

What is Wrong with Information Engineering and How to fix it?

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ABSTRACT

What is Wrong with Information Engineering and How to fix it?

By Clive Finkelstein, the “Father” of Information Engineering

As the Father and Architect of Information Engineering (IE) and after 50+ years in the IT industry, at the age of 75 I have now retired in Perth, Western Australia. I wanted to write this paper to set the record straight on Information Engineering. There have been spectacular successes with IE, and also some dismal failures. I wanted to clear up misconceptions of how to conduct IE projects; to outline how to maximize the chances of success; and also to highlight the misconceptions and the reasons why data-driven IE projects have been disproportionately small in number, but have been spectacularly large in achievement. In contrast, only minor improvements have been achieved with process-driven IE over what has been realized using traditional Software Engineering methods.

The paper starts by reviewing many well-known problems of systems development using Software Engineering and some solutions to these problems. I discuss my early experience with these problems while working for IBM over 15 years in Australia and the USA. I left IBM in 1976 to form my own company and develop an integrated methodology to address these problems. I describe the evolution of this methodology from 1976 – 1980 as a rigorous discipline – like an engineering discipline – for information; this dictated the choice of the name: Information Engineering.

The initial publications on IE were: first, an InDepth series of articles, published by Computerworld USA in May-June 1981; and second, the co-authored book that I wrote with James Martin, published by Savant Institute in Nov 1981. From this point, IE diverged as two distinct variants. Popularized by Martin, the world rapidly adopted IE throughout the 1980s. I compare these two variants: highlighting danger points to avoid; I also outline the steps to take to ensure success. In the 1980s, 1990s and into the 21st century, Information Engineering evolved dramatically. It has been largely automated and is now being successfully used to deliver Enterprise Architecture (EA) projects into production as integrated databases and reusable processes and systems – in 3-month increments – for small and medium organizations; and also for the largest commercial, government and Defense organizations.

The paper discusses how closely IE and EA work together. The paper concludes with an Appendix that discusses Business Opportunities for Educational, Consulting and Software providers who are interested in using, further, the IE course materials that are available for licensing or copyright purchase. I conclude with the IE modeling tools discussed in the Report.

Acknowledgements

I have acknowledged key individuals, by name, within the Executive Report. I would like to acknowledge the contributions made by all past and present staff of the following companies:

- Information Engineering Services Pty Ltd (IES) in Sydney and Perth. Australia.
- Information Engineering Australia Pty Ltd (IEA) and later, Information Engineering Systems Ltd (IESL) in Sydney, Australia.
- Information Engineering New Zealand Ltd (IENZ) in Auckland, NZ.
- Information Methods Corporation (IMC) in Boston, USA.
- Information Engineering Systems Corporation (IESC) in Washington, DC.

I also acknowledge the significant contributions to the IE methodology made by Gordon Miles of IENZ, as well as his peer review of this Executive Report.

EXECUTIVE SUMMARY

What is Wrong with Information Engineering and How to fix it?

The Executive Report discusses the history and the development of Information Engineering from 1976 – 1980. It covers the further evolution of IE through the 1980s, 1990s and then into the 21st century. A number of System Development breakthroughs were achieved using IE:

- Most people think in terms of processes, not data: business processes in most organizations (commercial, government and defense) are typically based on Strategic Plans that were defined many years ago. Because of this, these processes are backward looking. It is very difficult to decide the processes needed for the future, from this backward-looking perspective.
- With a focus first on *Strategic Business Plans*, working with senior business managers at the highest level, we found that they first decide on the mission of the enterprise for the future. They then set goals to realize that mission. This focus breaks the thinking of senior management away from the current processes, to consider **what** is needed for the future. From these goals they decide the strategies that will realize the goals for achievement in that future. These strategies are then defined as tactics, which are next implemented in the enterprise as business processes.
- As they define the goals they think of **“what”** data and information they need for decision-making. The strategies define **“how”** those goals can be achieved: the tactics then precisely define **“how”** the strategies will be implemented as business processes. From this forward-looking approach of **“what”** is needed, then **“how”** to achieve the goals, we saw that new processes invariably emerge.
- We realized that we had to start from this strategic business planning approach to ensure that business managers and business experts broke away from thinking about **“how”** processes could be improved. Instead, we saw that we had to make sure that they thought about **“what”** was needed for the future: that is, their thinking was forward-looking to decide what data was required.
- It was also clear that IT experts in project teams could not do this: they did not have the necessary business experience. Only business experts in the project teams had the experience to do it. It also meant that methods were needed that trained the business experts and the IT experts to work together in a design partnership so each group could apply their relevant expertise. Furthermore, these methods must be business-driven, not IT-driven: the business experts did not have the required technical expertise for IT-driven methods.
- Systems development methods used in the 50's, 60's and 70's were traditionally IT-driven and process-driven, based on processes for strategic plans from the past as we discussed earlier. Most organisations have multiple business processes that have evolved over many years, each of which require their own data.

- Many similar processes therefore exist with their own versions of data. This has resulted in redundant data versions and stovepipe systems with non-integrated databases. When those processes change (to respond to rapid business change) every one of these redundant data versions has to be changed: so resulting in data maintenance chaos.
- Due to our focus on Business Normalization, we found that the data models that we developed were data-driven, as distinct from data models that were traditionally process-driven. This data-driven approach produced databases that were fully integrated and so were far more stable. This method structured data for the future from a business-driven perspective, based on the strategic business plans.
- Business Normalization includes a forward-looking step, which is called: Normalization Crosscheck. This is a formal quality control step that draws on the knowledge of the business experts, guided by the strategic business plans. It ensures that there is greater incorporation of future data needs, so eliminating the data maintenance chaos that typically occurs with non-integrated databases produced by the traditional process-driven systems development approach that does not effectively consider possible future data changes.
- The accepted data modeling wisdom in the 70's was to leave all *many to many* associations as-is in data models intended for business managers: these were called "enterprise models". IT experts without relational-data implementation capabilities had equated decomposition of *many-to-many* associations to non-normalized, indexed physical files. As a consequence they lost the many advantages of normalized data models and object-oriented business processes.
- We made a ground-breaking discovery: when we followed all the rules of Business Normalization and decomposed these *many to many* associations, we identified "intersecting" (associative) entities that were named by the business experts for the business processes that they represented. The "accepted data modeling wisdom" discussed above had been a "Big Mistake" as Julia Roberts would say!!! However, *it is still being followed slavishly in the 21st century!*
- Furthermore, these intersecting entities represent business processes that are invariably reusable, as they are derived from fully integrated, non-redundant data models. Only one set of data maintenance processes is required: they are in fact object-oriented methods that can be automatically derived from data models.
- Project planning has traditionally been intuitive and very subjective. The result has been differing project plans, based on the level of project experience of the project managers developing those plans. Business benefits are not achieved until the development project is *fully completed*: but many systems development projects extend over many years; and so the realization of business benefits is therefore delayed for years.
- We found that we could derive project plans from data models. This method is rigorous, objective and always achieves the same result. It can be automated and incorporated in modeling tools.

- We found that complex, multi-year projects can now be implemented with progressive deliverables into production, so that the business benefits can be achieved early: priority business processes identified by management can be delivered into production as databases and systems in three-monthly increments.

The Report compares the two variants of IE that emerged in the 1980s:

- The original business-driven, data-driven IE variant
- The later IT-driven, process-driven IE variant

This comparison shows how to maximize the potential for success in IE projects. From the 1990s and into the 21st century, the business-driven, data-driven IE variant evolved further, to enterprise engineering. It is now being used for the rapid delivery of Enterprise Architecture projects into production in 3-month increments: as integrated databases and reusable processes and systems, progressively and incrementally delivered with increasing functionality every three months.

