

**A MORPHOLOGICAL STUDY ON WORD FORMATION  
OF ERP SOFTWARE TERMS IN WWW.WILEY.COM**

**THESIS**

**BY:**

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**ENGLISH LETTERS AND LANGUAGE DEPARTMENT**

**FACULTY OF HUMANITIES AND CULTURE**

**THE STATE ISLAMIC UNIVERSITY OF MALANG**

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**ENGLISH LETTERS AND LANGUAGE DEPARTMENT  
FACULTY OF HUMANITIES AND CULTURE  
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2008**

## APPROVAL SHEET

This is to certify that Nurrahmi Hindiyati's thesis entitled "**A Morphological Study on Word Formation of ERP Software Terms in www. wiley. com**" has been approved by the thesis advisor for further approval by the Board of Examiners.

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Malang, October 23<sup>th</sup> 2008

The Board of Examiners

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## **MOTTO**

**Undoubtedly, in the creation of heavens and earth and in the mutual alternation of night and day, there are signs for men of understanding.**

**Who remember Allah standing and sitting and lying on their sides, and contemplate in the creation of heavens and earth; (saying) "O our Lord! You have not made it invain, Hallowed be You, You save us from the torment of the Hell.**

**(Q.S. Ali Imron, Verse: 190-191)**

## **DEDICATION**

**This thesis is dedicated to:**

**My beloved Father and Mother,  
Muadji and (Alm) Nurul Chotimah  
For their endless great love, care, and pray  
Especially to my father thanks very much for your kindness  
And spirit to face this world.**

**My beloved sister  
Dina Mu'alimatul Indriana  
Thanks for your support, care and great affection  
You give me everything that I can't back it to you**

**My beloved brothers  
M. Ridwan Latif and M. Syahrul Ghoffar  
Who are always cheering my life, I am proud of having you**

**All my teachers and lecturers,  
For their valuable knowledge and experiences  
Thank for all you have done**

**My whole family in Lumajang  
Thanks for the support and affection  
Anyway I love you all**

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All my friends, KMI Gontor for girls graduates of 2002, I would like to extend my thanks for support, motivation, pray, and nice friendship experience together. I do love you and miss you all.

Finally, I truly realize that this thesis still needs the constructive criticism and suggestion from the readers in order to make it perfect and hopefully it can be useful for the readers, especially for the English Letters and language Department students.

Malang, 15-9-2008

Nurrahmi Hindiyati

## TABLE OF CONTENTS

|                          |     |
|--------------------------|-----|
| APPROVAL SHEET .....     | i   |
| LEGITIMATION SHEET ..... | ii  |
| MOTTO .....              | iii |
| DEDICATION.....          | iv  |
| ACKNOWLEDGEMENTS .....   | v   |
| ABSTRACT .....           | vi  |
| TABLE OF CONTENTS .....  | vii |

### CHAPTER 1 INTRODUCTION

|                                     |   |
|-------------------------------------|---|
| 1.1 Background of the Study .....   | 1 |
| 1.2 Problem Statements .....        | 4 |
| 1.3 Objectives of the Study.....    | 5 |
| 1.4 Scope and Limitation .....      | 5 |
| 1.5 Significance of the Study ..... | 5 |
| 1.6 Definition of Key Terms.....    | 6 |

### CHAPTER II REVIEW OF RELATED LITERATURE

|                             |    |
|-----------------------------|----|
| 2.1 Morphology Study .....  | 8  |
| 2.2 Word .....              | 11 |
| 2.3 Word formation.....     | 12 |
| 2.3.1 Derivation .....      | 13 |
| 2.3.1.1 Affixation.....     | 15 |
| 2.3.1.2 Non-affixation..... | 18 |
| 2.3.2. Compounding.....     | 20 |
| 2.4 www. wiley. com .....   | 24 |
| 2.5 Previous Studies.....   | 25 |

### CHAPTER III RESEARCH METHOD

|                          |    |
|--------------------------|----|
| 3.1 Research Design..... | 28 |
|--------------------------|----|

## ABSTRACT

Hindiyati, Nurrahmi. 2008. A Morphological Study on Word Formation of ERP Software Terms in [www. wiley. com](http://www.wiley.com), Thesis. S1 Program in English Letters and Language Department, Faculty of Humanities and Culture of State Islamic University of Malang. Advisor : Hj. Rohmani Nur Indah, M. Pd

Key Terms: Morphological Study, Word Formation, Software Term, [www.wiley.com](http://www.wiley.com), ERP.

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In the end of this year, computer technology has increased. Because of it, technology is very closely related to communication. Computer is also one instrument of media in communication, which makes human appreciate not only on information but also knowledge in the earth. In addition, information can open our mind about anything that we can find in this world. Moreover, technology development creates language with more evolution and modern use. Therefore, increasing language in technology era is one of the phenomena that ought to be considered as part of linguistics or student studies about language. One branch of linguistics that becomes topic will be discussed in this study is morphology. This branch concerns with the word form in which there is interrelationship among words. It means that morphology contains form and word then they create the meaning in language. The process on how the words form terms especially the software terms becomes the topic of this study.

The study used descriptive qualitative research. In this case the phenomenon observed is new words of technology namely software terms. Moreover, the software terms are in business application software. Additionally, the purposes of this study are to identify the kinds of word formation and the type which mostly used in ERP software terms. The data source of this study is the book of IT company website entitled “ERP making it happen”. The data are analyzed based on Ingo Plag 2003. There are two steps to analyze the data namely explaining the word formation obtained from a book of the website to give more understanding about the process of word formation made. The second is discussing the result of the data analysis and the next is concluding.

The result of this study shows three categories of word formation namely affixation, non-affixation and compounding. Affixation is kind of derivation comprising two categories namely prefix and suffix. Non-affixation is covering three major problems as conversions, prosody morphology and abbreviations and acronyms. In addition, compounding is mostly used in the data to create a new word. This is explained into four categories namely nominal, adjectival, verbal and neoclassical compound. The nominal compound becomes the dominant type namely endocentric compounds in which the meaning head of the compound is inside the combined words.

This study proposes the suggestion for others researcher who concern with word formation to use Plag’s theory and to use different software terms or other fields as their research object.

|                           |    |
|---------------------------|----|
| 3.2 Data Sources .....    | 28 |
| 3.3 Data Collection ..... | 29 |
| 3.4 Data Analysis .....   | 29 |
| 3.5 Triangulation.....    | 29 |

## **CHAPTER IV FINDINGS AND DISCUSSION**

|  |    |
|--|----|
| 4.1 Findings.....  | 31 |
| 4.1.1 Affixation .....   | 31 |
| 4.1.1.1 Prefixes .....   | 32 |
| 4.1.1.2 Suffixes .....   | 32 |
| 4.1.1.3 Infixes.....   | 35 |
| 4.1.2 Non-affixation.....  | 35 |
| 4.1.3 Compounding.....   | 37 |
| 4.1.3.1 Nominal Compounds.....   | 37 |
| 4.1.3.2 Adjectival Compounds.....  | 42 |
| 4.1.3.3 Verbal Compounds.....  | 43 |
| 4.1.3.4 Neoclassical Compounds.....  | 44 |
| 4.2 Discussions .....  | 44 |
| 4.2.1 Types of the word formation of ERP software terms<br>in www. wiley.com ..... | 45 |
| 4.2.1.1 Affixation .....   | 45 |
| 4.2.1.2 Non-affixation.....  | 47 |
| 4.2.1.3 Compounding.....   | 47 |
| 4.2.2 Type of the word formation is mostly used .....                              | 49 |

## **CHAPTER V CONCLUSIONS AND SUGGESTIONS**

|                       |    |
|-----------------------|----|
| 5.1 Conclusions.....  | 51 |
| 5.2 Suggestions ..... | 52 |

## **BIBLIOGRAPHY**

## **APPENDIXES**

## **CURRICULUM VITAE**

# CHAPTER I

## INTRODUCTION

This chapter presents the topics as follows background of the study, problems statement, objectives of the study, significance of the study, scope and limitation, and definition of the key terms.

