the cost estimates used by decision makers and investors in deciding whether or not to build new transportation infrastructure. Because of the small and uneven samples used in existing studies, different studies even point in opposite directions, and researchers consequently disagree regarding the credibility of cost estimates. Pickrell (1990), for instance, concludes that cost estimates are highly inaccurate, with actual costs being typically much higher than estimated costs, while Nijkamp and Ubbels (1999) claim that cost estimates are rather correct. Below we will see who is right.

The objective of the study reported here was to answer the following questions in a statistically valid manner: How common and how large are differences between actual and estimated costs in transportation infrastructure projects? Are the differences significant? Are they simply random errors? Or is there a statistical pattern to the differences that suggests other explanations? What are the implications for policy and decision making regarding transportation infrastructure development?

Four Steps to Understanding Deceptive Cost Estimation

We see four steps in the evolution of a body of scholarly research aimed at understanding practices of cost underestimation and deception in decision making for transportation infrastructure. The first step was taken by Pickrell (1990) and Fouracre, Allport, and Thomson (1990), who provided sound evidence for a small number of urban rail projects that substantial cost underestimation is a problem, and who implied that such underestimation may be caused by deception on the part of project promoters and forecasters. The second step was taken by Wachs (1990), who established—again for a small sample of urban rail projects—that lying, understood as intentional deception, is, in fact, an important cause of cost underestimation. Wachs began the difficult task of charting who does the lying, why it occurs, what the ethical implications are, etc.

The problem with the research in the first two steps is that it is based on too few cases to be statistically significant; the pattern found may be due to random properties of the small samples involved. This problem is solved in the third step, taken with the work reported in this article. Based on a large sample of transportation infrastructure projects, we show that (1) the pattern of cost underestimation uncovered by Pickrell and others is of general import and is statistically significant, and (2) the pattern holds for different project types, different geographical regions, and different historical periods. We also show that the large-sample pattern of cost underestimation uncovered by us lends statistical support to the conclusions about lying and cost underestimation arrived at by Wachs for his small sample.

The fourth and final step in understanding cost underestimation and deception would be to do for a large sample of different transportation infrastructure projects what Wachs did for his small sample of urban rail projects: establish whether systematic deception actually takes place, who does the deception, why it occurs, etc. This may be done by having a large number of forecasters and project promoters, representing a large number of projects, directly express, in interviews or surveys, their intentions with and reasons for underestimating costs. This is a key topic for further research.

In sum, then, we do not claim with this article to have provided final proof that lying is the main cause of cost underestimation in transportation infrastructure projects. We claim, however, to have taken one significant step in a cumulative research process for testing whether this is the case by establishing the best and largest set of data about cost underestimation in transportation infrastructure planning so far seen, by carrying out the first statistically significant study of the issues involved, and by establishing that our data support and give statistical significance to theses about lying developed in other research for smaller, statistically nonsignificant samples.

As part of further developing our understanding of cost underestimation, it would also be interesting to study the differences between projects that are approved on a competitive basis, by voters at an election, and those that are funded through formula-based allocations. One may speculate that there is an obvious incentive to make a project look better, and hence to underestimate costs, in the campaign leading up to an election. A good single-case study of this is Kain's (1990) article about a rail transit project in Dallas. Votes are cast more often for large rail, bridge, and tunnel projects than for road projects. For example, most U.S. highway funds are distributed to states based on a formula (i.e., there is no competitive process). A state department of transportation (DOT) is likely to have a fixed annual budget for construction. The DOT leadership would presumably want fairly accurate cost estimates before allocating the budget. One may speculate that large cost underestimation is less likely in this situation. There are exceptions to this scenario. Sometimes DOT officials want to persuade state legislators to increase their budget. And states occasionally submit bond issue proposals to voters. In Europe, the situation is similar on important points, although differences also exist. This may explain the result found below, that cost underestimation is substantially lower for roads than for rail, bridges, and tunnels, and that this is the case both in the U.S. and Europe. Needless to say, more research is necessary to substantiate this observation.

Finally, we want to emphasize that although the project sample used in this study is the largest of its kind, it is still too small to allow more than a few subdivisions, if comparative statistical analyses must still be possible. Therefore, in further work on understanding cost underestimation, the sample should be enlarged to better represent different types of projects and different geographical locations. As to project types, data for more private projects would be particularly useful in allowing statistically valid comparisons between public and private sector projects. Such comparisons do not exist today, and nobody knows whether private projects perform better or worse than public ones regarding cost underestimation. The sample should also be enlarged to contain data for more fixed-link and rail projects. Such data would allow a better (i.e., a statistically corroborated) comparative understanding of cost underestimation for more specific subtypes of projects such as bridges, tunnels, high-speed rail, urban rail, and conven-

tional rail. Such an understanding is nonexistent today. As to geography, immediate rewards would be gained from data for projects outside Europe and North America, especially for fixed links and roads. But even for Europe and North America, data on more projects are needed to allow better comparative analysis.

Measuring Cost Inaccuracy

The methods used in our study are described in the Appendix. All costs are construction costs. We follow international convention and measure the inaccuracy of cost estimates as so-called "cost escalation" (often also called "cost overrun"; i.e., actual costs minus estimated costs in percent of estimated costs). Actual costs are defined as real, accounted construction costs determined at the time of project completion. Estimated costs are defined as budgeted, or forecasted, construction costs at the time of decision to build. Although the project planning process varies with project type, country, and time, it is typically possible for any given project to identify a specific point in the process as the time of decision to build. Usually a cost estimate was available at this point in time for the decision makers. If not, then the closest available estimate was used, typically a later estimate resulting in a conservative bias in our measure for inaccuracy (see the Appendix). All costs are calculated in fixed prices in Euros by using the appropriate historical, sectoral, and geographical indices for discounting and the appropriate exchange rates for conversion between currencies.

Project promoters and their analysts sometimes object to this way of measuring cost inaccuracy (Flyvbjerg et al., in press). Various cost estimates are made at different stages of the process: project planning, decision to build, tendering, contracting, and later renegotiations. Cost estimates at each successive stage typically progress toward a smaller number of options, greater detail of designs, greater accuracy of quantities, and better information about unit price. Thus, cost estimates become more accurate over time, and the cost estimate at the time of making the decision to build is far from final. It is only to be expected, therefore, that such an early estimate would be highly inaccurate. And this estimate would be unfair as the basis for assessing the accuracy of cost forecasting, or so the objection against using the time-of-decision-to-build estimate goes (Simon, 1991). We defend this method, however, because when the focus is on decision making, and hence on the accuracy of the information available to decision makers, then it is *exactly* the cost estimate at the time of making the decision to build that is of primary interest. Otherwise it would be impossible to evaluate whether decisions are informed or not. Estimates made after the decision to build are by definition irrelevant to this decision. Whatever the reasons are for cost increases after decision makers give the go-ahead to build a project, or however large such increases are, legislators and citizens—or private investors in the case of privately funded projects—are entitled to know the uncertainty of budgets. Otherwise transparency and accountability suffer. We furthermore observe that if the inaccuracy of early cost estimates were simply a matter of incomplete information and inherent difficulties in predicting a distant future, as project promoters often say it is, then we would expect inaccuracies to be random or close to random. Inaccuracies, however, have a striking and highly interesting bias, as we will see below.

Another objection to using cost at the time of decision to build as a basis of comparison is that this supposedly would entail the classical error of comparing apples and oranges. Projects change over the planning and implementation process. When, for instance, the physical configuration of the original Los Angeles Blue Line Light Rail project was altered at substantial cost to comprise grade-crossing improvements, upgrading of adjacent streets, better sidewalks, new fences, etc., the project was no longer the same. It was, instead, a new and safer project, and comparing the costs of this project with the costs of the older, less safe one would supposedly entail the apples-and-oranges error. A problem with this argument is that existing research indicates that project promoters routinely ignore, hide, or otherwise leave out important project costs and risks in order to make total costs appear low (Flyvbjerg et al., in press; Wachs, 1989, 1990). For instance, environmental and safety concerns may initially be ignored, even though they will have to be taken into account later in the project cycle if the project lives on, and the project is more likely to live on if environmental and safety concerns are initially ignored. Similarly, ignoring or underplaying geological risks may be helpful in getting projects approved, and no other risk is more likely to boomerang back and haunt projects during construction. "Salami tactics" is the popular name used to describe the practice of introducing project components and risks one slice at a time in order to make costs appear low as long as possible. If such tactics are indeed a main mechanism in cost underestimation, as existing research indicates, then, clearly, comparing actual project costs with estimated costs at the time of decision to build does not entail the error of comparing apples and oranges but is simply a way of tracking how what was said to be a small, inexpensive apple turned out to actually be a big, expensive one.