Gordon Miles, as Managing Director of Information Engineering New Zealand Ltd, and based on his many years of experience working in facilitated strategic modeling and business planning sessions with senior business managers, their business experts, and IT experts of large, medium and small NZ companies, comments that: *“The best results were achieved when together both the business experts and IT experts could recognize what data objects were relevant, and their structural relationships, including the corporate strategies, and business experts could for themselves test the validity and business-critical data elements. This didn’t always happen but when it did it was magic; especially at the CEO level!!!”*

“Business experts could test the validity and strengths of their business plan and the attributes intrinsic in goal setting, measurement and achievement.”

“Business experts could also visualize the important business processes that would be required to create and maintain critical data objects and their structural relationships, and also the present and potential new business function requirements and responsibilities [later to be formally derived].”

“There are in New Zealand, today, examples of large, medium and small enterprises that have achieved outstanding business excellence and success through the construction and/or delivery of fully integrated data models – as a result of the data-driven IE concepts – and business systems that were precisely built.”

We found that business managers, who decided to fix this problem by *demanding* IT follow a data-driven and business-driven approach, are able to take back control of the enterprise. They are able to set the future direction of the enterprise; without the gridlock constraints of the IT-driven, process-driven approach, and are able to achieve spectacular business performance and business results.

The Report concludes by showing how closely IE and EA work together. Finally, Appendix 1 discusses Business Opportunities that may be of interest to Universities and commercial education providers as well as Consulting and Software Development organizations.

EXECUTIVE REPORT

What is Wrong with Information Engineering and How to fix it

Introduction

This Executive Report discusses the problems associated with Systems Development methods and proposes some ways to address these problems. It discusses the objectives of Information Engineering (IE) as a methodology to resolve the problems. It covers the history of IE, from its origins in 1976 – 1980 by Clive Finkelstein¹ and his staff at Information Engineering Services Pty Ltd (IES). During this period a number of systems development breakthroughs were achieved.

The report introduces the first publications on Information Engineering^{2 3} and its widespread adoption in the 1980's, popularized worldwide by James Martin. Two variants of IE emerged: these variants are compared in terms of the breakthroughs. It shows the further evolution of IE in the 1990's and into the 21st century and its application today as an integrated methodology for rapid development and delivery of Enterprise Architecture (EA).

Software Engineering methods have been traditionally used for systems development throughout the 1960s, 1970s and on into the 21st century. But they have also caused some problems, as discussed next.

Problems of Systems Development

The most critical issue facing government, defense, and commercial enterprises today is the rapid pace of change in almost every industry. With the rate of technological change increasing, together with today's budget and competitive pressures, enterprises must be able to change rapidly ... often just to survive—let alone to succeed.

The need to transform from today's inflexible business environment to an agile enterprise that can change direction rapidly has never been greater. Yet the structures, processes, and systems that we have today are inflexible: they are incapable of rapid change. And more computer

1 Clive Finkelstein is the Founder and Managing Director of Information Engineering Services Pty Ltd, in Perth, Western Australia.
2 Clive Finkelstein, "Information Engineering", Series of six InDepth Articles, Computerworld, Framingham, MA (May – June 1981). This was the first announcement of Information Engineering.
3 James Martin and Clive Finkelstein, "Information Engineering", Two Volume Technical Report, Savant Institute, Carnforth, Lancs (Nov 1981). We will henceforth call this the *1981 co-authored IE book*.

hardware, or software, or packages, or staff, or outsourcing is not the solution. They are part of the problem.

The solution requires methods and technologies for rapid business change—with systems that also change in lock step. This is *not* a computer problem. It is a business problem, one that needs strategic direction from senior management and strategic planners, with these directions then translated into rapid action by business experts working with IT experts.

What are needed are methods that enable senior managers—together with their planners, business managers, business experts, and IT staff—to work together to achieve business change, with each group contributing its specific expertise. The methods to achieve this are being successfully applied by many enterprises today. But these methods need new thinking. The tried and true ways are not fast enough. We need new ways to make the required business change transformations.

Our current systems development methods have served us well for developing operational information systems in the period of managed change that we had up until the 1990s. But now the pace of change is much faster than we ever anticipated when those systems were first built.

Historically, these systems have been difficult to change. The systems and databases that we built in the early years of the Information Age to enable our organizations to be more responsive to change are now monolithic and resistant to change. Today, they inhibit the ability of our organizations to change rapidly in order to compete ... sometimes even to survive. We are chained to inflexible systems that no longer respond to the rapid change environment of today—let alone the even greater change environment that we will find ourselves in tomorrow.

We need to build more flexible systems for the future that can change easily, rapidly, and often. To achieve this, the systems development methods that we use should take a different focus for the future. They must be able to identify potential future changes early. We must also build systems and databases differently, so that they can be changed rapidly to support vital business changes. These changes must be capable of being made within weeks, even days—not in years, as is the case today. We need *business integration methods*. We also need *enterprise integration*, together with rapid delivery methods and technologies. These require a focus on the future: through rapid delivery methods for strategic business planning, for creating balanced scorecards, and for corporate governance.

Some Solutions to these Problems

Business integration needs methods that address the integration of data, processes, locations, people, events, and motivation across an enterprise. Enterprise Architecture (EA) achieves this integration. John

Zachman⁴ developed EA through the 1970's to 1990's. Enterprise Architecture has historically involved many years of work in most organizations to achieve this integration. However this did not support the speed of systems development needed for rapid change.

Recently, business-driven methods have emerged that identify priority systems for rapid delivery, with *technology integration* used to deliver these priority systems rapidly into production in 3-month increments. These methods also use *methodology integration*: methods that have been defined so they support each other, integrating data and accessing it from reusable processes that can be implemented and delivered into production rapidly. The business-driven methods that realize this integration are covered in a book for rapid delivery of Enterprise Architecture⁵. We will refer to this book as the *Rapid EA Delivery* ebook.

We are at a dramatic and historical point of convergence: in business and in technology. The Internet and associated technologies today enable all of the customers, suppliers, and business partners of an enterprise to work together at electronic speeds. These technologies are transforming organizations. Processes that took days or weeks to complete previously by using mail, fax, and courier communications now take hours, minutes, and sometimes – even seconds. This is the direct consequence of technology.

But technology alone is not the answer. To achieve any degree of success in enterprise integration, technology integration must be used within a coherent, integrated enterprise, through business integration. Most enterprises still have a long way to go to realize business integration.

As we discussed earlier, the critical issue facing government, defense, and commercial enterprises today is the rapid pace of change in almost every industry. What are needed are integrated methods to enable senior managers—together with their planners, business managers, business experts, and IT staff—to work together to achieve business change, with each group contributing its specific expertise.

The methods to achieve this are being successfully applied by many enterprises today. But these methods need new thinking: they need a data-driven focus rather than a process-driven focus; and they need an active, business-driven emphasis rather than a passive, IT-driven approach and illustrated by business managers demanding that IT follow a business-driven and data-driven focus.

⁴ [John Zachman](#) is the Chairman of [Zachman International](#). He is acknowledged as the “Father” of Enterprise Architecture and is the originator of the [Zachman Framework](#),

⁵ Clive Finkelstein, “*Enterprise Architecture for Integration: Rapid Delivery Methods and Technologies*”, *Second Edition, IES (2011)*. This is an e-book available in PDF (\$A30) at www.ies.aust.com. It is available also for the iPad (\$US33.99) at the [Apple iBook Store](#) and for the [Amazon Kindle](#) (\$US29.15). We will henceforth call this the *Rapid EA Delivery* ebook.