### **1.1 Background of the study**

In the end of this year, computer technology has increased. Because of it, technology is very closely related to communication. Its differences happen in collecting, sending, saving, and processing information. Later, it makes people easily in getting information quickly and accurately.

Another opinion about the increasing of information technology is as Sawyer and William (2003: 2) has said:

Say goodbye to the personal computing era, “writer’s technology journalist Kevin Maney”. Just on the horizon is the era that comes next – the personal information era. You could also call it the era pervasive computing personal information era. The world is moving on beyond boxy computers that sit on desk or even on laps. We are entering a time in which handheld computers, two-way wireless pagers, and beefed-up cell phones (not to mention terminals everywhere-libraries, airports, cafes) will let you access information anytime anywhere. And not just general information but your personal information the electronic correspondence, documents, appointments, photos, songs, money matters, and other data important to you.

The statement above shows that technology has provided the information in every time with many ways. Computer is also one instrument of media in communication, which makes human more appreciate not only about the information but also knowledge

in the earth. In addition, information can open mind about anything that we found in this world.

Accordingly, this study argues that technology development create language with more evolution and modern use. Therefore, increasing language in technology era is one of the phenomena that ought to be considered in part of linguistics or student studies about language.

This study discusses about the terms in IT (Information Technology) which has developed in this time. IT also gives us many things not only information but also knowledge. Then, people never satisfied with science and always increase their knowledge which is related to their study. It is in accord with what our Prophet Muhammad SAW said that two desires of human beings which never make them satisfied are science and wealth desire (Shihab: 2008, <http://erzal.wordpress.com> ).

In addition, our God said in Holy Qur'an:

فَتَعَلَىٰ اللَّهُ الْمَلِكُ الْحَقُّ وَلَا تَعْجَلْ بِالْقُرْآنِ مِنْ قَبْلِ أَنْ يُقْضَىٰ إِلَيْكَ وَحْيُهُ وَقُل رَّبِّ  
زِدْنِي عِلْمًا ﴿١١٤﴾

Means:

*Then high above all be Allah the true king. And be not in haste*

*(O'Muhammad SAW) with the Qur'an before its revelation is completed to you, and say*

*“My Lord! Increase me in knowledge”. (Surah At Thaha: 114)*

(Al-Hilali: 2008, <http://noblequr'an.com/translation>).

According to the verse above, our God ordered us to get knowledge and study gradually to obtain our purpose; this includes developing the study on IT terms.

One branch of linguistics that becomes topic will be discussed in this study is morphology. Matthews (1974: 3) says that morphology is a term for that branch of linguistics which concerns with the forms of words in different uses and constructions. This branch of study is about the word form in which there is interrelationship among words. It means that morphology contains form and word then they create of the meaning in language.

Actually, morphology consists of inflection and word formation. The term 'word-formation' is dealing with formation of words. It means that the word has some of processes in making a new word. This study used the object of ERP software terms because it gives us the new words and form of words which the words rarely used in another cases. So, the word formations are found enriching us in our vocabularies especially in software terms.

The process on how the words form terms especially the software terms becomes the topic of this study. In this case, the software terms are priority chosen in business applications software. So, this study gives the example to prove the word formation process such as "unloading". The word "unloading" from the original word "load" with adding prefix *un-* and suffix *-ing*. "Unloading" is a noun using prefix *un-* and suffix *-ing* which include in prefixes and nominal suffixes. From the example, we can conclude that a noun combines by prefixes *un-* and suffix *-ing* becomes noun as usually used to indicating absence of the process. In another case, the word "Just-in-time" has not meaning "at that time" but "approach to achieving in manufacturing. From this example, we can conclude that the words appear as metaphor then, it makes special in this study.

In fact, there are some morphological studies which different material and subject with this study. For example, the study of Muhammad Ihsan (2005) entitled "A Morphological Analysis on Banjar Language used in South Kalimantan" and the study of Mu'alifatul Zuhriyah (2005) entitled "A Morphological Study on Javanese Compound used in Blitar". Both of them study about morphological analysis with using the dialect of South Kalimantan and Javanese. They offer the explanation about the form of words which Ihsan focusing studied on affixation, reduplication and compounding, while Zuhriyah studies about formation of compounding and the meaning are created in dialect of Javanese. Moreover, the study of Asrotul Ifafa (2007) entitled "Patterns of Word Formations in Comic Series Issued in the Jakarta Post" concerns with types of word formation in Jakarta Post using George Yule's theory.

Based on the explanation above, this study analyzes the word formation process of software terms using Ingo Plag's theory. Therefore, the title of this thesis is "*A Morphological Study on Word Formation of ERP Software Terms in www.wiley.com*".

## **1.2 Problems Statement**

Based on the background of the study above, the general point of this study is on how the word formation of ERP software terms in website is [www.wiley.com](http://www.wiley.com). The following research question cover:

1. What are the types of the word formation of ERP software terms in [www.wiley.com](http://www.wiley.com)?
2. Which type of the word formation is mostly used?



### **1.3 Objectives of the Study**

The study which has purpose to describe the word formation of software terms in [www.wiley.com](http://www.wiley.com), and it is specified:

1. to describe types of the word formation of ERP software terms in [www.wiley.com](http://www.wiley.com).
2. to describe the type of the word formation that is mostly used in ERP software terms.

### **1.4 Significance of the Study**

The findings of this study were supposed to give theoretical and practical contribution on the area of morphology. Theoretically, the findings of the study were expected to be useful and give new information about morphology studies and particularly in enriching the study of word formation in English especially in software terms.

Practically, it is expected to be useful for the writer to get more understanding about the word formation, especially in software terms. For teacher, it becomes additional empirical data about morphology studies. So, it can support the students who concern with word formation as their interest. Finally, it is also expected this thesis can be used as one of references for the next thesis writers on morphology especially in word formation.

### **1.5 Scope and Limitation**

Related to the problems of the study, this study used morphology about word formation. The word formation will be focused in software application and not studies in

software system. There are two kinds of software applications, they are: Account and ERP (Enterprise Resource Planning) software. Later, this study chooses ERP software terms as the object of study in word formation. ERP is a concept of the business application with ES (Enterprise software/system). The business application of ERP software book is chosen because many new glossaries or vocabularies are found in information technology.

In this study, the problem will be limited to analyze the word formation of the software terms in [www.wiley.com](http://www.wiley.com) using the theory proposed by Ingo Plag (2003). The word formation are classified into two types namely, derivation and compound which are chosen become object of word formation.