Finally, we observe that if we were to follow the objections against using the cost estimate at the time of de-

cision to build as the basis of tracking cost escalation, it would be impossible to make meaningful comparisons of costs because no common standard of comparison would be available. We also observe that this method is the international standard for measuring inaccuracy of cost estimates (Fouracre et al., 1990; Leavitt et al., 1993; National Audit Office & Department of Transport, 1992; Nijkamp & Ubbels, 1999; Pickrell, 1990; Walmsley & Pickett, 1992; World Bank, 1994). This standard conveniently allows meaningful and consistent comparisons within individual projects and across projects, project types, and geographical areas. This standard, then, is employed below to measure the inaccuracy of cost estimates in 258 transportation infrastructure projects worth US$90 billion.

Inaccuracy of Cost Estimates

Figure 1 shows a histogram with the distribution of inaccuracies of cost estimates. If errors in estimating costs were small, the histogram would be narrowly concentrated around zero. If errors in overestimating costs were of the same size and frequency as errors in underestimating costs, the histogram would be symmetrically distributed around zero. Neither is the case. We make the following observations regarding the distribution of inaccuracies of construction cost estimates:

- Costs are underestimated in almost 9 out of 10 projects. For a randomly selected project, the likelihood of actual costs being larger than estimated costs is 86%. The likelihood of actual costs being lower than or equal to estimated costs is 14%.
- Actual costs are on average 28% higher than estimated costs (sd=39).
- We reject with overwhelming significance the thesis that the error of overestimating costs is as common as the error of underestimating costs ($p<0.001$; two-sided test, using the binomial distribution). Estimated costs are biased, and the bias is caused by systematic underestimation.
- We reject with overwhelming significance the thesis that the numerical size of the error of underestimating costs is the same as the numerical size of the error of overestimating costs ($p<0.001$; nonparametric Mann-Whitney test). Costs are not only underestimated much more often than they are overestimated or correct, costs that have been underestimated are also wrong by a substantially larger margin than costs that have been overestimated.

We conclude that the error of underestimating costs is significantly much more common and much larger than the error of overestimating costs. Underestimation of costs at the time of decision to build is the rule rather than the exception for transportation infrastructure projects. Frequent and substantial cost escalation is the result.

Cost Underestimation by Project Type

In this section, we discuss whether different types of projects perform differently with respect to cost underestimation. Figure 2 shows histograms with inaccuracies of cost estimates for each of the following project types: (1) rail (high-speed; urban; and conventional, inter-city rail), (2) fixed link (bridges and tunnels), and (3) road (highways and freeways). Table 1 shows the expected (average) inaccuracy and standard deviation for each type of project.

Statistical analyses of the data in Table 1 show both means and standard deviations to be different with a high level of significance. Rail projects incur the highest difference between actual and estimated costs, with an average of no less than 44.7%, followed by fixed-link projects averaging 33.8% and roads at 20.4%. An F-test falsifies the null hypothesis at a very high level of statistical significance that type of project has no effect on percentage cost escalation ($p<0.001$). Project type matters. The substantial and significant differences among project types indicate that pooling the three types of projects in statistical analyses, as we did above, is strictly not appropriate. Therefore, in the analyses that follow, each type of project will be considered separately.

Based on the available evidence, we conclude that rail promoters appear to be particularly prone to cost underestimation, followed by promoters of fixed-link projects. Promoters of road projects appear to be relatively less inclined to underestimate costs, although actual costs are higher than estimated costs much more often than not for road projects as well.

Further subdivisions of the sample indicate that high-speed rail tops the list of cost underestimation, followed by urban and conventional rail, in that order. Similarly, cost underestimation appears to be larger for tunnels than for bridges. These results suggest that the complexities of technology and geology might have an effect on cost underestimation. These results are not statistically significant, however. Even if the sample is the largest of its kind, it is too small to allow repeated subdivisions and still produce significant results. This problem can be solved only by further data collection from more projects.

We conclude that the question of whether there are significant differences in the practice of cost underesti-

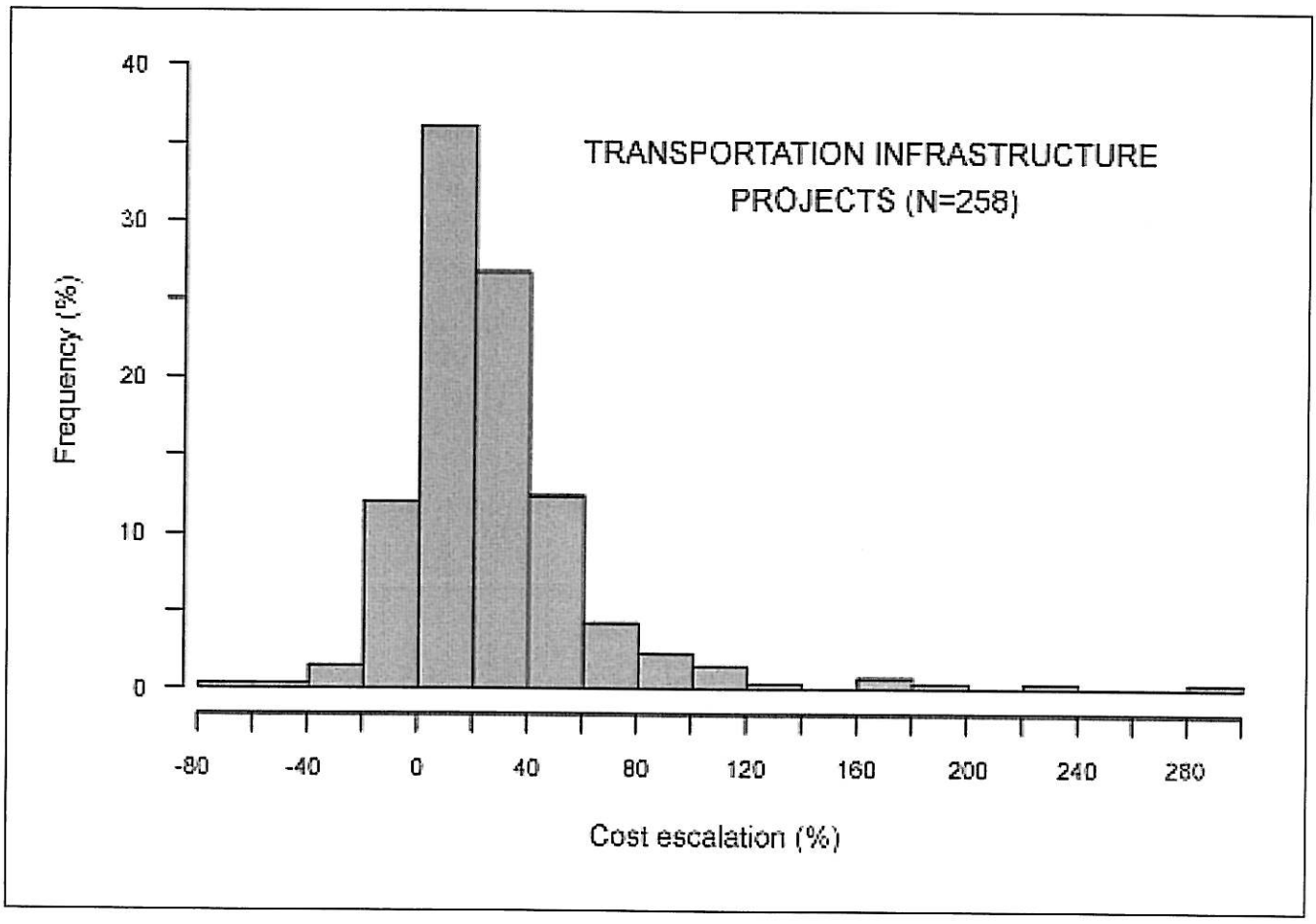

FIGURE 1. Inaccuracy of cost estimates in 258 transportation infrastructure projects (fixed prices).