We need to build more flexible systems for the future that can change easily, rapidly, and often. To achieve this, the systems development methods that we use should take a different focus for the future. They must be able to identify potential future changes early. We must also build systems and databases differently, so that they can be changed rapidly to support vital business changes. These changes must be capable of being made within weeks, even days—not in years, as is the case today. The resolution of these problems addresses enterprise integration using enterprise architecture methods and technologies. Enterprise architecture achieves *business integration*. It requires a focus on the future: through strategic planning methods.

My Early Exposure to the Problems

My early introduction to the IT industry was through my experience and training at IBM in Australia and later in the USA. I joined IBM Australia Ltd in Sydney on January 22, 1962⁶. In the 1960's hardware was expensive, so IBM provided free programming support through its Systems Engineers to its hardware customers.

My first analysis, design and coding project was to install and support IBM computers for a state government off-course horse betting organization: the Totalisator Agency Board (TAB) in Perth, Western Australia⁷. The TAB later moved its operations online to support online horse betting from remote terminals throughout WA⁸.

My next major project was to install and support an IBM System/360 computer for a major bank: the National Bank (now *National Australia Bank: NAB*) in Melbourne. In the 1960's–1970's, data input was by 80 column punched cards. NAB had ordered 20 x IBM 2260 Visual Display Units (VDUs), which they wanted to use to replace 80 column punched cards⁹.

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- 6 I first learned programming on the IBM 1400 series (1401/1440/1460) and then the IBM System/360.
 - 7 From 1964–1966, I installed at the Totalisator Agency Board (TAB) an IBM 1440 with an IBM 1231 Optical Mark Page Reader to collate phoned-in horse-betting totals from remote agencies throughout WA. I later installed at TAB an IBM System 360 Model 30 with 32MB memory, using the 1400 Emulator special feature. I wrote a multi-tasking operating system for the TAB that enabled its 1440 programs to execute on the IBM 360 Model 30 using the IBM 1400 Emulator special feature. I did not submit this operating system to the IBM Program Library as I did not want to continue to maintain it. (“Big Mistake”, as Julia Roberts said in “Pretty Woman” – I did not know it at the time, but this was a pioneering implementation of virtual machine technology, which is widely used today. If I had done so, my life may have taken a very different direction.)
 - 8 This was the second online system installed by IBM in Australia (the first being QANTAM for QANTAS). It was a single IBM System 360 Model 30, with no backup machine. This required us to design and code a multi-tasking, online operating system with automatic restart on a Machine Check hardware failure, running under IBM DOS using BTAM (Basic Telecommunications Access Method) to support 50 remote Siemens T100 Teleprinters (similar machines as used for Telex transmission in Australia in the 1960's). IBM DOS was a single task operating system at that time, so we had to write multitasking support for the online system. Our performance goals were to support 10,000 transactions per hour with < 2 second response time: we actually achieved better performance – 50,000 transactions per hour with a 0.5 second response time!!!
 - 9 This required the design and coding of an Online Data Entry System that ran in a 14 MB DOS partition. By this time, IBM DOS supported multi-tasking, but still required BTAM. The performance goals were to support 7,200 keystrokes per hour using the 2260s, with under 1 second response time – which we achieved.

I gained a great deal of online design experience through these projects, which gave me the capability to provide support throughout the Asia-Pacific region for the IBM Customer Information Control System (CICS), an IBM Program Product that had been released worldwide for implementation of online systems. My responsibilities also included the development and presentation of CICS courses for IBM throughout Australia.

In 1972 I was transferred on a two-year assignment by IBM Australia to the IBM World Trade Systems Center (WTSC) in Palo Alto, CA¹⁰. My role was to provide worldwide technical, education and marketing support for CICS, and later for CICS/VS and DL/1.¹¹ I liaised with the CICS Software Development group in Palo Alto to resolve technical problems¹².

My responsibilities also included development and presentation of CICS/VS and DL/1 DOS/VS courses to train IBM country support systems engineers and education instructors throughout the world. It was based on this experience gained over 10 years with IBM that I was continually coming up against the problems of Systems Development, discussed earlier. I felt that application systems were being designed from the point of view of the computer (due to technical problems of inadequate software capability). They were not being designed from the point of view of the business¹³.

After my two-year assignment at the WTSC in Palo Alto, I was transferred back to Sydney as DB/DC Marketing Support Manager for IBM Australia. My role was to increase the penetration of IBM DB/DC program products in Australia¹⁴ by 1976.

Over this period I was starting to develop ideas of how to resolve the system development problems. I knew that methods were needed that are driven by the business: based on deep business knowledge (so that business experts could participate with IT experts in a design partnership). I knew these methods should not be IT-driven (as they had been), which had excluded effective business expert participation.

10 The WTSC was in Palo Alto in Santa Clara County, 40 miles south of San Francisco. This was before Santa Clara County became known as "Silicon Valley".

11 DL/1 (Data Language/1) was the IBM data base management system (DBMS) support for IBM DOS and later IBM DOS/VS. It was based on IMS (Information Management System) and later IMS/VS (Information Management System/Virtual Storage).

12 This was effectively what is a Call Center role today. However, the support was via written communication: the technology we used was telex and telegraph; not phone – due to the high communication cost of overseas phone calls at that time.

13 I refined these ideas in my first book, which was written for IBM in 1973. It was published as a Systems Reference Library (SRL) book: "[CICS/VS System/Application Design Guide](#)". This book discussed the systems analysis and design considerations using CICS/VS for 10 applications across 8 industries. For this, in 1973 I received an Outstanding Contribution Award from the Chairman of IBM Corporation. However I did not feel I was yet taking sufficient consideration of the business.

14 IBM's Data Base/Data Communications (DB/DC) program products were CICS/VS, DL/1 DOS/VS and IMS/VS.

In 1976 I was approaching 15 years with IBM. I decided to resign and use my 15 years' long service leave¹⁵ to set up a company to develop an integrated set of methodologies for systems development. This company was initially called Infocom Australia; established on Aug 6, 1976¹⁶.

The History of Information Engineering

I set a 5-year plan to achieve the development of this integrated set of methodologies: from 1976 – 1980. I hired staff based on their past business and IT experience, to help develop specific methodologies. As these new methods evolved, we applied them to real-life projects that enabled us to make refinements. We developed public education courses to teach these new methods, which in turn lead to new consulting projects and further refinement.

A number of methods emerged: the most important are listed below using their initial names, with the later names given to these methods shown in brackets. They were first documented in the book I co-authored with James Martin in 1981¹⁷; they were further documented in my 1989 book¹⁸ and my 1992 book¹⁹. The initial IE methods and the business-driven methods that evolved from them are documented in Table 1 (with footnote reference to each publication and to the relevant chapters, in brackets). The main contributors to these methods are noted in Table 1.

Table 1: Evolution of Information Engineering

Initial IE Methods²⁰	Business-driven IE Methods²¹
<ul style="list-style-type: none"> Data Analysis using 3NF Normalization 	<ul style="list-style-type: none"> Business-Driven Data Modelling and <i>Business Normalization</i> (see Chapter 6 and Chapter 9)
Data Analysis included Normalization to 3NF ("Traditional Normalization"). But this was difficult for business experts. It evolved to <i>Business Normalization</i> , for use by both business experts and IT experts, working together. The main contributor to this method was Peter Kemmis from 1977-1978.	The greater business knowledge incorporated in these databases achieved more complete data integration (so eliminating data redundancy) than had ever been achieved before. It introduced 1BNF – 5BNF (which captured expert business knowledge). It included a formal <i>Normalization Crosscheck</i> for quality control, to incorporate anticipated data changes that accommodated potential future business changes.

15 15 years' long service leave is a 3-month's leave entitlement in Australia after 15 year's of full-time employment.

16 This company later changed its name on Dec 10, 1980 to Information Engineering Services Pty Ltd (IES). This is the parent company. Subsidiary operating companies were later established in Australia, New Zealand and USA: Information Engineering Australia Pty Ltd (IEA); Information Engineering Systems Ltd (IESL); Information Engineering New Zealand Ltd (IENZ); Information Methods Corporation (IMC); and Information Engineering Systems Corporation (IESC).