## **1.6 Definition of the Key Terms**

### **1. Morphological Study**

It is a branch of linguistics that analyzes about the form of words and interrelationship among word or we can call it by science of word formation.

### **2. Word Formation**

It is a very important means of word formation which involves building up complex words from free morpheme and bound morpheme. This study specifies on word formation based on Ingo Plag's theories on derivational and compounding.

### **3. Software Term**

It is a specific vocabulary is used in a program for computer operation or for processing information. This, study analyzes software application terms.

#### 4. [www.wiley.com](http://www.wiley.com)

It is the website of businesses includes scientific, technical, medical and scholarly journals, encyclopedias, books, and online products and services; professional/trade publishes books, subscription products, training materials, and online applications and websites; and educational materials for undergraduate and graduate students and lifelong learners. It is global network which located in Hoboken, New Jersey, with operations in the U.S., Europe, Asia, Canada, and Australia.

#### 5. ERP (Enterprise Resource Planning) Software

It is software that consists of large customer software applications that help companies to organize and operate the business. ERP implementation will give you competitive advantage and help you run on your business more effectively, effeciently, and responsively. ERP is predecessor began in the 1960s as Material Requirement planning (MRP) is helping to transform our industrial landscape. Beside that, ERP predicts and balances demand and supply.

## **CHAPTER II**

### **REVIEW OF RELATED LITERATURE**

In this chapter, there are some theories presented, which are related with the problem statement. They are morphological analysis, word, word formation which consists of derivational and compounding. In derivational, there are two categories namely affixation divided into three types namely prefixation, suffixation, and infixation. While, the second category is non-affixation that is divided into three types namely convention, prosody morphology and abbreviations and acronyms. The discussion is followed by compounding, website and the last one is previous study.

#### **2.1 Morphological Study**

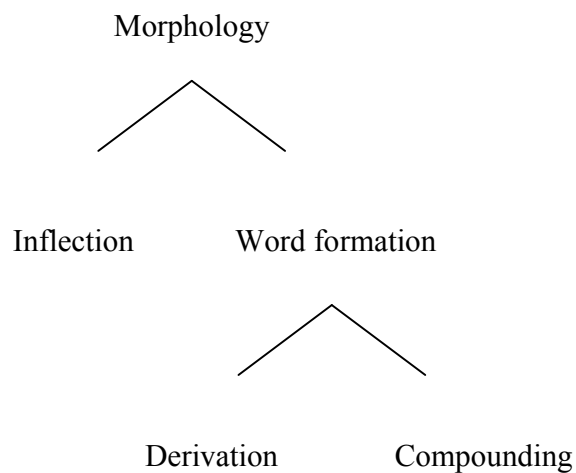
There are many theories that support the study with different statement from some linguists. Furthermore, some theories can be taken to impulse this subject to become more comprehensive for the readers. It is said that morphology is part of linguistics that studies of morpheme. Morphology is also studying and analyzing structure, forms, and words classification (Alwasilah, 1990: 101).

According to Fromkin, Rodman, and Hyams (2003: 76) it is said that the meaning of morphology is the study of internal structure of words, and the rules of words are formed. They give different definition on morphology that consists of two morphemes, 'morph' and 'ology'. The word "ology" means science or branch of knowledge concerning. Subsequently, morphology is the science of studying word forms. It means this science explores and clarifies the base of word forms. Moreover, Crystal (1987: 90)

said that morphology is one branch of linguistics in grammar which studies the structure of words. Both of two linguists above have similarity in meaning of morphology that is related with structure of word. Beside that, Crystal tells more detailed that morphology is connected with grammar studies. It means that words forms being a new word in language with using the structure.

In other words, Brinton (2000: 79) remarks that morphological analysis is the way that words are analyzed into morphs following formal divisions. It is diverse from the explanation before that the words will be changed and becomes a new word with formal distributions. So, he gives the other reason to his theory in morphology analysis because he wants to differentiate between morphology analysis and morphemic analysis. Therefore, it makes easy and clear to realize in morphology study.

On the other hand, based on theory of Plag (2003: 17) the schematic concept of the realm of morphology is described so far:



The graph has divided and explained about morphology in detail. So, the schema has covered all about the words. This theory gives the sub-topic of morphology divided

in two categories namely inflection and word formation. Inflection morphemes encode grammatical categories such as plural (workers), person (works), tense (picked), or case (John's). These categories are relevant for the building of sentences and are referred to by grammar. The plural and person suffixes are therefore syntactically relevant, hence inflectional. In English derivational morphemes can occur at either end of the base words whereas regular inflection is always expressed by suffixes. Only irregular inflection makes use of non-affixation means, at for example in *mouse-mice* or *sing-song*. There is no inflection prefix in English as in Plag (2003: 15). Furthermore, word formation explained two types namely derivation and compounding. So, we can differentiate between derivation and inflection such as:

| Derivation                                | Inflection                        |
|---|-----------------------------------|
| - encodes lexical meaning                 | - encodes grammatical categories  |
| - is not syntactically relevant           | - is syntactically relevant       |
| - can occur inside derivation             | - occurs outside all derivation   |
| - often change the part of speech         | - does not change part of speech  |
| - is often semantically opaque            | - is rarely semantically opaque   |
| - is often restricted in its productivity | - is fully productive             |
| - is not restricted to suffixation        | - always suffixation (in English) |

These studies apply this theory to analyze the words based on the problems of study.

The different processes which make a new word cannot be left from grammar, syntax, phonology, and semantic. All of them can be related to morphology studies.

Word can be changed in meaning and form if we added the syllables such as prefixes, suffixes that more usually called by affixation.

## 2.2 Word

There are many linguists give the different definition about word. Some of them present the definition as:

Matthews (1974: 23) remarks that there are two different senses in his theory. Firstly, word was described as assemblage of syllables and phonemes or syllables and letters. Secondly, lexemes or word is the one which has to be maintained most consistently.

Moreover, Fromkin, Rodman, and Hyams (2003: 69) state that when we don't know about word, we will not know about morpheme. In addition, we know the word morpheme, it means a particular string of sounds must be united with a meaning and a meaning must be united with specific sounds, in order for the sounds or the meaning to be a word in our mental dictionaries.

In other words, Brinton (2000: 74) said that word meaning in morphology has an internal cohesion and is indivisible by other units; a word can be modified only externally by the addition of suffixes and prefixes.

The statement above shows that Matthews (1974: 21) and Fromkin, Rodman and Hyams (2003: 70) have similar meaning that a word is part of linguistics which has connected between sound and meaning. While, Brinton (2000: 75) argues that a word is the smallest unit of linguistics that has natural relation of syllables with cannot be separated by other units.

## 2.3 Word Formation

In word formation, there are some definitions and different ideas from some linguists below:

- Yule (1985: 52) states that word formation studies of the process whereby new words come into being in a language. Besides that, he classified the types of word formation as blending, clipping, backformation, compounding, coinage, borrowing, conversion, acronyms, derivation prefixes and suffixes, and multiple processes.
- Brinton (2000: 85) remarks that English has a number of means by which morphemes combined or are altered to form new words. For the process he divided them into seven types namely derivation, reduplication, conversion, or functional shift, compounds, blends, backformation, shortening which contains acronyms and initialisms, clipped forms.
- Gleason (1955: 107) said that two basic processes of stem formation in English namely first the addition of derivational affixes to roots or to stem of two or more morphemes and next, the combination of two or more stems to form compounds.
- Plag (2003: 9) said that the term 'word-formation' is dealing with formation of words. It means that the word has some of processes in making a new word. In addition, Plag divided word formation into two categories namely, first is derivation which includes affixation and non-affixation. Affixation consists of prefixation, suffixation, and infixation while non-affixation consists of conversion, truncation, and blending.