TABLE 1. Inaccuracy of transportation project cost estimates by type of project (fixed prices).

Project type	Number of cases (N)	Average cost escalation (%)	Standard deviation	Level of significance (p)
Rail	58	44.7	38.4	<0.001
Fixed-link	33	33.8	62.4	<0.004
Road	167	20.4	29.9	<0.001
All projects	258	27.6	38.7	<0.001

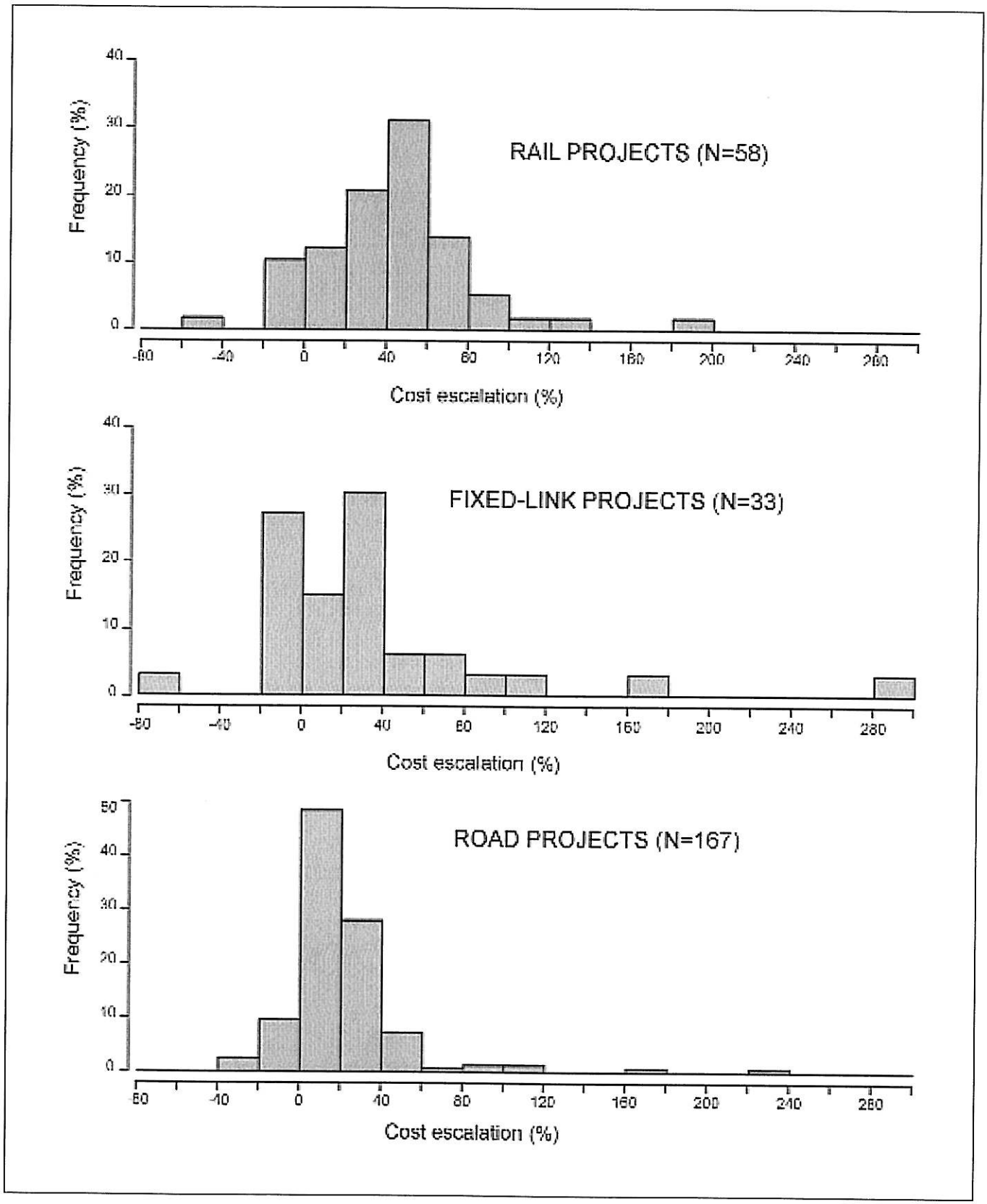

FIGURE 2. Inaccuracy of cost estimates in rail, fixed-link, and road projects (fixed prices).

mation among rail, fixed-link, and road projects must be answered in the affirmative. The average difference between actual and estimated costs for rail projects is substantially and significantly higher than that for roads, with fixed-link projects in a statistically nonsignificant middle position. The average inaccuracy for rail projects is more than twice that for roads, resulting in average cost escalations for rail more than double that for roads. For all three project types, the evidence shows that it is sound advice for policy and decision makers as well as investors, bankers, media, and the public to take any estimate of construction costs with a grain of salt, especially for rail and fixed-link projects.

Cost Underestimation by Geographical Location

In addition to testing whether cost underestimation differs for different kinds of projects, we also tested whether it varies with geographical location among Europe, North America, and "other geographical areas" (a group of 10 developing nations plus Japan). Table 2 shows the differences between actual and estimated costs in these three areas for rail, fixed-link, and road projects. There is no indication of statistical interaction between geographical area and type of project. We therefore consider the effects from these variables on cost underestimation separately. For all projects, we find that the difference between geographical areas in terms of underestimation is highly significant ($p<0.001$). Geography matters to cost underestimation.

If Europe and North America are compared separately, which is compulsory for fixed links and roads because no observations exist for these projects in other geographical areas, comparisons can be made by t-tests (as the standard deviations are rather different, the Welch version is used). For fixed-link projects, the average difference between actual and estimated costs is 43.4% in Europe versus 25.7% North America, but the difference between the two geographical areas is nonsignificant ($p=0.414$). Given the limited number of observations and the large standard deviations for fixed-link projects, we would need to enlarge the sample with more fixed-link projects in Europe and North America in order to test whether the differences might be significant for more observations. For rail projects, the average difference between actual and estimated costs is 34.2% in Europe versus 40.8% in North America. For road projects, the similar numbers are 22.4% versus 8.4%. Again, the differences between geographical areas are nonsignificant ($p=0.510$ and $p=0.184$, respectively).

We conclude, accordingly, that the highly significant differences we found above for geographical location come from projects in the "other geographical areas" category. The average difference between actual and estimated costs in this category is a hefty 64.6%.

Have Estimates Improved Over Time?

In the previous two sections, we saw how cost underestimation varies with project type and geography. In this section, we conclude the statistical analyses by studying how underestimation has varied over time. We ask and answer the question of whether project promoters and forecasters have become more or less inclined over time to underestimate the costs of transportation infrastructure projects. If underestimation were unintentional and related to lack of experience or faulty methods in estimating and forecasting costs, then, a priori, we would expect underestimation to decrease over time as better methods were developed and more experience gained through the planning and implementation of more infrastructure projects.

Figure 3 shows a plot of the differences between actual and estimated costs against year of decision to build

TABLE 2. Inaccuracy of transportation project cost estimates by geographical location (fixed prices).

	Europe			North America			Other geographical areas		
Project type	Number of projects (N)	Average cost escalation (%)	Standard deviation	Number of projects (N)	Average cost escalation (%)	Standard deviation	Number of projects (N)	Average cost escalation (%)	Standard deviation
Rail	23	34.2	25.1	19	40.8	36.8	16	64.6	49.5
Fixed-link	15	43.4	52.0	18	25.7	70.5	0	—	—
Road	143	22.4	24.9	24	8.4	49.4	0	—	—
All projects	181	25.7	28.7	61	23.6	54.2	16	64.6	49.5

for the 111 projects in the sample for which these data are available. The diagram does not seem to indicate an effect from time on cost underestimation. Statistical analyses corroborate this impression. The null hypothesis that year of decision has no effect on the difference between actual and estimated costs cannot be rejected (p=0.22, F-test). A test using year of completion instead of year of decision (with data for 246 projects) gives a similar result (p=0.28, F-test).