17 James Martin and Clive Finkelstein, "*Information Engineering*", Two Volume Technical Report, Savant Institute, Carnforth, Lancs (Nov 1981) – the 1981 co-authored IE book.

18 Clive Finkelstein, "*An Introduction to Information Engineering*", Addison-Wesley: Sydney, Australia (1989).

19 Clive Finkelstein, "*Information Engineering: Strategic Development Methods*", Addison-Wesley: Sydney, Australia (1992).

20 As documented in the 1981 co-authored IE book¹⁷.

21 For example, the rules of Business Normalization focus on "how" to apply each rule, rather than on the academic precision of the rules of traditional normalization as documented by Chris Date and others. These are easier for business experts and also IT experts to apply. Additionally, recursive associations are used by Business Normalization to represent expert business knowledge in 5BNF. See Chapters 6 and 9 of the *Rapid EA Delivery ebook*⁵.

<ul style="list-style-type: none"> • Strategic Requirements Planning 	<ul style="list-style-type: none"> • Strategic Business Planning using Goal Analysis – later called Strategy Analysis (See Chapter 3)
<p>Strategic Requirements Planning was first documented in the <i>1981 co-authored IE book</i>¹⁷. It was refined in my 1989¹⁸ and 1992¹⁹ IE books and was later replaced by Goal Analysis. The main contributor to these methods was Gordon Miles in NZ.</p>	<p>Gordon Miles, Managing Director of IENZ, developed Goal Analysis, during the 1980's in projects working with senior business managers of several large New Zealand companies. Goal Analysis was refined to Strategy Analysis by Clive Finkelstein. Strategy Analysis is a rapid Strategic Business Planning method, based on a tailored Questionnaire.</p>
<ul style="list-style-type: none"> • Information Analysis 	<ul style="list-style-type: none"> • Strategic Modelling (see <i>Chapter 7</i>)
<p>Information Analysis was an initial attempt to use Strategic Business Plans to identify information and data needed by senior business managers that could be represented in logical data models. However, we found that these strategic plans were very incomplete in most organisations. The main contributor to this method was John Edwards from 1978 – 1979.</p>	<p>Strategic Modelling uses: as a catalyst for a facilitated session with business managers, a similar tailored Questionnaire as used by Strategy Analysis (see above) to develop a Strategic Model of the business. This is an enterprise model, which identifies high-level reusable activities for prioritization of early system deliveries.</p>
<ul style="list-style-type: none"> • Procedure Formation 	<ul style="list-style-type: none"> • Process Modelling
<p>Procedure Formation was an innovative approach to derive reusable logic from data models. It was included as a chapter in the <i>1981 co-authored IE book</i>, but its full content did not appear in the final publication: if it had, it may have spurred the development of object-oriented logic a decade sooner. The main contributor to this method was John Edwards from 1978 – 1979.</p>	<p>Further refinement used Activity Modeling (see Chapter 8) to identify reusable activities and processes for rapid implementation using BPMN²² (see Chapters 10, 14 and 15). A number of modeling tools now support BPMN for rapid development and delivery into production.</p>
<ul style="list-style-type: none"> • Project Management using Fringe Analysis 	<ul style="list-style-type: none"> • Project Management using Entity Dependency Analysis (see Chapter 7)
<p>This was a completely new approach to deriving project plans from data models. It was a rigorous method to replace the intuitive and subjective methods for project planning that had been used (and are still used today). The main contributor to this method was Charles Richter from 1983 – 1987. It was first implemented in IEA's <i>User: Expert Systems</i> running under MS DOS.</p>	<p>Clive Finkelstein further refined this in the 1990's. It was objective and repeatable and so could be automated. This is fully documented in Chapter 7 of the <i>Rapid EA Delivery ebook</i>.</p> <p>Two modeling tools presently support the automated derivation of project plans from data models: Visible Advantage and Enterprise Architect.</p>

In 1980 – while attending the 1980 World Congress in Melbourne, Adrian Tidswell (from the Australian company), Gordon Miles (from the NZ company)

²² Business Process Modeling Notation (BPMN) is an open-architecture diagramming notation, for use by modeling tools to define process logic. This logic is later used to generate executable XML-based code in BPEL (Business Process Execution Language). See Chapters 10, 14 and 15 of the *Rapid EA Delivery ebook*⁵. This is a rapid delivery technology to define processes and generate executable code without requiring extensive manual programming, which is slow and error prone.

and I were walking through the city discussing the development, refinement and evolution of this integrated set of methods, which still did not have a formal name. We realized that together, our companies had developed a rigorous discipline for information. I commented that it was rigorous: like an engineering discipline and the name emerged: “Information Engineering” (IE)!

It sounded similar to “Software Engineering”, which was widely used (and still is used) for developing application systems. But it suggested the development of Information Systems. We all agreed on this as the new name and changed all references to the new methodology name: including the company names:

- Infocom Australia Pty Ltd was changed to Information Engineering Services Pty Ltd (IES) in Sydney, NSW.
- An Australian operational subsidiary company was established as Information Engineering Australia Pty Ltd (IEA), in Sydney, NSW. This later changed its name to Information Engineering Systems Ltd (IESL)
- Infocom New Zealand Ltd was changed to Information Engineering New Zealand Ltd (IENZ), as the New Zealand operational subsidiary company in Auckland, NZ.
- A USA operational subsidiary company was first established as Information Methods Corporation (IMC) in Boston, MA. A second operational subsidiary company was later established as Information Engineering Systems Corporation (IESC)²³ in Washington, DC.

From 1978 to 1982 we promoted and managed the [James Martin](#) World Seminars throughout S. E. Asia²⁴. As he witnessed the development, and evolution of these methods that we were refining as Information Engineering, in 1980 he asked if I would be prepared to co-author three books on IE with him. I agreed to co-author one book first, which became the *1981 co-authored IE book*¹⁷.

²³ IESC was established in 1987 to support a 5-year umbrella contract that we had won with the US Navy and US Marines to provide IE support through consulting, education and software. Software development of *IE: Advantage* (which automated IE to that point of its development) was transferred in 1987 to IESC for the Navy and Marines projects. Experienced IE consultants from IEA were also transferred to IESC to support the Navy and Marines projects and to train US staff. IESC later merged in 1997 with Visible Systems Corporation in Boston, MA. *IE: Advantage* was then renamed *Visible Advantage*.

²⁴ This was the 5-day World seminar presented personally by James Martin. Martin was an inspirational speaker, holding the attention of a technical audience of hundreds: spell-bound over the entire 5 days. IEA and IENZ promoted and managed these seminars for him in Sydney, Melbourne, Auckland, Singapore and Hong Kong. We suggested to him that he should also present introductory, 1-day seminars directed to management, so they could decide whom to send to the 5-day seminars. He agreed to this and these Management Seminars were presented in all capital cities. He also agreed to give an evening talk from the Concert Hall of the Sydney Opera House to promote the Management seminars and a 1-hour interview on ABC National TV, broadcast throughout Australia, to announce his evening talk at the Opera House.

From the understanding he had gained of IE from co-authoring that book, he introduced it worldwide during the 1980's in his 5-day World Seminars and also to consultants in his company: *James Martin Associates Inc (JMA)*. Tragically, James Martin died in June 2013²⁵.