From the statements above, there are four statements with similar types of word formation process. In this case, Plag gives us the explanation more clearly and simple than others. It shows that Plag has good division of word formation which is easy to understand. Plag also has different explanation of word formation because he gives us more detail in sharing form of a new word.

### **2.3.1 Derivation**

Derivation is one of section in word formation which is differentiated in classification of it. In this case, there are also different assumptions among linguists as mentioned below:

- Crystal (1987: 90) states that derivational morphology studies the principle governing the construction of new words, without reference to the specific grammatical role a word might play in a sentence.
- Widdowson (1996: 48) states that derivation is aspect of word which quite naturally leads us to enquire further into the way words mean, into lexical semantics, and this will be the focus of attention in meaning.
- Fromkin, Rodman, and Hyams (2003: 86) said that derivational morphemes have clear semantic content. In this sense they are like content words, except that they are not words. As we have seen, when a derivational morpheme is added to a root or stem, it adds meaning.

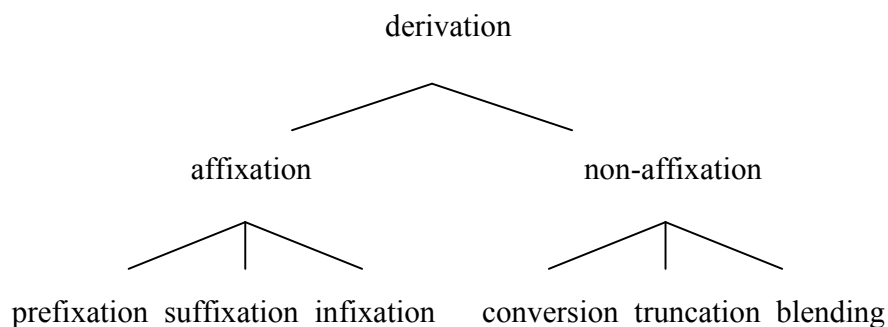
From the definition above, Crystal has different meaning about derivational. It shows that derivational is study the rule of main creation of the new word. While, Widdowson and Fromkin, Rodman, and Hyams have resemblance in giving the meanings

of derivation which discuss and mention about word related to semantics. Moreover, they conclude that derivational is study of morpheme with additional root or stem to add meaning of a new word. In their explanation, they were focusing on the form of the added sense in a new word.

- Bolinger and Sears (1981: 61) said that derivation is the general term that includes prefixes and suffixes to major element a base frequently a word, which may already have one or more affixes incorporated in affix.
- Brinton (2000: 86) remarks that the additional of derivational affix (a prefix, a suffix, and, in some language, an infix) is called derivation.

Both of two theories above explain that they have similarity in giving meaning and clarifying derivation. The forms of words are based on additional syllables in front of, middle and the end of base word. Beside that, Brinton provides the characteristics or categories in derivation namely a prefix, a suffix, an infix. In addition, Bolinger and Sears offer the definition of derivation regarding to affix.

- Plag (2003: 17) states that the formal means employed in derivational morphology and discussed so far can be classified in the following:



The graph has explained more detail that it belongs to derivational types. In addition, Plag gives the distribution of kinds of derivation more detail in graph. This study considered that this hypothesis is better to other assumptions before. Because of the information and the division made by Plag are more comprehensive as seen in the graph. Therefore, the simple idea of derivation was chosen as the supporting theory for this study.

### **2.3.1.1 Affixation**

Affixation is part of derivational that contains of three kinds of categories that will be discussed in this study. The kinds of affixation will be explained are prefixation, suffixation and infixation.

Based on the Plag (2003: 104) affixes were provided by wide range of derivational patterns available in the language. Suffixation and prefixation are very common, whereas infixation is a marginal and extremely restricted phenomenon in English word-formation.

#### **a. Suffixes**

There are four types that will be discussed in this case namely nominal, verbal, adjectival and adverbial.

Nominal suffixes are often employed to derive abstract nouns from verbs, adjectives and nouns. Such abstract nouns can denote actions, results of actions, or other related concepts, but also properties, qualities, and the like. The example of this types are *-age, -al, -ance (with its variants -ence/-ancy/-ency), -ant, -ce/cy, -dom, -ee, -eer, -er, -*

(e)ry, -ess, -ful, -hood, -(i)an (and its variant -ean), -ing, -ion, -ism, -ist, -ity, -ment, -ness, and -ship.

Secondly is verbal suffixes with four suffixes which derive verbs from other categories (mostly adjectives and nouns), -ate, -en, -ify, and -ize.

In addition, adjectival suffixes includes in suffixation which is divided into two groups such as relation adjectives and qualitative adjectives. Relational adjectives, whose role is simply to relate the noun the adjective qualifies to the base word of derived adjective. While, qualitative adjectives is a large group of derived adjectives that express more specific concepts. Sometimes, relational adjectives can adopt qualitative meaning, as can be seen in -able/-ible, -al, -ary, -ed, -esque, -ful, -ic/-ical, -ing, -ish, -ive, -less, -ly, and -ous.

The previous type of suffixation is adverbial suffixes with formations as -ly and -wise. In this case, some formations have difference in meaning between adjective and the adverb by -ly mention that *shortly*, *hardly*, and *dryly* are semantically distinct from their base words and *hotly*, *coldly*, and *darkly* can only have metaphorical senses. Furthermore, -wise is suffix derives adverbs from nouns, with two distinguishable sub-groups: manner/dimension adverbs, and so-called viewpoint adverbs.

### **b. Prefixes**

It is divided into three groups which are classified semantically. First, there is a large group that quantify over their base words' meaning, for example 'one' (uni-, *unilateral*), 'twice or two' (bi-, *bisexual* and di-, *disyllabic*), 'many' (*multi-*, *multi-purpose* and *poly-*, *polyphonic*), 'half' (*semi-*, *semi-conscious*), 'all' (*omni-*,

*omnipresent*), ‘small’ (*micro-*, *microwave*), ‘large’ (*macro-*, *macro-economics*), ‘to excess’ (*hyper-*, *hyperactive* and *over-*, *overprotective*), ‘not sufficiently’ (*underground*).

Second, there are numerous locative prefixes such as *circum-* ‘around’, *counter-* ‘against’, *endo-* ‘internal to X’, *epi-* ‘on, over’, *inter-* ‘between’, *intra-* ‘inside’, *para-* ‘along with’, *retro-* ‘back, backwards’, *trans-* ‘across’.

Third, there are temporal prefixes expressing nations like ‘before’ (*ante-*, *pre-*, and *fore-*), ‘after’ (*post-*, *post structuralism*), or ‘new’ (*neo-*, *neoclassical*). A fourth group consists of prefixes expressing negation (*a (n)-*, *de-*, *dis-*, *in-*, *non-*, *un-*). Beside that, prefixes express diverse nations such as ‘wrong, evil’ (*mal-*, *malpractice*), ‘badly, wrongly’ (*mis-*, *misinterpret*), ‘false, deceptive’ (*pseudo-*), ‘together, jointly’ (*co-*), ‘in place of’ (*vice-*), etc. In the following, the negative prefixes look more detail and two of their close relatives, *mis-* and *anti-*.