We therefore conclude that cost underestimation has not decreased over time. Underestimation today is in the same order of magnitude as it was 10, 30, and 70 years ago. If techniques and skills for estimating and forecasting costs of transportation infrastructure projects have improved over time, this does not show in the data. No learning seems to take place in this important and highly costly sector of public and private decision making. This seems strange and invites speculation that the persistent existence over time, location, and project type of significant and widespread cost underestimation is a sign that an equilibrium has been reached: Strong incentives and weak disincentives for underestimation may have taught project promoters what there is to learn, namely, that cost underestimation pays off. If this is the case, underestimation must be expected and it must be expected to be intentional. We examine such speculation below. Before doing so, we compare cost underestimation in transportation projects with that in other projects.

Cost Underestimation in Other Infrastructure Projects

In addition to cost data for transportation infrastructure projects, we have reviewed cost data for several hundred other projects including power plants, dams, water distribution, oil and gas extraction, information technology systems, aerospace systems, and weapons systems (Arditi et al., 1985; Blake et al., 1976; Canaday, 1980; Department of Energy Study Group, 1975; Dlakwa & Culpin, 1990; Fraser, 1990; Hall, 1980; Healey, 1964; Henderson, 1977; Hufschmidt & Gerin, 1970; Merewitz, 1973b; Merrow, 1988; Morris & Hough, 1987; World Bank, 1994, n.d.). The data indicate that other types of projects are at least as, if not more, prone to cost underestimation as are transportation infrastructure projects.

Among the more spectacular examples of cost underestimation are the Sydney Opera House, with actual costs approximately 15 times higher than those projected, and the Concorde supersonic airplane, with a cost 12 times higher than predicted (Hall, n.d., p. 3). The data also indicate that cost underestimations for other projects have neither increased nor decreased historically, and that underestimation is common in both First- and Third-World countries. When the Suez canal was completed in 1869, actual construction costs were 20 times higher than the earliest estimated costs and 3 times higher than the cost estimate for the year before construction began. The Panama Canal, which was completed in 1914, had cost escalations in the range of 70 to 200% (Summers, 1967, p. 148).

In sum, the phenomena of cost underestimation and escalation appear to be characteristic not only of transportation projects but of other types of infrastructure projects as well.

Explanations of Underestimation: Error or Lie?

Explanations of cost underestimation come in four types: technical, economic, psychological, and political. In this section, we examine which explanations best fit our data.

Technical Explanations

Most studies that compare actual and estimated costs of infrastructure projects explain what they call "forecasting errors" in technical terms, such as imperfect techniques, inadequate data, honest mistakes, inherent problems in predicting the future, lack of experience on the part of forecasters, etc. (Ascher, 1978; Flyvbjerg et al., in press; Morris & Hough, 1987; Wachs, 1990). Few would dispute that such factors may be important sources of uncertainty and may result in misleading forecasts. And for small-sample studies, which are typical of this research field, technical explanations have gained credence because samples have been too small to allow tests by statistical methods. However, the data and tests presented above, which come from the first large-sample study in the field, lead us to reject technical explanations of forecasting errors. Such explanations simply do not fit the data.

First, if misleading forecasts were truly caused by technical inadequacies, simple mistakes, and inherent problems with predicting the future, we would expect a less biased distribution of errors in cost estimates around zero. In fact, we have found with overwhelming statistical significance ($p<0.001$) that the distribution of such errors has a nonzero mean. Second, if imperfect techniques, inadequate data, and lack of experience were main explanations of the underestimations, we would expect an improvement in forecasting accuracy over time, since errors and their sources would be recognized and addressed through the refinement of data collection, forecasting methods, etc. Substantial resources have

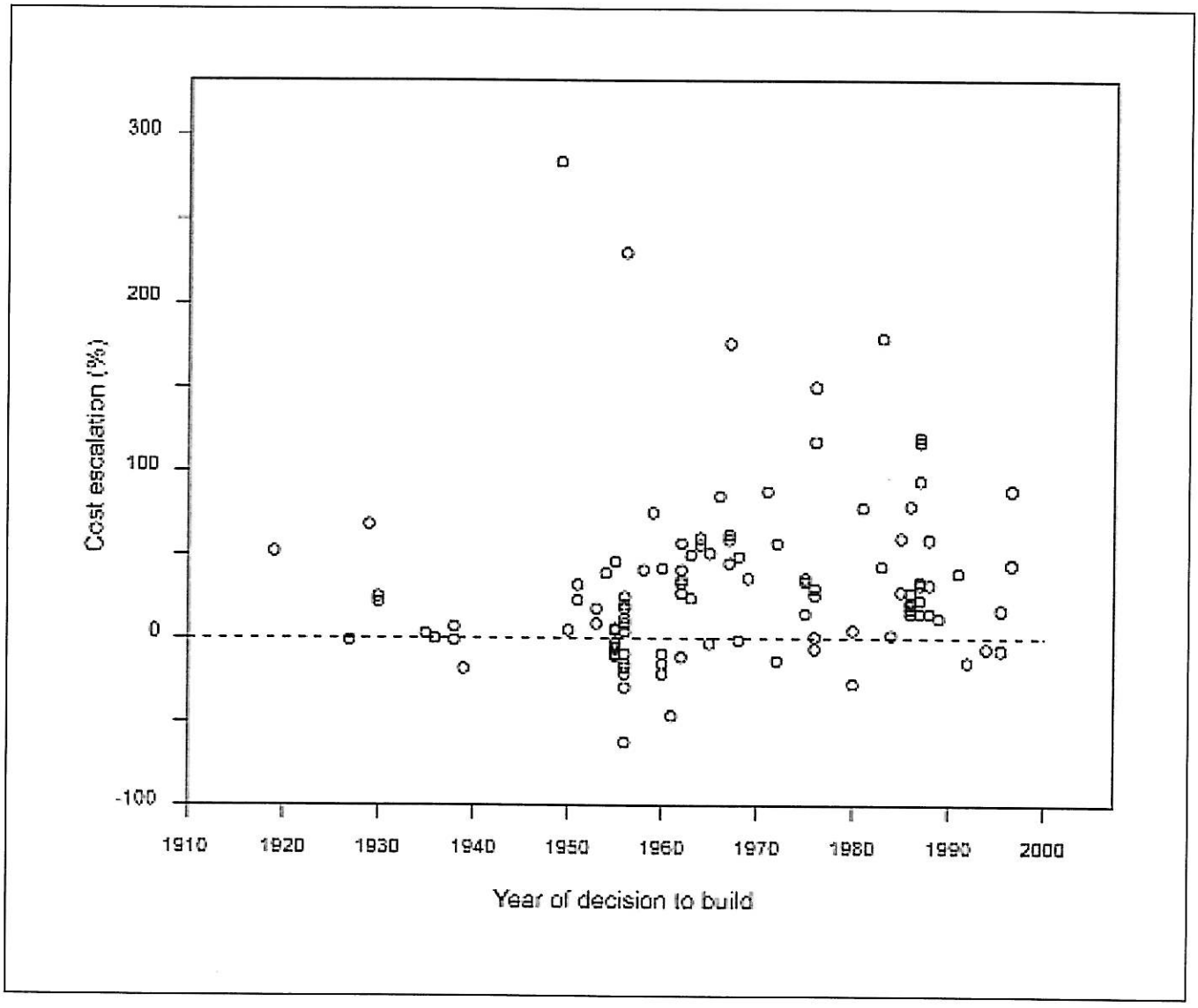

FIGURE 3. Inaccuracy of cost estimates in transportation projects over time, 1910–1998 (fixed prices, 111 projects).

been spent over several decades on improving data and methods. Still our data show that this has had no effect on the accuracy of forecasts. Technical factors, therefore, do not appear to explain the data. It is not so-called forecasting "errors" or cost "escalation" or their causes that need explaining. It is the fact that in 9 out of 10 cases, costs are underestimated.

We may agree with proponents of technical explanations that it is, for example, impossible to predict for the individual project exactly *which* geological, environmental, or safety problems will appear and make costs soar. But we maintain that it is possible to predict the risk, based on experience from other projects, *that* some such problems will haunt a project and how this will affect costs. We also maintain that such risk can and should be accounted for in forecasts of costs, but typically is not. For technical explanations to be valid, they would have to explain why forecasts are so consistent in ignoring cost risks over time, location, and project type.