We achieved some major *Systems Development Breakthroughs* during the initial years of IE from 1976 – 1980, as summarized next:

Systems Development Breakthroughs

- Most people think in terms of processes, not data: business processes in most organizations (commercial, government and defense) are typically based on Strategic Plans that were defined many years ago. Because of this, they are backward looking. It is very difficult to decide the processes needed for the future, from this backward-looking perspective.
- With a focus first on *Strategic Business Plans*, working with senior business managers at the highest level, we found that they first decide on the mission of the enterprise for the future. They then set goals to realize that mission. This focus breaks the thinking of senior management away from the current processes, to consider ***what*** is needed for the future. From these goals they decide the strategies that will realize the goals for achievement in that future. These strategies are then defined as tactics, which are next implemented in the enterprise as business processes.
- As they define the goals they think of ***“what”*** data and information they need for decision-making. The strategies define ***“how”*** those goals can be achieved: the tactics then precisely define ***“how”*** the strategies will be implemented as business processes. From this forward-looking approach of ***“what”*** is needed, then ***“how”*** to achieve the goals, we saw that new processes invariably emerge.
- We realized that we had to start from this strategic business planning approach to ensure that business managers and business experts broke away from thinking about ***“how”*** processes could be improved. Instead, we saw that we had to make sure that they thought about ***“what”*** was needed for the future: that is, their thinking was forward-looking to decide what data was required.
- It was also clear that IT experts in project teams could not do this: they did not have the necessary business experience. Only business experts in the project teams had the experience to do it. It also meant that methods were needed that trained the business experts and the IT experts to work together in a design partnership so each group could apply their relevant expertise. Furthermore, these methods must be business-driven, not IT-driven: the business experts did not have the required technical expertise for IT-driven methods.
- Systems development methods used in the 50's, 60's and 70's were traditionally IT-driven and process-driven, based on processes for strategic

²⁵ Since the 1990s, he lived on his own private island, Agar's Island, in Bermuda, where he died on 24 June 2013, apparently in a swimming accident.

plans from the past, as we discussed earlier. Most organisations have multiple business processes that have evolved over many years, each of which require their own data.

- Many similar processes therefore exist with their own versions of data. This has resulted in redundant data versions and stovepipe systems with non-integrated databases. When those processes change (to respond to rapid business change) every one of these redundant data versions has to be changed: so resulting in data maintenance chaos.
- Due to our focus on Business Normalization, we found that the data models that we developed were data-driven, as distinct from data models that were traditionally process-driven. This data-driven approach produced databases that were *fully* integrated and so were far more stable. This method structured data for the future from a business-driven perspective, based on the strategic business plans.
- Business Normalization includes a forward-looking step, which is called: *Normalization Crosscheck*²⁶. This is a formal quality control step that draws on the knowledge of the business experts, guided by the strategic business plans. It ensures that there is greater incorporation of future data needs, so eliminating the data maintenance chaos that typically occurs with non-integrated databases produced by the traditional process-driven systems development approach that does not effectively consider possible future data changes.
- The accepted data modeling wisdom in the 70's was to leave all *many to many* associations as-is in data models intended for business managers: these were called "enterprise models". IT experts without relational-data implementation capabilities had equated decomposition of *many-to-many* associations to non-normalized, indexed physical files²⁸. As a consequence they lost the advantages of normalized data models and object-oriented business processes.
- We made a ground-breaking discovery: when we followed all the rules of Business Normalization and decomposed these *many to many* associations, we identified "intersecting" (associative) entities that were named by the business experts for the business processes that they represented. The "accepted data modeling wisdom" discussed above had been a "Big Mistake" as Julia Roberts would say!!! However, *it is still being followed slavishly in the 21st century!*
- Furthermore, these intersecting entities represent business processes that are invariably reusable, as they are derived from fully integrated, non-redundant data models. Only one set of data maintenance processes²⁹ is required: they are in fact object-oriented methods that can be automatically

²⁶ See Chapter 9 of the *Rapid EA Delivery ebook* ⁵.

²⁸ The accepted data modeling wisdom was that it would be too confusing for business managers if these *many-to-many* associations were decomposed. In fact, the reverse is true: the *many-to-many* associations hide the presence of business activities and processes.

²⁹ These processes are Create, Read, Update and Delete (named "CRUD" by James Martin).

derived from data models³⁰. This was an integral part of the Procedure Formation method that we discussed in Table 1.

- We found that business managers at this stage, who demanded that IT follow a data-driven and business-driven approach, are realizing they are now able to take back control of the enterprise. They are now able to set the future direction of the enterprise; without the gridlock constraints of the IT-driven, process-driven approach.
- Project planning has traditionally been intuitive and very subjective. The result has been differing project plans, based on the level of project experience of the project managers developing those plans. Business benefits are not achieved until the development project is *fully completed*: but many systems development projects extend over many years; and so the realization of business benefits is therefore delayed for years.
- Using the entity dependency analysis method described in Chapter 7 of the *Rapid EA Delivery ebook*⁵, we found that we could derive project plans from data models. This method is rigorous, objective and always achieves the same result. It can be automated and incorporated in modeling tools³¹.
- We found that complex, multi-year projects can now be implemented with progressive deliverables into production, so that the business benefits can be achieved early: priority business processes identified by management can be delivered into production as databases and systems in three-month increments.

Comparing the Variants of Information Engineering

Returning to the *History of IE*, there was widespread adoption of IE in the 1980's throughout the world. However, there was no *formal* contact between the consultants from James Martin Associates (JMA) and the IE-experienced Australian and New Zealand consultants³². As a result, in the absence of this real-world IE experience by James Martin or within JMA, two variants of IE started to emerge:

- The original version of IE was data-driven. It is sometimes called the "Finkelstein Version", but more correctly is the "Business-driven, Data-driven version of Information Engineering". We will henceforth use the term: "*Business-driven, Data-driven IE*".

30 These are sometimes called "data access processes". The first modeling tool to automate this was Visible Advantage, which automatically derives data access processes from data models, to be implemented as object-oriented code. Visible Developer automatically derives executable logic from databases.

31 Visible Advantage and Enterprise Architect have implemented the entity dependency analysis method, so enabling them to derive project plans from data models, automatically, for prioritization by business management.

32 These Australian and New Zealand consultants were from Information Engineering Services Pty Ltd (IES), Information Engineering Australia Pty Ltd (IEA) and Information Engineering New Zealand Ltd (IENZ). Two Australian IEA consultants (John Edwards and John Hope) did join JMA in the USA in the 1980's, but their IE experience was either ignored or overridden by JMA. Instead JMA consultants relied on their past IT and process-driven experience as they refined IE into their variant of IE (see *Comparing the Variants of IE*, below). This ignored the *Systems Development Breakthroughs*.

- The later version of IE was process-driven. It is sometimes called the “Martin Version”, but more correctly is the “IT-driven, Process-driven version of Information Engineering”. We will henceforth use the term: “*IT-driven, Process-driven IE*”.

The differences between these two variants are compared next, in Table 2. As you read through these differences, you will see that the IT-driven, Process-driven variant leads to IE projects that do not benefit from the system development breakthroughs that the Business-driven, Data-driven variant realizes. Some successful IE projects using this latter variant are described at the end of Chapter 7 in the *Rapid EA Delivery ebook*⁵.