### **c. Infixes**

Furthermore, infixation is the last type from affixation in which usually morphologists agree that English has no infixes. However, there is the possibility of inserting expletives in the middle of words to create new words expressing the strongly negative attitude of the speaker (e.g. *kanga-bloody-roo*, *abso-blooming-lutely*). In fact, English has a process of (certain) words, but there are no bound morphemes that qualify for infix category.

In conclusion, we can see that affixes exemplified in the wide range of derivational patterns obtainable in the language. So, suffixation and prefixation is universal or ordinary, whereas infixation is marginal and very limited phenomenon in English word formation.

### **2.3.1.2 Non-Affixation**

The next, we discuss about non-affixation, it is instead of affixation, so, many types of it will be explained more detail. It is a number of word-formation processes that do not involve affixes as their primary or only means of deriving words from other words or morphemes. Moreover, Plag (2003: 129) said that English has a rich inventory of such non-concentrative processes, including conversion, truncation, blending, and abbreviation. It will be discussed completely as mentioned below:

#### **a. Conversion**

Conversion can be defined as the derivation of a new word without any overt marking. In order to find cases of conversion we have to look for pairs of words that are derivationally related and are completely identical in their phonetic realization. As Plag (2003: 108) said that conversion raises three main problems that will be discussed in the following sections: the problem of directionality, the problem of zero-morphs, and the problem of the morphology-syntax boundary.

- The directionality of conversion can be established, however, one may occasionally end up with difficult cases. For example, forms such as love (the noun) and love (the verb) are hard to decide upon. Both are current since Old English times, and neither seems to be semantically primary.
- Zero-affixation in which morphologists thinks that zero-form is justified only in those cases where there is also an overt form that expresses exactly the same meaning or function. It is also called the *overt analogue criterion*.

- Conversion is purely syntactic mechanism also could be defined as the use of a word with a given syntactic category in a syntactic position that it normally does not occupy.

**b. Prosody Morphology**

It deals with the interaction of morphological and prosodic information in determining the structure of complex words. In addition, there are two kinds of word-formation processes in English where prosody plays a prominent role, truncations and blends.

Truncation is a process in which the relationship between a derived word and its base is expressed by the lack of phonetic material in the derived word. The examples are:

- |                   |                          |
|-------------------|--------------------------|
| a. Ron (← Aaron)  | b. demo (←demonstration) |
| Liz (← Elizabeth) | lab (←laboratory)        |
| Mike (←Michael)   | disco (←discotheque)     |

While, another large class of complex words whose formation is best described in terms of prosodic categories is blends. Blending differs from the processes discussed in the previous section in that it involves two or (rarely) more base words (instead of only one), but shares with truncations a massive loss phonetic (or orthographic) material. For the example, there are two types namely:

- |                                 |                            |
|---------------------------------|----------------------------|
| a. Blends, type 1               | b. Blends, type 2          |
| motor + hotel → motel           | breakfast + lunch → brunch |
| television/broadcast → telecast | channel + tunnel → chunnel |

The examples above show that in first type dealing with existing compounds that are shortened to form a new word. It is contrast to abbreviated compounds, the base

words of the blends in second type which are typically not attested as compounds in their full form.

### **c. Abbreviations and acronyms**

Abbreviations are similar in nature to blends, because both blends and abbreviations are combinations of parts of different words. Abbreviations are most commonly formed by taking initial letters of multi-word sequences to make up a new word, as shown below:

|      |                                    |
|------|------------------------------------|
| NATO | North Atlantic Treaty Organization |
| WHO  | World Health Organization          |
| UK   | United Kingdom                     |

Beside that, abbreviations are also found in incorporate non-initial letters:

|      |                     |
|------|---------------------|
| kHz  | kilohertz           |
| BSc  | Bachelor of Science |
| Inc. | Incorporate         |

In conclusion, non-affixation is not involve affixes as their primary or only means of deriving words form other words or morphemes. In additionally, English has rich inventory of such non-concatenation processes, including conversion, truncation, blending, and abbreviation. Thus, the presumption and the example above showed the kind of non-affixation correctly.

### **2.3.2 Compounding**

In word formation, compounding is one of section discussed beside derivation. It is a subject or topic that studied about combining the base of word. So, the new word



formed by compounding among two words. Therefore, to make easily in understanding about this subject better to us knowing the basic characteristic of compounding.

Plag's theory gives real clarifies and explores the kinds of element or types of characteristic in compounding. It is shown by the statement that there are crucial assumptions namely compound which consists of two and not more element and, the second element is words (Plag, 2003: 132).

In this study, there are four types which include nominal, adjectival, verbal and neoclassical compound. They will be explained below:

### 1. Nominal compounds

Nominal compound is compound with nouns as heads which falls into the three subclasses mentioned above, involving nouns, verbs, and adjectives as non-heads.

Noun-noun compounds are the most common type of compound in English.

Consider the difference between the forms in (a) on the one hand, and (b) and (c) on the other:

- |                |            |              |
|----------------|------------|--------------|
| a. pencil case | b. redneck | c. classmate |
| book cover     | loudmouth  | pen pal      |
| letter head    | greybeard  | spoilsport   |

The forms in (a) all have in common that they are noun-noun compounds and that they denote a subclass of the referents of the head: a *pencil case* is the place or box for pencil, a *book cover* is kind of cover, a *letter head* is the head of a letter. The semantic head of these compounds is inside the compound, which is the reason why these compounds are called by **endocentric compounds**. The compounds in example (b) and (c) thus all refer to persons, which means that their semantic head is outside the

compound, and they are traditionally called by **exocentric compounds**. In other words, in example (b) are also sometimes called **possessive compounds**, because they denote an entity that is characterized (sometimes metaphorically) by the property expressed by the compound (Plag, 2003: 145).

## 2. Adjectival compounds

Adjectival compounds can have nouns or other adjectives as non-heads. The interpretation of noun-adjective compounds basically follows the same principles as that of noun-noun compounds. The non-head element can serve either as a modifier or given appropriate adjectival head, as an argument of the head. The following are the examples:

|           |            |
|-----------|------------|
| knee-deep | sugar-fee  |
| blood-red | girl-crazy |

From the example above, the compounds in the left-hand column receive various kinds of interpretations ('deep to the height of one's knee', 'red like blood'). The most common type of interpretation is the one involving a comparison ('red like blood'). The items in the right-hand column can be analyzed in such a way that the first element of the compound satisfies an argument position of the adjective. In syntactic constructions this argument would appear next to a preposition: *free of sugar*, *crazy for girls* (Plag, 2003: 152).