Economic Explanations

Economic explanations conceive of cost underestimation in terms of economic rationality. Two types of economic explanation exist; one explains in terms of eco-

nomic self-interest, the other in terms of the public interest. As regards self-interest, when a project goes forward, it creates work for engineers and construction firms, and many stakeholders make money. If these stakeholders are involved in or indirectly influence the forecasting process, then this may influence outcomes in ways that make it more likely that the project will be built. Having costs underestimated and benefits overestimated would be economically rational for such stakeholders because it would increase the likelihood of revenues and profits. Economic self-interest also exists at the level of cities and states. Here, too, it may explain cost underestimation. Pickrell (1990, 1992) pointed out that transit capital investment projects in the U.S. compete for discretionary grants from a limited federal budget each year. This creates an incentive for cities to make their projects look better, or else some other city may get the money.

As regards the public interest, project promoters and forecasters may deliberately underestimate costs in order to provide public officials with an incentive to cut costs and thereby to save the public's money. According to this type of explanation, higher cost estimates would be an incentive for wasteful contractors to spend more of the taxpayer's money. Empirical studies have identified promoters and forecasters who say they underestimate costs in this manner and with this purpose (i.e., to save public money; Wachs, 1990). The argument has also been adopted by scholars, for instance Merewitz (1973b), who explicitly concludes that "keeping costs low is more important than estimating costs correctly" (p. 280).

Both types of economic explanation account well for the systematic underestimation of costs found in our data. Both depict such underestimation as deliberate, and as economically rational. If we now define a lie in the conventional fashion as making a statement intended to deceive others (Bok, 1979, p. 14; Cliffe et al., 2000, p. 3), we see that deliberate cost underestimation is lying, and we arrive at one of the most basic explanations of lying, and of cost underestimation, that exists: Lying pays off, or at least economic agents believe it does. Moreover, if such lying is done for the public good (e.g., to save taxpayers' money), political theory would classify it in that special category of lying called the "noble lie," the lie motivated by altruism. According to Bok (1979), this is the "most dangerous body of deceit of all" (p. 175).

In the case of cost underestimation in public works projects, proponents of the noble lie overlook an important fact: Their core argument—that taxpayers' money is saved by cost underestimation—is seriously flawed. Anyone with even the slightest trust in cost-benefit analysis and welfare economics must reject this argument. Underestimating the costs of a given project leads to a falsely high benefit-cost ratio for that project, which in turn leads to two problems. First, the project may be started despite the fact that it is not economically viable. Or, second, it may be started instead of another project that would have yielded higher returns had the actual costs of both projects been known. Both cases result in the inefficient use of resources and therefore in waste of taxpayers' money. Thus, for reasons of economic efficiency alone, the argument that cost underestimation saves money must be rejected; underestimation is more likely to result in waste of taxpayers' money. But the argument must also be rejected for ethical and legal reasons. In most democracies, for project promoters and forecasters to deliberately misinform legislators, administrators, bankers, the public, and the media would not only be considered unethical but in some instances also illegal, for instance where civil servants would misinform cabinet members or cabinet members would misinform the parliament. There is a formal "obligation to truth" built into most democratic constitutions on this point. This obligation would be violated by deliberate underestimation of costs, whatever the reasons may be. Hence, even though economic explanations fit the data and help us understand important aspects of cost underestimation, such explanations cannot be used to justify it.

Psychological Explanations

Psychological explanations attempt to explain biases in forecasts by a bias in the mental makeup of project promoters and forecasters. Politicians may have a "monument complex," engineers like to build things, and local transportation officials sometimes have the mentality of empire builders. The most common psychological explanation is probably "appraisal optimism." According to this explanation, promoters and forecasters are held to be overly optimistic about project outcomes in the appraisal phase, when projects are planned and decided (Fouracre et al., 1990, p. 10; Mackie & Preston, 1998; Walmsley & Pickett, 1992, p. 11; World Bank, 1994, p. 86). An optimistic cost estimate is clearly a low one. The existence of appraisal optimism in promoters and forecasters would result in actual costs being higher than estimated costs. Consequently, the existence of appraisal optimism would be able to account, in whole or in part, for the peculiar bias of cost estimates found in our data, where costs are systematically underestimated. Such optimism, and associated cost underestimation, would not be lying, needless to say, because the deception involved is self-deception and therefore not deliberate. Cost underestimation would be error according to this explanation.

There is a problem with psychological explanations, however. Appraisal optimism would be an important

and credible explanation of underestimated costs if estimates were produced by inexperienced promoters and forecasters, i.e., persons who were estimating costs for the first or second time and who were thus unknowing about the realities of infrastructure building and were not drawing on the knowledge and skills of more experienced colleagues. Such situations may exist and may explain individual cases of cost underestimation. But given the fact that the human psyche is distinguished by a significant ability to learn from experience, it seems unlikely that promoters and forecasters would continue to make the same mistakes decade after decade instead of learning from their actions. It seems even more unlikely that a whole profession of forecasters and promoters would collectively be subject to such a bias and would not learn over time. Learning would result in the reduction, if not elimination, of appraisal optimism, which would then result in cost estimates becoming more accurate over time. But our data clearly shows that this has not happened.

The profession of forecasters would indeed have to be an optimistic group to keep their appraisal optimism throughout the 70-year period our study covers and not learn that they were deceiving themselves and others by underestimating costs. This would account for the data, but is not a credible explanation. As observed elsewhere, the incentive to publish and justify optimistic estimates is very strong, and the penalties for having been overoptimistic are generally insignificant (Davidson & Huot, 1989, p. 137; Flyvbjerg et al., in press). This is a better explanation of the pervasive existence of optimistic estimates than an inherent bias for optimism in the psyche of promoters and forecasters. And "optimism" calculated on the basis of incentives is not optimism, of course; it is deliberate deception. Therefore, on the basis of our data, we reject appraisal optimism as a primary cause of cost underestimation.

Political Explanations

Political explanations construe cost underestimation in terms of interests and power (Flyvbjerg, 1998). Surprisingly little work has been done that explains the pattern of misleading forecasts in such terms (Wachs, 1990, p. 145). A key question for political explanations is whether forecasts are intentionally biased to serve the interests of project promoters in getting projects started. This question again raises the difficult issue of lying. Questions of lying are notoriously hard to answer, because in order to establish whether lying has taken place, one must know the intentions of actors. For legal, economic, moral, and other reasons, if promoters and forecasters have intentionally fabricated a deceptive cost estimate for a project to get it started, they are unlikely to tell researchers or others that this is the case (Flyvbjerg, 1996; Wachs, 1989).

When Eurotunnel, the private company that owns the tunnel under the English Channel, went public in 1987 to raise funds for the project, investors were told that building the tunnel would be relatively straightforward. Regarding risks of cost escalation, the prospectus read:

> Whilst the undertaking of a tunneling project of this nature necessarily involves certain construction risks, the techniques to be used are well proven. . . . The Directors, having consulted the Mâitre d'Oeuvre, believe that 10% . . . would be a reasonable allowance for the possible impact of unforeseen circumstances on construction costs.[2] ("Under Water," 1989, p. 37)

Two hundred banks communicated these figures for cost and risk to investors, including a large number of small investors. As observed by *The Economist* ("Under Water," 1989), anyone persuaded in this way to buy shares in Eurotunnel in the belief that the cost estimate was the mean of possible outcomes was, in effect, deceived. The cost estimate of the prospectus was a best possible outcome, and the deception consisted in making investors believe in the highly unlikely assumption—disproved in one major construction project after another—that everything would go according to plan, with no delays; no changes in safety and environmental performance specifications; no management problems; no problems with contractual arrangements, new technologies, or geology; no major conflicts; no political promises not kept; etc. The assumptions were, in other words, those of an ideal world. The real risks of cost escalation for the Channel tunnel were many times higher than those communicated to potential investors, as evidenced by the fact that once built, the real costs of the project were higher by a factor of two compared with forecasts.

Flyvbjerg, Bruzelius, and Rothengatter (in press) document for a large number of projects that the Everything-Goes-According-to-Plan type of deception used for the Channel tunnel is common. Such deception is, in fact, so widespread that in a report on infrastructure and development, the World Bank (1994, pp. ii, 22) found reason to coin a special term for it: the "EGAP-principle." Cost estimation following the EGAP-principle simply disregards the risk of cost escalation resulting from delays, accidents, project changes, etc. This is a major problem in project development and appraisal, according to the World Bank.