Table 2: Stages of Information Engineering

IT-driven, Process-driven IE variant ³³	Business-driven, Data-driven IE variant ³⁴
<p>Stage 1: Information Strategy Planning</p>	<p>Strategy Analysis</p>
<p>The focus is to identify the information needs of the enterprise. It involves senior IT management (e.g. CIO, CTO) and ideally also senior business managers. However, most people think first in terms of processes at this level, not data. They think “how” the current processes work and where they can be improved. As we discussed earlier, from this process perspective it is very difficult to decide “what” data and information is needed for the future, let alone determine any new processes that are needed.</p> <p>Many IE projects have used this step with the CIO and CTO only, to focus only on the technologies (hardware, software and communications) needed for the future. They have squandered the opportunity to gain strategic direction of the enterprise for the future by actively involving senior business managers.</p>	<p>Strategy Analysis begins with a tailored questionnaire that is completed by senior business managers who will attend a Strategic Business Planning Workshop. These questionnaire responses are used as a catalyst in the workshop to refine the mission and goals for the future.</p> <p>In group discussions during the workshop, the managers decide “what” goals are needed for that future. From these, they determine “how” strategies and tactics will achieve those goals. New processes for the future often then emerge. These group discussions result in refined business planning statements that focus on the future and are captured by a business-driven IE modeling tool.</p>
<p>Stage 2: Business Area Analysis</p>	<p>Strategic, Tactical and Operational Modeling</p>
<p>Processes are grouped typically in a CRUD matrix to identify business areas. This is a very subjective method, with different business areas identified depending on the experience of the IT staff doing the CRUD matrix analysis.</p> <p>The business area project teams typically comprise data modelers and systems analysts (i.e. IT staff). These IT-driven teams interview business experts in the business areas individually, who participate passively to develop data models and process models. Where there are differences in the feedback from the business experts, the IT teams typically decide how to represent these differences, as the business experts do not know how to do data modeling or process modeling.</p> <p>Unfortunately, these IT-driven team members often do not have the business expertise to make the necessary business decisions to resolve the differences. Regrettably these decisions have sometimes locked the relevant business areas into the past; they are unable to evolve rapidly into the future. The resulting data models and process models are therefore IT-driven and process-driven, with redundant, non-integrated databases and redundant processes and the consequent data maintenance chaos.</p> <p>This approach of IT-driven project teams using data modeling to interview business experts individually and passively does not benefit from the clarity of data definition that is achieved when the data modeling is conducted in active</p>	<p>Often, it is not feasible to start with strategy analysis. Instead strategic modeling uses the same tailored questionnaire³⁵, which is completed by the business managers who will attend a facilitated <i>Strategic Modeling Workshop</i>.</p> <p>With the questionnaire responses as a catalyst, the facilitator introduces the concepts of data modeling from a business perspective. Based on their responses to the strategic modeling questionnaire and further group discussion and refinement, the business managers and business experts see the high-level data model that is developed from their discussions as a “<i>picture of the business</i>”.</p> <p>These group discussions also result in refined business planning statements that are captured by the IE modeling tool.</p> <p>Many to many associations are immediately decomposed to identify business activities or processes. The IE modeling tool analyzes the strategic data model to derive project plans automatically. The managers identify priority activities or processes: the relevant project plans for these processes are grouped together as priority tactical project plans. Business experts and IT experts are assigned to these tactical projects in business-driven project teams.</p> <p>Together, all team members attend a <i>Tactical Modeling Workshop</i>, where they learn business-driven data modeling together with Business Normalization, supported by a business-driven IE modeling tool. In the workshop, using the priority activities and processes identified by the business managers in</p>

33 This column is based on the three IE Books by James Martin: James Martin, “*Information Engineering, Book 1: Introduction*”, Prentice-Hall (1989); James Martin, “*Information Engineering, Book 2: Planning and Analysis*”, Prentice-Hall (1989); James Martin, “*Information Engineering, Book 3: Design and Construction*”, Prentice-Hall (1990).

34 This column is based on the *Rapid EA Delivery ebook*: Clive Finkelstein, “Enterprise Architecture for Integration: Rapid Delivery Methods and Technologies”, Second Edition, IES (2011). This e-book is available in PDF at www.ies.aust.com. It is available also for the iPad at the Apple iBook Store and for the Amazon Kindle.

35 This is the strategic modeling questionnaire. It is issued prior to the Strategic Modeling Workshop. It uses the same questions as the strategic planning questionnaire: issued prior to the Strategic Business Planning Workshop (see above in Table 2).

<p>participation, group sessions with business experts who have been trained in business-driven data modeling. The result is the development of data models that also have not carried out a formal <i>Normalization Crosscheck</i> to ensure that potential future business changes have been considered and incorporated in the data models so that they continue to be stable into the future.</p> <p>As a result the data models, further, are not fully normalized and may not therefore be fully integrated. This means that there may be even more multiple data maintenance processes to maintain data up-to-date with business changes.</p> <p>Furthermore, the modeling tools supporting this variant do not have the capability to derive project plans automatically from data models. This variant does not have the ability to analyze data models automatically, to derive priority processes that are to be delivered early, as priority subprojects. The data models are therefore large, complex and monolithic. Completion extends over multiple years, with no capability to deliver priority processes into production early, as priority databases and systems. Business benefits arising from these monolithic IE projects are therefore also delayed many years until the IE project is <i>fully completed</i>.</p>	<p>the strategic model and the refined business plan statements, the strategy and tactics statements in these business plans are used as catalysts to identify required data entities and data attributes. These are added to the strategic model using the IE modeling tool to transform it into a tactical data model. Any differences in the data models are resolved as group decisions that are actively business-driven, not IT-driven.</p> <p>The project teams use Business Normalization and the formal <i>Normalization Crosscheck</i> step to identify the operational data entities and data attributes required for the future.</p> <p>The IE modeling tool is able to continually analyze the evolving data model to derive priority operational project plans, continuing to an operational level of detail, with all required data attributes added to operational data models. The resulting data models are strongly business-driven and data-driven. Any redundant data is fully incorporated in non-redundant, integrated data models that are forward-looking, stable and defined to a complete level of data attribute detail. Priority subprojects can be easily extracted for early delivery into production as databases and systems in 3-month increments. Only when business-driven data modeling has been completed, with full definition of operational data entities and data attributes, do the priority operational subprojects move to the next stage.</p>
<p>Stage 3: System Design</p>	<p>Activity Modeling and Process Modeling</p>
<p>Based on the technology decided in Stage 1 to be used for implementation, the IT teams transform the data models and process models to physical database designs and action diagrams that are to be implemented as systems. The business experts are typically not involved in these technical systems design decisions.</p> <p>The data models are fully defined in a modeling tool, which is then used to generate, automatically, the database definition scripts for the selected target DBMS. Loading of data into the databases can then begin.</p>	<p>The business and IT members in the project teams learn activity and/or process modeling, by attending an <i>Activity Modeling Workshop</i> and/or a <i>Process Modeling Workshop</i>. In these workshops, the priority activities and processes identified during the strategic modeling workshop in the modeling tool are used with the completed priority operational data models to develop activity models or process models. These are much simpler data models that easily integrate into more complex databases and systems when they are progressively delivered into production.</p> <p>Cost justification of alternative activities and technologies is determined using <i>Activity-Based Costing</i>. The business experts in the project teams, supported by their IT team colleagues, typically define process models using IE modeling tools that support BPMN.</p> <p>The selection of Technology is not finalized until the next stage.</p>
<p>Stage 4: Construction</p>	<p>Technology Selection and Systems Delivery</p>
<p>Based on the selected technology to be used to develop systems, coding or other language implementation tools are used to develop the executable code for all of the systems to be delivered. However, because of the mammoth size typically of these projects, it is very difficult to urgently deliver priority subsets of systems early. Delivery is only possible when all coding and testing is complete, typically taking years.</p>	<p>Technology selection is not finalized until after the data modeling and activity or process modeling of priority processes has been fully completed. Because this modeling is actively managed based on the automatically derived project plans, these are small priority subprojects that typically take only 2 to 3 months for completion of data modeling, activity and/or process modeling.</p> <p>The operational data models have already been fully defined in the modeling tool, which is then used to generate, automatically, the database definition scripts for the selected target DBMS. Loading of data into the databases can begin.</p> <p>Priority process models that have been defined in BPMN can</p>