Adjective-adjective compounds with the first adjective as modifier (as in icy-cold, bluefish- green) do not seem to be as numerous as noun-adjective compounds. Finally, there are adjectival compounds that involve adjectives as heads and behave in a similar fashion as deverbal synthetic compounds. The examples are:

|           |                       |             |
|-----------|-----------------------|-------------|
| Blue-eyed | university-controlled | hair-rising |
|-----------|-----------------------|-------------|

From the example above we can make the structural analysis like:

1. [[blue-eye] –ed]
2. [blue [eye –ed]]
3. [[university control] –ed]
4. [university [control –ed]]
5. [[hair raise] –ing]
6. [hair [raise –ing]]

### 3. Verbal compounds

These compounds may have nouns, adjectives, and verbs as their non-head, as exemplified:

| Noun as non-head | Adjective as non-head | Verb as non-head |
|------------------|-----------------------|------------------|
| Proof-read       | Deep-fry              | Dry-clean        |
| Talent-spot      | Shortcut              | Freeze-dry       |
| Ghost-write      | Broadcast             | Drink-drive      |

The majority of compounds involving a verbal head are best analyzed as the result of a back-formation or conversion process. Thus, the items in the left column are all back-formations from noun-noun compounds with either a verbal noun in *-ing* or a person noun in *-er* in head position (e.g. *proof-reading*, *talent-spotter*, and *chain-smoker*). Considered with adjective-verb compounds, conversion is involved with *to shortcut* ('to take a shortcut'), and *to dry-clean* ('to use a blind-fold'), while *to deep-fry* and *to broadcast* seem to be rather idiosyncratic instances of this type, whose semantics is not transparent.

It means that back-formation and conversation analyses make sense which is supported by mentioning fact that verbal compounds with nouns as non-heads are impossible in English, and verbs cannot incorporate adjectival/adverbial.

#### **4. Neoclassical compounds**

Neoclassical formations as forms in which is the of Latin or Greek origin are joint to form new combinations but they not proven in original language. So, the example shown below:

|                     |                      |                  |
|---------------------|----------------------|------------------|
| <i>Biochemistry</i> | <i>Photograph</i>    | <i>Geology</i>   |
| <i>Biorhythm</i>    | <i>Photoionize</i>   | <i>Biology</i>   |
| <i>Biography</i>    | <i>Photoanalysis</i> | <i>Neurology</i> |

According to the Plag (2003: 155), neoclassical compound is the formation processes a number of interesting formal properties that distinguish them from other types of compounds that discussed before.

There are numerous different patterns of compound formation which can be distinguished on the basis of formal and semantic criteria. Compounds systematically combine words of certain categories, they display certain predictable stress patterns, and they are interpreted in principled ways.

#### **2.4 [www.wiley.com](http://www.wiley.com)**

Founded 1807, John Wiley & Sons, Inc. This website has been a valued source of information and understanding for 200 years, helping people around the world meet their needs and fulfill their aspirations. Since 1901, Wiley and its acquired companies have

published the works of more than 350 Nobel laureates in all categories: Literature, Economics, Physiology/Medicine, Physics, Chemistry and Peace.

The website gives us about world information of business and how to get a success in enterprise development. Moreover, this page can be solution for the businessmen when they want make easier their job of business managements.

## **2.5 Previous Studies**

In this study, there are some previous researches reviewed to give the feedback for this thesis. Morphology has been researched by many people with different ways. Subsequently, it makes certain as source information for the next researches in analyzing the same concern especially in word formation. There are three previous studies that give the new idea in this study. All of them discussed morphology with different characters of their writing in providing justification about form of words. It means there are variations of the theory used by them that lead this study to choose another theory namely Ingo Plag's word formation.

First, the study of Muhammad Ihsan (2005) entitled "A Morphological Analysis on Banjar Language used in South Kalimantan". His study focuses on the affixation, reduplication, and compound of the utterances that are usually used by communities of South Kalimantan in their daily conversation, and those from the stories of *Si Palui*. In his research, there are two data sources namely the South Kalimantan people who speak Banjar language. The second is written expressions taken from "*Si Palui*" stories, from 1<sup>st</sup> until 28<sup>th</sup> February 2005. Moreover, he uses the descriptive qualitative method as it is meant to describe and explain the phenomenon that happens in the real situation of the

field. Here, he describes Banjar language and analyze it with many types or classes and ways. In the first stage, he identifies those utterances both in oral communication and written expression based on his research problems concerning Banjar language affixation, reduplication and compound. Furthermore, he analyzes the data and classifies each part of the selected and collected data into the morphological terms. Finally, he makes conclusion based on the results of the analysis. In his result, he found three types of morphological analysis namely affixation, reduplication and compounding based on the oral communication and written expressions of banjar language.

Another previous study is conducted by Mu'alifatul Zuhriyah (2005) entitled "A Morphological Study on Javanese Compound used in Blitar". Her study focuses on Javanese compounds, which were specified on the formation and the meaning of compounding. Therefore, the method which is suitable for this research is descriptive qualitative. Based on the combination of words, she get the result which Javanese compounds create several meaning that is to state something which relates to person's characteristic, to state something relates to the color, to state the opposite meaning, to state the comparative meaning and to state something of feeling or expression, to state something relates to the measure.

Asrotul Ifafa conduct a study (2007) entitled "Patterns of Word Formations in Comic Series Issued in the Jakarta Post". In her study, she described word formation theory based on George Yule. Later, she gives the explanation about patterns of word formation specified in comic series issued in the Jakarta Post. She analyzes the data which are divided into form of word-formation process. They are derivation, compounding, shortening, acronym, blending, and unidentified. So, she studies the

patterns of word-formations in comic series issued in the Jakarta post published from December 2003. The result shows the special type of word-formation in comic is visual communication. The visual aspects used as medium for the character to move and speak within a reality to begin before and carry past the action depicted, establishing “reality” perpetually. Not only used visual communication the writer also used picture. Comic strips are virtually pictures because picture may trigger huge associate pathway to memory experiences, pleasure that predate verbal equivalent. The unidentified word is one of the characteristic that makes them interesting. This special types of word that no one being on the word formation literary.

From three previous studies that mentioned above, we can take the summary about morphology analysis. Both Ihsan and Zuhriyah studied compounds but Ihsan more specifically discussed affixation and reduplication. So, he had taken the data from oral communication and written expression. In addition, analyzing and classifying also used by him in each part of the selected and collected data into morphological terms. In Zuhriyah is study explanation of words used in lexical meaning. It means that she studies morphology which related to semantics study. In their studies, they give the example by considering the dialect on Banjar and Javanese. While, Ifafa studies about the pattern of word formation which focuses on derivational, compounding, shortening, acronym, blending and unidentified. She also mentions about the characters in comics as her object and the process of word formation that found in Jakarta Post.

In conclusion, this study considers that software terms has different object from three previous studies above. Plag's theory is not used by previous studies; it means that this study has a new idea in identifying and analyzing word formation process.

## **CHAPTER III**

### **RESEARCH METHODS**

This chapter covers the discussion on research design, data source, data collection, data analysis, and triangulation.

#### **3.1 Research Design**

This study applies descriptive qualitative research. It is called by qualitative study as Denzin and Lincoln in Moleong (2007: 5) said that qualitative research is research using natured background with purpose to interpret phenomenon that happens. The methods are used in qualitative research such as interview, observation, and documentation. In this study, the phenomenon observed is new words of technology namely software terms. So, it must be clarified because this study is to identify and to describe kinds of word are found which it can be easier to makes a good writing with choosing the correct words in making a sentence.

#### **3.2 Data Source**

The data of this study are the terms found in the information technology especially in ERP software terms. So, the data source of this study is a book of IT company website entitled "ERP Making It Happen" specify in [www.wiley.com](http://www.wiley.com). It is the best of a book that published by John Wiley and Sons.