It is one thing, however, to point out that investors, public or private, were deceived in particular cases. It is

quite another to get those involved in the deceptions to talk about this and to possibly admit that deception was intentional, i.e., that it was lying. We are aware of only one study that actually succeeded in getting those involved in underestimating costs to talk about such issues (Wachs, 1986, 1989, 1990). Wachs interviewed public officials, consultants, and planners who had been involved in transit planning cases in the U.S. He found that a pattern of highly misleading forecasts of costs and patronage could not be explained by technical issues and were best explained by lying. In case after case, planners, engineers, and economists told Wachs that they had had to "cook" forecasts in order to produce numbers that would satisfy their superiors and get projects started, whether or not the numbers could be justified on technical grounds (Wachs, 1990, p. 144). One typical planner admitted that he had repeatedly adjusted the cost figures for a certain project downward and the patronage figures upward to satisfy a local elected official who wanted to maximize the chances of getting the project in question started. Wachs' work is unusually penetrating for a work on forecasting. But again, it is small-sample research, and Wachs acknowledges that most of his evidence is circumstantial (Wachs, 1986, p. 28). The evidence does not allow conclusions regarding the project population. Nevertheless, based on the strong pattern of misrepresentation and lying found in his case studies, Wachs goes on to hypothesize that the type of abuse he has uncovered is "nearly universal" (1990, p. 146; 1986, p. 28) and that it takes place not only in transit planning but also in other sectors of the economy where forecasting routinely plays an important role in policy debates.

Our data give support to Wachs' claim. The pattern of highly underestimated costs is found not only in the small sample of projects Wachs studied; the pattern is statistically significant and holds for the project population mean (i.e., for the majority of transportation infrastructure projects). However, on one point, Wachs (1986) seems to draw a conclusion somewhat stronger than is warranted. "[F]orecasted costs always seem to be *lower* than actual costs" (p. 24) he says (emphasis in original). Our data show that although "always" (100%) may cover the small sample of projects Wachs chose to study, when the sample is enlarged by a factor of 20–30 to a more representative one, "only" in 86% of all cases are forecasted costs lower than actual costs. Such trifles—14 percentage points—apart, the pattern identified by Wachs is a general one, and his explanation of cost underestimation in terms of lying to get projects started fit our data particularly well. Of the existing explanations of cost development in transportation infrastructure projects, we therefore opt for political and economic explanations. The use of deception and lying as tactics in power struggles aimed at getting projects started and at making a profit appear to best explain why costs are highly and systematically underestimated in transportation infrastructure projects.

Summary and Conclusions

The main findings from the study reported in this article—all highly significant and most likely conservative—are as follows:

- In 9 out of 10 transportation infrastructure projects, costs are underestimated.
- For rail projects, actual costs are on average 45% higher than estimated costs (sd=38).
- For fixed-link projects (tunnels and bridges), actual costs are on average 34% higher than estimated costs (sd=62).
- For road projects, actual costs are on average 20% higher than estimated costs (sd=30).
- For all project types, actual costs are on average 28% higher than estimated costs (sd=39).
- Cost underestimation exists across 20 nations and 5 continents; it appears to be a global phenomenon.
- Cost underestimation appears to be more pronounced in developing nations than in North America and Europe (data for rail projects only).
- Cost underestimation has not decreased over the past 70 years. No learning that would improve cost estimate accuracy seems to take place.
- Cost underestimation cannot be explained by error and seems to be best explained by strategic misrepresentation, i.e., lying.
- Transportation infrastructure projects do not appear to be more prone to cost underestimation than are other types of large projects.

We conclude that the cost estimates used in public debates, media coverage, and decision making for transportation infrastructure development are highly, systematically, and significantly deceptive. So are the cost-benefit analyses into which cost estimates are routinely fed to calculate the viability and ranking of projects. The misrepresentation of costs is likely to lead to the misallocation of scarce resources, which, in turn, will produce losers among those financing and using infrastructure, be they taxpayers or private investors.

We emphasize that these conclusions should not be interpreted as an attack on public (vs. private) spending on infrastructure, since the data are insufficient to decide whether private projects perform better or worse

than public ones regarding cost underestimation. Nor do the conclusions warrant an attack on spending on transportation vs. spending on other projects, since other projects appear to be as liable to cost underestimation and escalation as are transportation projects. With transportation projects as an in-depth case study, the conclusions simply establish that significant cost underestimation is a widespread practice in project development and implementation, and that this practice forms a substantial barrier to the effective allocation of scarce resources for building important infrastructure.

The key policy implication for this consequential and highly expensive field of public policy is that those legislators, administrators, bankers, media representatives, and members of the public who value honest numbers should not trust the cost estimates presented by infrastructure promoters and forecasters. Another important implication is that institutional checks and balances—including financial, professional, or even criminal penalties for consistent or foreseeable estimation errors—should be developed to ensure the production of less deceptive cost estimates. The work of designing such checks and balances has been begun elsewhere, with a focus on four basic instruments of accountability: (1) increased transparency, (2) the use of performance specifications, (3) explicit formulation of the regulatory regimes that apply to project development and implementation, and (4) the involvement of private risk capital, even in public projects (Bruzelius et al., 1998; Flyvbjerg et al., in press).

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NOTES

1. Merewitz's (1973a, 1973b) study compared cost overrun in urban rapid transit projects, especially the San Francisco Bay Area Rapid Transit (BART) system, with overrun in other types of public works projects. Merewitz's aims were thus different from ours, and his sample of transportation projects was substantially smaller: 17 rapid transit projects and 49 highway projects, compared with our 58 rail projects, 167 highway projects, and 33 bridge or tunnel projects. In addition to issues of a small sample, in our attempt to replicate Merewitz's analysis we found that his handling of data raises a number of other issues. First, Merewitz did not correct his cost data for inflation, i.e., current prices were used instead of fixed ones. This is known to be a major source of error due to varying inflation rates between projects and varying duration of construction periods. Second, in statistical tests, Merewitz compared the mean cost overrun of subgroups of projects (e.g., rapid transit) with the grand mean of overrun for all projects, thus making the error of comparing projects with themselves. Subgroups should be tested directly against other subgroups in deciding whether they differ at all and, if so, which ones differ. Third, Merewitz's two reports (1973a, 1973b) are inconsistent. One (1973a) calculates the grand mean of cost overrun as the average of means for subgroups; that is, the grand mean is unweighted, where common practice is to use the weighted mean, as appears to be the approach taken in the other (1973b). Fourth, due to insufficient information, the p-values calculated by Merewitz are difficult to verify; most likely they are flawed, however, and Merewitz's one-sided p-values are misleading. Finally, Merewitz used a debatable assumption about symmetry, which has more impact for the nonparametric test used than nonnormality has for parametric methods. Despite these shortcomings, the approach taken in Merewitz's study was innovative for its time and in principle pointed in the right direction regarding how to analyze cost escalation in public works projects. The study cannot be said to be a true large-sample study for transportation infrastructure, however, and its statistical significance is unclear.
2. The Mâitre d'Oeuvre was an organization established to monitor project planning and implementation for the Channel tunnel. It was established in 1985, and until 1988 it represented the owners. In 1988 it was reverted to an impartial position (Major Projects Association, 1994, pp. 151–153).

REFERENCES

Arditi, D., Akan, G. T., & Gurdamar, S. (1985). Cost overruns in public projects. *International Journal of Project Management, 3*(4), 218–225.

Ascher, W. (1978). *Forecasting: An appraisal for policy-makers and planners.* Baltimore: Johns Hopkins University Press.

Blake, C., Cox, D., & Fraize, W. (1976). *Analysis of projected vs. actual costs for nuclear and coal-fired power plants* (Report repared for the United States Energy Research and Development Administration). McLean, VA: Mitre Corporation.

Bok, S. (1979). *Lying: Moral choice in public and private life.* New York: Vintage.

Bruzelius, N., Flyvbjerg, B., & Rothengatter, W. (1998). Big decisions, big risks: Improving accountability in mega projects. *International Review of Administrative Sciences, 64*(3), 423–440.