	<p>be delivered rapidly, generated automatically as executable BPEL³⁶ code for incremental delivery of priority processes as systems every 3 months as early deliverables. Alternatively, other languages can be used for coding and delivery of these priority subprojects.</p> <p>The result is the early delivery of these priority processes into production as systems every 3 months, with progressive, incremental deliveries of increasing functionality and early realization of the business benefits.</p>
<p>Maintenance of IE Projects</p>	<p>Maintenance of IE Projects</p>
<p>Because the data models are large and monolithic, business changes that must be introduced into the resulting databases and systems involve major review and updating in projects that are almost as big as the original IE project. Coding changes may need to be manually introduced, which are slow and error-prone. Maintenance often takes many years.</p>	<p>When business changes do occur, those changes are used to update the refined business plans in the modeling tool. Any required data entity or data attribute changes are incorporated in the strategic data model, in the tactical data model and in the operational data models. These changes are reflected in the derivation of the updated tactical and operational project plans. Updated database definition scripts are automatically regenerated and the operational databases are updated.</p> <p>The project teams make strategy and tactics changes to the activity models and the process models. Where those process models are defined using BPMN in the modeling tool, the updated BPMN processes are used automatically to regenerate executable BPEL code. The result is the rapid accommodation of business changes in days, weeks or months, without the delays of the past: from monolithic systems and slow, error-prone, manual coding techniques.</p>

Gordon Miles, based on his many years of experience working in facilitated strategic modeling and business planning sessions with senior business managers, their business experts, and IT experts of large, medium and small NZ companies, comments that: “The best results were achieved when together both the business experts and IT experts could recognize what data objects were relevant, and their structural relationships, including the corporate strategies, and business experts could for themselves test the validity and business-critical data elements. This didn’t always happen but when it did it was magic; especially at the CEO level!!!”

“Business experts could test the validity and strengths of their business plan and the attributes intrinsic in goal setting, measurement and achievement.”

“Business experts could also visualize the important business processes that would be required to create and maintain critical data objects and their structural relationships, and also the present and potential new business function requirements and responsibilities [later to be formally derived].”

“There are in New Zealand, today, examples of large, medium and small enterprises that have achieved outstanding business excellence and success through the construction and/or delivery of fully integrated data models – as a result of these data-driven IE concepts – and business systems that were precisely built.”

36 There are a number of products on the market today that automatically generate executable Business Process Execution Language (BPEL) XML-based code from BPMN. See Chapters 14 and 15 of the *Rapid EA Delivery ebook*⁵.

Enterprise Architecture

John Zachman, while at IBM, had been involved in the development of *Business System Planning (BSP)* for IBM. In August 1982, I conducted an in-house IE course for the Brazilian Government in Sao Paulo; a manager in the government handed me a copy of a paper from the IBM Systems Journal on the deficiencies of BSP. The author of the paper had encountered the same systems development problems as we discussed earlier. He was very critical about BSP not addressing these problems. This was most unusual, as critical comments almost never appeared in the IBM Systems Journal.

The author was John Zachman; I was interested to meet him. I first met John at a Share/Guide Conference in New Orleans in late August 1982. We were both scheduled to present papers at the conference. He was aware of the 1981 co-authored IE book that I had written with James Martin and he was interested to meet me. We each attended our respective presentations and met afterwards. He was a breath of fresh air to me, as he was aware of the problems that were introduced by the traditional IT-driven, process-driven approach to systems development. We struck up an instant friendship that has continued now for 32 years.

His presentation at the conference covered his early thoughts about what he initially referred to as *Information Systems Architecture*. This later evolved into *Enterprise Architecture (EA)*. As I learned more about EA, I was struck by how well Business-driven, Data-driven IE worked with EA, as outlined next.

Using Information Engineering with Enterprise Architecture

John advocated the need to start with an understanding of the *Motivation* of senior business managers, who used strategic business plans to set priorities and plot the course of the enterprise into the future. This addressed the **“Why”** of the enterprise. We had also realized this.

From these priorities the senior managers identified middle managers and business experts who had the business knowledge needed for these priorities. This addressed the **“Who”** of the enterprise.

He then advocated that these business managers and business experts should focus first on the data that was needed, according to the priorities set by senior management. This addressed the **“What”** of the enterprise, using data modeling to achieve fully integrated databases. *Strategy Analysis* and *Strategic Modeling*, followed by *Tactical Modeling* and *Operational Modeling* worked well here (see Table 2).

Only when the data had been fully defined was it appropriate to address processes, which defined the **“How”**. *Activity Modeling* and *Process Modeling* fitted here (see Table 2). He also addressed **“Where”** and **“When”**.

We found that the discipline of EA as a whole was of most benefit for very large organizations, because of their complexity and the communication problems of their size, but elements of EA were also of great benefit to medium and small organizations, where the problems of communication and size are not as significant, but rapid delivery is still important.

These six interrogatives: “*What*”, “*How*”, “*Where*”, “*Who*”, “*When*” and “*Why*” form the six columns of the *Zachman Framework for Enterprise Architecture*. I submitted the manuscript of the *First Edition*³⁷ of the *Rapid EA Delivery book* to him for review before its initial publication in 2006. He graciously agreed to write the Foreword to both the First Edition and the Second Edition.

Chapter 1 of the First Edition introduces the original version of the Zachman Framework. The Second Edition ebook (the *Rapid EA Delivery ebook*⁵) covers the latest version 3.0 of the Zachman Framework. Both editions describe how Business-driven, Data-driven IE (which I call “*Enterprise Engineering*” in the ebook) is used as the rapid delivery method for Enterprise Architecture.

However, as I used the latest evolution of Information Engineering as Enterprise Engineering, I was struck by how exceptionally well it fits with EA. *For example, when Visible Advantage analyzes the strategic data model, it automatically derives an Enterprise Architecture Portfolio Plan of databases and systems to be delivered in the EA project.* This is *extremely difficult* to produce using the CRUD matrix of the other IE variant. Furthermore, this EA Portfolio Plan is in fact a derived *Enterprise Architecture Portfolio Project Plan* (EAPPP) for rapid, progressive and incremental delivery into production of priority databases and systems. This is not even possible with the IT-driven, Process-driven IE variant, as none of the IE modeling tools supporting that variant have this capability.

Next Steps

So what should you do next? If you are interested in learning more about the latest evolution of Information Engineering (as *Enterprise Engineering*), then I suggest you download the PDF version, or the iPad or Kindle version of the *Rapid EA Delivery ebook*⁵. It is written as a self-study book; it fully documents the methods for rapid delivery of EA, with many exercise problems and sample solutions; and with product descriptions in Chapters 13, 14 and 15 that use rapid delivery technologies. Read the [Preface](#) first, as this provides a *Reading Guide* for different reader audiences.

If you are interested in purchasing the copyright of IE education course materials for consulting and/or software development organizations; or are interested in licensing opportunities for Universities, commercial education providers and also for consulting organizations, I suggest you now read *Appendix 1* of this report. It identifies a number of *Business Opportunities*.

Appendix 1 also discusses modeling tools for IE and EA projects that may be of interest to venture capitalists, software development organizations or modeling tool vendors.

37 The First Edition was published as a hardcover book: Clive Finkelstein, “*Enterprise Architecture for Integration: Rapid Delivery Methods and Technologies*”, Artech House, Norwood MA (2006). As a hardcover, printed book it is rather expensive. It is still available from www.amazon.com.

APPENDIX 1: BUSINESS OPPORTUNITIES

During my business career, I developed several courses that I presented as skills-transfer, hands-on workshops throughout the world. These are delivered as PowerPoint courses, with complete Instructor Notes. The Reference text for these workshops is the *Rapid EA Delivery ebook*⁵.