### **3.3 Data Collection**

In gathering the data, the steps are as the following: at first step is reading the chosen material because the material has too large fields, so it must be specified. In addition, the material consists of two kinds namely software application and software system. So, the material specially chosen is software application. Second step is selecting the words belong to software application which included account and ERP software which ERP software terms become the selecting terms in this study. And the last step of this study is organizing the data based on the types of word formation namely derivation and compounding.

### **3.4 Data Analysis**

After collecting the data, this study applies some steps to analyze the data. The first is explaining the word formation obtained from a book from the website. In this step, gives more understanding about the process word of forms are made. The second is discussing the result of the data analysis. Finally, the last step is concluding.

### **3.5 Triangulation**

Moleong (2000: 178) said that triangulation is used in different ways, but essentially, it refers to collect and compare different perspective on situation. It means that triangulation is a method to strengthen or corroboration effort. This study uses an informant to recheck the data identified and also using interview or documentation so, it is called by data sources triangulation. He is Syahril Dian Purwono ST, a consultant in IRIS, a public company to give more information about software terms. The informant is

not a linguist but he makes the data accurate, because he gives the information in selecting the words which not all of the words can be included into ERP software terms.

## **CHAPTER IV**

### **FINDINGS AND DISCUSSIONS**

This chapter consists of findings of the data and discussions. In the findings there are word formation categories namely derivation that includes affixation and non-affixation and the last is compounding.

#### **4.1 Findings**

Based on the data, there are four texts found with three categories of word formation according to the ERP software terms. The three categories concern with affixation, non-affixation and compounding. We can see the analysis summary in appendix. The complete data are presented as follow:

##### **4.1.1 Affixation**

Affixation is kind of derivation comprising three categories namely prefixes, suffixes and infixes that are used in software terms. It is the way to make a new word in language by adding the base word. In this case, the data are the terms found in the book of IT website.

Suffixes and prefixes are mainly used in software terms while; infixes are never used because it cannot be found in the data. The data show that suffixes appear as the dominant word formation used.

Moreover, the category of affixation namely prefixes, suffixes, and infixes will be explained more clearly with the data found in the book of IT as follow:

#### 4.1.1.1 Prefixes

A prefix is part of affixation as way to form a new word by adding the base word. In this case, there are many kinds of prefixes but only two types that are used in software terms namely prefix *un-* and *re-*. In the text there are only two words using prefixes. The example is below:

##### a. Prefix *un-*

From the data, it is found that the word “unloading” includes prefix *un-*. In this type, prefix *un-* + noun becomes noun. It means that joining the syllable *un-* makes the word loading becomes “unloading” identified with noun (datum 46).

##### b. Prefix *re-*

Prefix *re-* in software terms could be inserted in the base root of verb, noun, adjective, and adverb. In this kind it is also clear that prefix *re-* + noun become noun. It means that joining the syllable *re-* makes the word allocation becomes “reallocation” recognized as noun. The word “reallocation” found in the last text of the data (datum 71).

#### 4.1.1.2 Suffixes

It is a part of affixation following the base word. There are many kinds of suffixes used which dominantly used in software terms. In addition, a suffix is divided into four types namely nominal, verbal, adjective, and adverb suffixes. This study found several kinds of suffixes which mostly in the form of nominal suffixes. All of the types covering suffix *-er*, *-ing*, and *-ion* will be explained more detail below:

## 1. Nominal Suffixes

It is kind of suffixes that many words from the data include in nominal suffixes. In this case, there are three parts that appear from the twenty two parts, they are nominal suffixes *-er*, *-ing*, and *-ion*. According to the three parts, nominal suffixes *-ion* is more dominant in software terms. It is explained below:

### a. Suffix -er

Suffix *-er* is part of suffixes in which the base word will be added by *-er* and mostly becomes noun. Moreover, it is usually used to create person nouns or to identify place. For example, the word taken from the data of ERP software terms as:

- Customer = custom + -er  
Noun = noun + suffix *-er*
- Supplier = supply + -er  
Noun = noun + suffix *-er*

Based on the example above, we can conclude that both of the terms indicated person nouns. It means that “customer” and “supplier” are created into noun by adding suffix *-er* (datum 14 and 24).

In others analysis there are two examples which show about inflectional and derivational suffixes as the following example:

- Planners = plan + -er + -s  
Noun = noun + derivational suffix *-er* + inflectional *-s*
- Buyers = buy + -er + -s  
Noun = noun + derivational suffix *-er* + inflectional *-s*

The example shows us that both of the terms “planners” and “buyers” have two kinds of morphological analysis which include derivational suffix *-er* and inflectional suffix *-s* or usually called by plural *-s*. It means that both indicated personal noun and plural of “planner” and “buyer” (datum 49 and 52).

b. Suffix *-ing*

This is a part of suffixes made by adding *-ing* of the original word to create a new word. In addition, suffix *-ing* denotes the processes or results of something. For example in ERP software terms as follow:

- Loading = load + *-ing*  
Noun = noun + suffix *-ing*
- Programming = program + *-ing*  
Noun = noun + suffix *-ing*

The analysis above shows that both “loading” and “programming” have similar meaning that is process to load and to program. Moreover, the base words “load” and “program” are noun and adding *-ing* make them still become noun. These words appear at datum 26 and 48.

c. Suffix *-ion*

This type is part of nominal suffixes formed by adding *-ion* of the base word to produce a new word. Beside that, it has three allomorphs when attached to a verb in *-ify*, *-ate*, *-ation* then suffix *-ion* denote events or results of processes. The following data of ERP software terms will be explained below:

- Simulation = simulate + *-ion*  
Noun = verb + suffix *-ion* (datum 30)

- Installation = install + -ation  
Noun = verb + suffix *-ation* (datum 39)
- Allocation = allocate + -ion  
Noun = verb + suffix *-ion* (datum 61)
- Location = locate + -ion  
Noun = verb + suffix *-ion* (datum 69)
- Fabrication = fabric + -ate + -ion  
Noun = noun + suffix *-ate* + suffix *-ion* (datum 70)

The data show that the original word before adding *-ion* is verb but after giving suffix *-ion* the words become noun. So, for the word “installation” is different from others because the base word is added by *-ation*. It used the allomorph of form *-ation* which is one of *-ion* allomorphs. From the analysis of the word “fabrication”, we conclude that the base word “fabric” as noun is added by two suffixes *-ate* and *-ion*. When the word becoming “fabricate”, it becomes verb and when added by *-ion* or become “fabrication” it is as noun.

#### **4.1.1.3 Infixes**

This type is uncommonly used in ERP software terms because in this study no word can be found using infixes because it is only used in Indonesian language.

#### **4.1.2 Non-Affixation**

It is part of word formation which deals with non-affixation that covering three major problems as conversion, prosody morphology, and abbreviations and acronyms.

## **1. Conversions and Prosody Morphology**

Both conversion and prosody morphology are uncommon word on ERP software terms. The data show that they are unavailable because the words used in software terms are mostly in abbreviations and acronyms.