Canaday, H. T. (1980). *Construction cost overruns in electric utilities: Some trends and implications* (Occasional Paper No. 3). Columbus: National Regulatory Research Institute, Ohio State University.

Cliffe, L., Ramsey, M., & Bartlett, D. (2000). *The politics of lying: Implications for democracy.* London: Macmillan.

Commission of the European Union. (1993). *Growth, competitiveness, employment: The challenges and ways forward into the 21st century* (White Paper). Brussels: Author.

Davidson, F. P., & Huot, J.-C. (1989). Management trends for major projects. *Project Appraisal, 4*(3), 133–142.

Department of Energy Study Group. (1975). *North Sea costs escalation study* (Energy Paper No. 8). London: Department of Energy.

Dlakwa, M. M., & Culpin, M. F. (1990). Reasons for overrun in public sector construction projects in Nigeria. *International Journal of Project Management, 8*(4), 237–240.

Flyvbjerg, B. (1996). The dark side of planning: Rationality and *Realrationalität*. In S. Mandelbaum, L. Mazza, & R. Burchell (Eds.), *Explorations in planning theory* (pp. 383–394). New Brunswick, NJ: Center for Urban Policy Research Press.

Flyvbjerg, B. (1998). *Rationality and power: Democracy in practice.* Chicago: University of Chicago Press.

Flyvbjerg, B., Bruzelius, N., & Rothengatter, W. (in press). *Megaprojects and risk: An anatomy of ambition.* Cambridge, UK: Cambridge University Press.

Fouracre, P. R., Allport, R. J., & Thomson, J. M. (1990). *The performance and impact of rail mass transit in developing countries* (TRRL Research Report 278). Crowthorne, UK: Transport and Road Research Laboratory.

Fraser, R. M. (1990). Compensation for extra preliminary and general (P & G) costs arising from delays, variations and disruptions: The palmiet pumped storage scheme. *Tunneling and Underground Space Technology, 5*(3), 205–216.

Hall, P. (1980). *Great planning disasters.* Harmondsworth, UK: Penguin Books.

Hall, P. (n.d). Great planning disasters revisited. Unpublished manuscript, Bartlett School, University College, London.

Healey, J. M. (1964). Errors in project cost estimates. *Indian Economic Journal, 12*(1), 44–52.

Henderson, P. D. (1977). Two British errors: Their probable size and some possible lessons. *Oxford Economic Papers, 29*(2), 159–205.

Holm, M. K. S. (1999). *Inaccuracy of traffic forecasts and cost estimates in Swedish road and rail projects.* Unpublished manuscript, Aalborg University, Department of Development and Planning.

Hufschmidt, M. M., & Gerin, J. (1970). Systematic errors in cost estimates for public investment projects. In J. Margolis (Ed.), *The analysis of public output* (pp. 267–315). New York: Columbia University Press.

Kain, J. F. (1990). Deception in Dallas: Strategic misrepresentation in rail transit promotion and evaluation. *Journal of the American Planning Association, 56*(2), 184–196.

Leavitt, D., Ennis, S., & McGovern, P. (1993). *The cost escalation of rail projects: Using previous experience to re-evaluate the calspeed estimates* (Working Paper No. 567). Berkeley: Institute of Urban and Regional Development, University of California.

Lewis, H. (1986). *The metro report: The impact of metro and public transport integration in Tyne and Wear.* Newcastle, UK: Tyne and Wear Passenger Transport Executive.

Mackie, P., & Preston, J. (1998). Twenty-one sources of error and bias in transport project appraisal. *Transport Policy, 5*(1), 1–7.

Major Projects Association. (1994). *Beyond 2000: A source book for major projects.* Oxford, UK: Author.

Merewitz, L. (1973a). *How do urban rapid transit projects compare in cost estimate experience?* (Reprint No. 104). Berkeley: Institute of Urban and Regional Development, University of California.

Merewitz, L. (1973b). Cost overruns in public works. In W. Niskanen, A. C. Hansen, R. H. Havemann, R. Turvey, & R. Zeckhauser (Eds.), *Benefit cost and policy analysis* (pp. 277–295). Chicago: Aldine.

Merrow, E. W. (1988). *Understanding the outcomes of megaprojects: A quantitative analysis of very large civilian projects.* Santa Monica, CA: RAND Corporation.

Morris, P. W. G., & Hough, G. H. (1987). *The anatomy of major projects: A study of the reality of project management.* New York: John Wiley and Sons.

National Audit Office, Department of Transport. (1985). *Expenditure on motorways and trunk roads.* London: National Audit Office.

National Audit Office, Department of Transport. (1992). *Contracting for roads.* London: National Audit Office.

National Audit Office, Department of Transport; Scottish Development Department; & Welsh Office. (1988). *Road planning.* London: Her Majesty's Stationary Office.

Nijkamp, P., & Ubbels, B. (1999). How reliable are estimates of infrastructure costs? A comparative analysis. *International Journal of Transport Economics, 26*(1), 23–53.

Pickrell, D. H. (1990). *Urban rail transit projects: Forecast versus actual ridership and cost.* Washington, DC: U.S. Department of Transportation.

Pickrell, D. H. (1992). A desire named streetcar: Fantasy and fact in rail transit planning. *Journal of the American Planning Association, 58*(2), 158–176.

Riksrevisionsverket. (1994). *Infrastrukturinvesteringar: En kostnadsjämförelse mellan plan och utfall i 15 större projekt inom Vägverket och Banverket.* Stockholm: Author.

Simon, J. (1991). Let's make forecast and actual comparisons fair. *TR News, 156*, 6–9.

Skamris, M. K., & Flyvbjerg, B. (1997). Inaccuracy of traffic forecasts and cost estimates on large transport projects. *Transport Policy, 4*(3), 141–146.

Summers, R. (1967). Cost estimates as predictors of actual costs: A statistical study of military developments. In T. Marschak, T. K. Glennan, & R. Summers (Eds.), *Strategy for R&D: Studies in the microeconomics of development* (pp. 140–189). Berlin: Springer-Verlag.

Szyliowicz, J. S., & Goetz, A. R. (1995). Getting realistic about megaproject planning: The case of the new Denver International Airport. *Policy Sciences, 28*(4), 347–367.

Under water, over budget. (1989, October 7). *The Economist*, pp. 37–38.

Vejdirektoratet. (1995). *Notat om anlægsregnskaber.* Copenhagen: Danish Road Directorate.

Wachs, M. (1986). Technique vs. advocacy in forecasting: A study of rail rapid transit. *Urban Resources, 4*(1), 23–30.

Wachs, M. (1989). When planners lie with numbers. *Journal of the American Planning Association, 55*(4), 476–479.

Wachs, M. (1990). Ethics and advocacy in forecasting for public policy. *Business and Professional Ethics Journal, 9*(1–2), 141–157.

Walmsley, D. A., & Pickett, M. W. (1992). *The cost and patronage of rapid transit systems compared with forecasts* (Research Report 352). Crowthorne, UK: Transport Research Laboratory.

World Bank. (1994). *World development report 1994: Infrastructure for development.* Oxford, UK: Oxford University Press.

World Bank. (n. d.). *Economic analysis of projects: Towards a results-oriented approach to evaluation* (ECON Report). Washington, DC: Author.

APPENDIX

The first task of the research reported in this paper was to establish a sample of infrastructure projects substantially larger than what is common in this area of research, a sample large enough to allow statistical analyses of costs. Here a first problem was that data on actual costs in transportation infrastructure projects are relatively difficult to come by. One reason is that it is quite time consuming to produce such data. For public sector projects, funding and accounting procedures are typically unfit for keeping track of the multiple and complex changes that occur in total project costs over time. For large projects, the relevant time frame may cover 5, 10, or more fiscal years from decision to build, until construction starts, until the project is completed and operations begin. Reconstructing the actual total costs of a public project, therefore, typically entails long and difficult archival work and complex accounting. For private projects, even if funding and accounting practices may be more conducive to producing data on actual total costs, such data are often classified to keep them from the hands of competitors. Unfortunately, this also tends to keep data from the hands of scholars. And for both public and private projects, data on actual costs may be held back by project owners because more often than not, actual costs reveal substantial cost escalation, and cost escalation is normally considered somewhat of an embarrassment to promoters and owners. In sum, establishing reliable data on actual costs for even a single transportation infrastructure project is often highly time consuming or simply impossible.