This is my legacy; as I have now retired, I am prepared to make these courses available under license and/or to sell ownership outright of the Copyright to the courses. The industry has been good to me over a period of more than 50 years. It would be great to see this work not come to an end with my passing. I am looking for a consulting/education/software development organization that is motivated to acquire course materials and skills that will enable them to achieve spectacular IE or EA rapid project delivery results for their clients; so those clients can achieve dramatic business performance and business results. With the purchase of this Copyright, you would become my successor.

Otherwise, universities who want to present the latest methods for rapid delivery of IE and EA projects may be interested in licensing these course materials. This is based on a modest license fee per student, which is typically bundled by the University into the registration fee for the course (sometimes also bundling in the purchase cost of the ebook used as the Reference text).

These licensed course materials may also be of interest to commercial educational organizations or consulting organizations who wish to present Public courses on IE or EA throughout the world, or alternatively for in-house presentation to their commercial, government or defense clients.

As part of this licensing, I will personally present for your instructors, a Teach-the-Teachers (TTT), skills-transfer course on-site, at an additional charge for my time and travel expenses. I will personally endorse your courses, if your instructors have been trained by me in TTT courses.

In purchasing the Copyright to the course materials, this ownership also includes the right to license to Universities and other education or consulting organizations; effectively earning revenue from an education franchise.

The course materials for licensing or copyright purchase are detailed next.

Licensing of Rapid EA Delivery Workshop Course Materials

The *Rapid Delivery of Enterprise Architecture Workshop* can be tailored and packaged as various 5-day skills-transfer course, based on the background of the intended audience, as follows:

- Day 1: Rapid Delivery of Enterprise Architecture for Managers
- Days 2-3: Rapid Delivery Portfolio Methods for Enterprise Architecture
- Days 4-5: Rapid Delivery Technologies for Enterprise Architecture

This is typically presented over 30 – 40 hours as a University course. A detailed Course Description is available on request. It can be tailored for

presentation as several 1 and 2-day courses, or as a complete 5-day hands-on workshop as discussed.

Licensing of Certified Business Data Modeler (CBDM) Course Materials

I have also developed a self-study data-modeling course that qualifies individuals as a *Certified Business Data Modeler (CBDM)*. This is available for purchase from the IES web site at www.ies.aust.com; click on the CBDM link in the Contents section of the Home page to review details about this self-study course. It is delivered as a PowerPoint course with complete Instructor Notes for student self-study. This will be of interest to Universities and commercial educational or consulting organizations that want to offer remote data modeling courses for distance learning, online.

It also includes the *Data Modeling Case Study Workshop*, which is a real-life business problem. The student's solution is entered into the Student Edition of Visible Advantage, which is supplied free as part of the CBDM course. This student solution comprises the CBDM Exam for qualification.

This CBDM self-study course is available for licensing and for Copyright Purchase. This includes training for your instructors in TTT courses, so they can qualify students as CBDM based on their *Data Modeling Case Study Workshop* solution: to ensure consistency of this qualification. CBDM TTT training is available at an additional charge for my time and travel expenses. I will personally endorse your CBDM course, if your instructors have been trained by me in a CBDM TTT course.

Further Information

To discuss these licensing or copyright purchase options further, please email me at clive.finkelstein@ies.aust.com.

Modeling Tools to Support IE and EA Projects

Many modeling tools support the IT-driven, Process-driven IE variant. The most notable was IEF, developed in the 1980s by Texas Instruments (TI), with consulting support provided to TI by James Martin. Martin's own modeling tool: IEW (and later ADW) supports his IT-driven, Process-driven variant. However, we saw in Table 2 that this variant suffers from the absence of IE modeling tools with any capability to derive, automatically, project plans from data models.

Following publication of the First Edition of my *Rapid EA Delivery hardcover book* ³⁶, in 2007 Sparx Systems Pty Ltd, the Australian developer of *Enterprise Architect*, engaged me to provide consulting support so that *Enterprise Architect* would have the capability to derive project plans automatically from data models. I did this and from Version 7.0, Enterprise Architect has had this capability. *Enterprise Architect* is documented in the Product Descriptions of Chapter 15 of the *Rapid EA Delivery ebook* ⁵.

Enterprise Architect is an IT-driven modeling tool that provides excellent support for UML, IE and EA, including support for TOGAF and DODAF³⁸. However, Version 7.0 only supported the UML data-modeling notation, which is confusing for business people.

Modeling Tools for Business-driven, Data-Driven IE and EA projects

Visible Advantage is the only modeling tool that fully supports the Business-driven, Data-driven IE variant for IE projects and for EA projects. It is a modeling tool that I personally designed: it was first released in 1984 as *USER: Expert Systems*, running under MS DOS.

As IE evolved, I personally managed its evolution to *IE: Advantage* running under Windows. I transferred our development resources from IEA in Sydney to IESC in Washington, DC to support the US Navy and US Marines umbrella IE contract. In 1997, when IESC merged with Visible Systems Corporation^{39 40} (VSC) in Boston MA, *IE: Advantage* was renamed *Visible Advantage*.

VSC has its own original modeling tool, *Visible Analyst*, which is outstanding. It has been widely used by more than 100,000 users and by students at many Universities throughout the world, as it is bundled with a number of software engineering textbooks. It is an IT-driven modeling tool that supports software engineering, UML, IE, EA and BPMN.

Following the merger with IESC, VSC incorporated the code from *Visible Advantage* that captures strategic business plans, into *Visible Analyst*: to give it the capability to support strategic planning statements for projects.

However, VSC historically has struggled over the years due to under-funding. They have been unable to fund further development to extract:

- The code for entity dependency analysis support from *Visible Advantage*, into *Visible Analyst*: to give it the capability to derive project plans automatically from data models, or
- The code for automatic derivation of data access processes from data models out of *Visible Advantage*, into *Visible Analyst*: to give it the capability to derive process logic as reusable object-oriented methods. *For example, today this reusable data access process logic for Create, Read, Update and Delete could alternatively be used to automatically generate reusable sub processes in BPMN.* This would be a significant breakthrough for code generation, automatically, from data models.

Investment Opportunities

Visible Analyst is an excellent IT-driven modeling tool in its own right. However, *Visible Advantage*, while fully automating the Business-driven, Data-

38 TOGAF is *The Open Group Architecture Framework*; while DoDAF is the *Department of Defense Architecture Framework*.

39 Visible Systems Corporation (VSC) is located in Framingham, MA out of Boston. Visit its website at www.visible.com for further information about its products: *Visible Advantage*, *Visible Analyst*, *Visible Developer* and *Polaris*.

40 I declare my financial interest in VSC: I am a minority shareholder with (I believe) less than 0.01% of all issued shares. I am also a minor creditor, awaiting repayment of two outstanding invoices.

driven IE variant (as Enterprise Engineering) for IE and EA projects, still exists in 2014 in 16-bit code.

It presently runs under Windows XP, Windows Vista and Windows 7, and runs under Mac OS X in a virtual machine with Parallels Desktop for Mac or with VMWare. Today it should be updated to 64-bit code, to run natively under the latest versions of Windows and also Mac OS X, or to execute wholly online: as a web-based modeling tool..

I am unable to speak for the management of VSC⁴¹ but investment to enable them to fund this would probably be welcomed. In fact, with adequate funding for marketing, sales and development, I believe that VSC has the potential to grow to a multi-billion dollar company.

I do not know, but they may even be prepared to consider selling Visible Advantage outright to another modeling tool vendor. If this was to eventuate, I am prepared to provide consulting support to that purchaser, so that Visible Advantage (and projects using this tool) can benefit even further from the rapid delivery technologies that are now available today.

41 Following the merger of IESC and VSC in 1997, I was given the honorary (i.e. unpaid) title of "Chief Scientist". I provided free consulting support to help VSC transfer code from Visible Advantage, into Visible Analyst, but they have been unable to fund this further enhancement of Visible Analyst.