This state of affairs explains why small-sample studies dominate scholarship in this field of research. But despite the problems mentioned, after 4 years of data collection and refinement, we were able to establish a sample of 258 transportation infrastructure projects with data on both actual construction costs and estimated costs at the time of decision to build. The project portfolio is worth approximately US$90 billion (1995 prices). The project types are bridges, tunnels, highways, freeways, high-speed rail, urban rail, and conventional (interurban) rail. The projects are located in 20 countries on 5 continents, including both developed and developing nations. The projects were completed between 1927 and 1998. Older projects were included in the sample in order to test whether the accuracy of estimated costs improved over time. The construction costs of projects range from US$1.5 million to US$8.5 billion (1995 prices), with the smallest projects typically being stretches of roads in larger road schemes, and the largest projects being rail links, tunnels, and bridges. As far as we know, this is the largest sample of projects with data on cost development that has been established in this field of research.

In statistical analysis, data should be a sample from a larger population, and the sample should represent the population properly. These requirements are ideally satisfied by drawing the sample by randomized lot. Randomization ensures with high probability that factors that cannot be controlled are equalized. A sample should also be designed such that the representation of subgroups corresponds to their occurrence and importance in the population. In studies of human affairs, however, where controlled laboratory experiments often cannot be conducted, it is frequently impossible to meet these ideal conditions. This is also the case for the current study, and we therefore had to take a different approach to sampling and statistical analysis.

We selected the projects for the sample on the basis of data availability. All projects that we knew of for which data on construction cost development were obtainable were considered for inclusion in the sample. Cost development is defined as the difference between actual and estimated costs in percentage of estimated costs, with all costs measured in fixed prices. Actual costs are defined as real, accounted costs determined at the time of completing a project. Estimated costs are defined as budgeted, or forecasted, costs at the time of decision to build. Even if the project planning process varies with project type, country, and time, it is typically possible to locate for any given project a specific point in the process that can be identified as the time of decision to build. Usually a cost estimate was available for this point in time. If not, the closest available estimate was used, typically a later estimate resulting in a conservative bias in our measurement of cost development. Cost data were collected from a variety of sources, including annual project accounts, questionnaires, interviews, and other studies.

Data on cost development were available for 343 projects. We then rejected 85 projects because of insufficient data quality. For instance, for some projects we could not obtain a clear answer regarding what was included in costs, or whether cost data were given in current or fixed prices, or which price level (year) had been used in estimating and discounting costs. More specifically, of those 85 projects, we rejected 27 because we could not establish whether or not cost data were valid and reliable. We rejected 12 projects because they had been completed before 1915 and no reliable indices were available for discounting costs to the present. Finally, we excluded 46 projects because cost development for them turned out to have been calculated before construction was completed and operations begun; therefore, the actual final costs for these projects may be different from the cost estimates used to calculate cost development, and no information was available on actual final costs. In addition to the 85 rejected projects mentioned here, we also rejected a number of projects to avoid double counting of projects. This typically involved projects from other studies that appeared in more than one study or where we had a strong suspicion that this might be the case. In sum, all projects for which data were considered valid and reliable were included in the sample. This covers both projects for which we ourselves collected the data and projects for which other researchers in other studies did the data collection (Fouracre et al., 1990; Hall, 1980; Leavitt et al., 1993; Lewis, 1986; Merewitz, 1973a; National Audit Office, Department of Transport, 1985, 1992; National Audit Office, Department of Transport, Scottish Development Department, & Welsh Office, 1988; Pickrell, 1990; Riksrevisionsverket, 1994; Vejdirektoratet, 1995; Walmsley & Pickett, 1992). Cost data were made comparable across projects by discounting prices to the 1995 level and calculating them in Euros, using the appropriate geographical, sectoral, and historical indices for discounting and the appropriate exchange rates for conversion between currencies.

Our own data collection concentrated on large European projects because too few data existed for this type of project to allow comparative studies. For instance, for projects with actual construction costs larger than 500 million Euros (1995 prices; EUR1=US$1.29 in 1995), we were initially able to identify from other studies only two European projects for which data were available on both actual and estimated costs. If we lowered the project size and looked at projects larger than 100 million Euros, we were able to identify such data for eight European projects. We saw the lack of reliable cost data for European projects as particularly problematic since the Commission of the European Union had just launched its policy for establishing the so-called trans-European transport networks, which would involve the construction of a large number of major transportation infrastructure projects across Europe at an initial cost of 220 billion Euros (Commission of the European Union, 1993, p. 75). As regards costs, we concluded that the knowledge base for the Commission's policy was less than well developed, and we hoped to help remedy this situation through our data collection. Our efforts on this point proved successful. We collected primary data on cost for 37 projects in Denmark, France, Germany, Sweden, and the U.K. and were thus able to greatly increase the number of large European projects with reliable data for both actual and estimated costs, allowing for the first time a comparative study for this type of project in which statistical methods could be applied.

As for any sample, a key question is whether the sample is representative of the population. Here the question is whether the projects included in the sample are representative of the population of transportation infrastructure projects. Since the criterion for sampling was data availability, this question translates into one of whether projects with available data are representative. There are four reasons why this is probably not the case. First, it may be speculated that projects that are managed well with respect to data availability may also be managed well in other respects, resulting in better than average (i.e., nonrepresentative) performance for such projects. Second, it has been argued that the very existence of data that make the evaluation of performance possible may contribute to improved performance when such data are used by project management to monitor projects (World Bank, 1994, p. 17). Again, such projects would not be representative of the project population. Third, we might speculate that managers of projects with a particularly bad track record regarding cost escalation have an interest in not making cost data available, which would then result in underrepresentation of such projects in the sample. Conversely, managers of projects with a good track record for costs might be interested in making this public, resulting in overrepresentation of these projects. Fourth, and finally, even where managers have made cost data available, they may have chosen to give out data that present their projects in as favorable a light as possible. Often there are several estimates of costs to choose from and several calculations of actual costs for a given project at a given time. If researchers collect data by means of survey questionnaires, as is often the case, there might be a temptation for managers to choose the combination of actual and estimated costs that suits them best, possibly a combination that makes their projects look good.

The available data do not allow an exact, empirical assessment of the magnitude of the problem of misrep-

resentation. But the few data that exist that shed light on this problem support the thesis that data are biased. When we compared data from the Swedish Auditor General for a subsample of road projects, for which the problems of misrepresentation did not seem to be an issue, with data for all road projects in our sample, we found that cost escalation in the Swedish subsample is significantly higher than for all projects (Holm, 1999, pp. 11–15). We conclude, for the reasons given above, that most likely the sample is biased and the bias is conservative. In other words, the difference between actual and estimated costs derived from the sample is likely to be lower than the difference in the project population. This should be kept in mind when interpreting the results from statistical analyses of the sample. The sample is not perfect by any means. Still it is the best obtainable sample given the current state of the art in this field of research.

In the statistical analyses, percentage cost development in the sample is considered normally distributed unless otherwise stated. Residual plots, not shown here, indicate that normal distribution might not be completely satisfied, the distributions being somewhat skewed with larger upper tails. However, transformations (e.g., the logarithmic one) do not improve this significantly. For simplicity, therefore, no transformation has been made, unless otherwise stated.

The subdivisions of the sample implemented as part of analyses entail methodological problems of their own. Thus the representation of observations in different combinations of subgroups is quite skewed for the data considered. The analysis would be improved considerably if the representation were more even. Partial and complete confounding occur; that is, if a combination of two or more effects is significant, it is sometimes difficult to decide whether one, the other, or both cause the difference. For interactions, often not all the combinations are represented, or the representations can be quite scarce. We have adapted our interpretations of the data to these limitations, needless to say. If better data could be gathered, sharper conclusions could be made.

The statistical models used are linear normal models (i.e., analysis of variance and regression analysis with the appropriate F-tests and t-tests). The tests of hypotheses concerning mean values are known to be robust to deviations from normality. Also, chi-square tests for independence have been used for count data. For each test, the p-value has been reported. This value is a measure for rareness if identity of groups is assumed. Traditionally, a p-value less than 0.01 is considered highly significant and less than 0.05 significant, whereas a larger p-value means that the deviation could be due to chance.