## **2. Abbreviations and Acronyms**

It is a kind of non-affixation with many words found in software terms. In addition, abbreviation and acronyms usually take initial letters or multi word sequences to make up a new word. It is explained below:

- ERP : Enterprise Resource Planning (datum 1).
- ES : Enterprise Systems (datum 3).
- S&OP : Sales and Operations Planning (datum 5).
- MPS : Master Production Scheduling (datum 9).
- MRP : Material Requirements Planning (datum 11).
- CRP : Capacity Requirements Planning (datum 12).
- DRP : Distribution Requirements Planning (datum 13).
- MRP II: Manufacturing Resource Planning (datum 23).
- APS : Advanced Planning System (datum 31).
- GAAP : Generally Accepted Accounting Principles (datum 35).
- VMI : Vendor Managed Inventories (datum 41).
- CR : Continuous Replenishment (datum 42).
- MES : Manufacturing Execution Systems (datum 43).
- SKU : Stock Keeping Unit (datum 56)



- HARP : Half-Baked Resource Planning (datum 63)
- DC : Distribution Center (datum 67).
- EDI : Electronic Data Interchange (datum 72).

The explanation above shows that abbreviations involve lost material (not additional material, as affixation). They are made by using initial letter to form a new word.

### **4.1.3 Compounding**

It is kind of word formation which is mostly used to create a new word in English. There are many kinds of compounding which are clarified into four categories such as nominal, adjectival, verbal and neoclassical compound. The data show that compared with affixation and non affixation, compounding is central of word formation in ERP software terms. The evidences will be explained below:

#### **4.1.3.1 Nominal Compounds**

It is type of compounding that is divided into three categories. First, semantic head of these compounds is inside the compound that is usually called by *endocentric compounds*. Second, the compounds that refers to persons, which mean that their semantic head is outside the compound, and usually called by *exocentric compounds*. Third, the compounds denote an entity that is characterized (sometimes metaphorically) by the property expressed and usually called by *possessive compounds*.

### 1. Endocentric compounds

It is a kind of the headedness compounds which are dominant in ERP software terms. Moreover, the words denote a subclass of the referents of the head analyzed below:

- Enterprise Resource Planning: noun + noun + noun

It is kind of software application or kinds of planning (datum 2).

- Sales forecasting: noun + noun

It is a prediction of sales (datum 4).

- Advanced Planning System: noun + noun + noun

It is a kind of system in statistical capabilities (datum 6).

- Supplier Rating System: noun + noun + noun

It is grouping of supplier appear from quality (datum 7).

- Performance Metrics: noun + noun

It is options of measurement (datum 8).

- General ledger: noun + noun

It is a kind of ledger (datum 18).

- Cash management: noun + noun

It is management of cash (datum 19).

- Customer relation management: noun + noun + noun

It is a kind of relation with buyer management (datum 20).

- Human resources: noun + noun

It shows the duty or someone's position in business (datum 21).

- Data warehousing: noun + noun  
It is a kind of data used by customer (datum 22).
- Demand management: noun + noun  
It is management of demand (datum 28).
- Close loop: adjective + noun  
It is a set of business process built around material requirements planning and also additional planning function of production (datum 29).
- Business plan: noun + noun  
It is statement of income projections, cost and profit usually accompanied by budgets and projected balance sheet as well as a cash flow statement (datum 32).
- Make – to – order: noun + preposition + noun  
It is finished after the receipt of a customer order (datum 33).
- Make – to – stock: noun + preposition + noun  
It is a kind of shipped from finished goods off the shelf (datum 34).
- Bill of Material: noun + preposition + noun  
It is a kind of listing (datum 40).
- Information system: noun + noun  
It is system of information (datum 44).
- Information technology: noun + noun  
It is technology of information (datum 45).
- Supplier scheduling: noun + noun  
It is purchasing approach which gives supplier schedule (datum 47).

- Shop Floor Control: noun + noun + noun  
It is kind of report production (datum 50).
- Cycle Counting: noun + noun  
It is a physical inventory- taking technique where inventory is counted on periodic schedule rather than once a year (datum 51).
- Plant Floor Control: noun + noun + noun  
It is kind of report production (datum 53).
- Overload: noun + noun  
It is load of over (datum 54).
- Under Load: noun + noun  
It is load of under (datum 55).
- Back Flush: noun + noun  
It is a kind of reception finished report (datum 57).
- Schedule Receipts: noun + noun  
It is schedule of acceptance from supplier according to last week (datum 58).
- Product Structure: noun + noun  
It is structure or formula of product (datum 62).
- Time Fence: noun + noun  
It is a point of time with various restrictions (datum 66).

The findings above show that new words are dominantly formed by noun and noun. The words prove that most of the words are formed from nominal compound with noun referring as head. It appears in the words (*Enterprise Resource Planning, Sales forecasting, Advanced Planning System, Supplier Rating System, Performance Metrics,*

*General ledger, Cash management, Customer relation management, Human resources, Data warehousing, Demand Management, Business Plan, Information System, Information Technology, Supplier Scheduling, Shop Floor Control, Cycle Counting, Plant Floor Control, Overload, Under Load, Back Flush, Schedule Receipts, Product Structure, and Time Fence*). In addition, endocentric compound can be found in the words formed by adjective and noun as *Closed Loop*. Moreover, there are words created by noun, preposition and noun that include in this type such as: *Make – to – order, Make – to – stock, and Bill of Material*.

## 2. Exocentric compound

It is a kind of nominal compound that seems to be restricted to forms denoting human being, it cannot be found in the ERP software terms.

## 3. Possessive compounds

This type included in nominal compound which denotes an entity that the words sometimes appear as metaphor. In this case, there are five examples explained below:

- Just – in – time: adjective + noun + noun

It word has not meaning "at this time" but it means an approach to achieving in manufacturing (datum 36).

- Lean manufacturing: adjective + noun

This term does not mean "lean of factory" but it means an approach of production that emphasizes on the minimization of the amount of all the

resources (including time) used in the various activities of the enterprise (datum 37).

- Quick Slice: adjective + noun

This word does not mean "part of speed" but it means a method of implementing most of the ERP functions into a small slice of the business typically one product or product line, in a very short time (datum 38).

- On – Hand Balance: adjective + noun + noun

This word does not mean "a balance hand" but it means the quantity shown in the inventory records as being physically in stock (datum 60).

- Available – to – promise: adjective + preposition + noun

This word does not mean "promise that has available" but it means the uncommitted portion of inventory and future production (datum 64).

- Work – in – process : noun + noun + noun

This word does not mean "process of work" but it means product in various stages of completion, including raw material that has been released for initial processing and completely processed material (datum 65).

#### **4.1.3.2 Adjectival Compounds**

It is a kind of compound that has characteristics noun or other adjectives as non-heads. The explanation of noun-adjective compounds basically follows the same principles as that of noun-noun compounds. So, the example will be clarified below:

- Accounts Receivable: noun + adjective

[[accounts receive] able]

- Accounts payable: noun + adjective

[[accounts pay] able]

Both of the two words above show that the words are combined with noun and adjective. So, the first word has meaning "amount of money that is received" and the second "amount of money that is paid"(datum 16 and 17).

- Job – Shop: noun + noun

[Job shop]

It shows that the word joined by noun and noun which has meaning "a functional organization whose department or work centers is organized by particular types of equipment or operation"(datum 59).

From the example above, we can conclude that the first and second words have various meaning (*receive of account, paid of account*). The most common type of interpretation is the one involving a comparison (*account has received, account has paid*). Subsequently, the third example would appear with preposition *shop of job*.

#### **4.1.3.3 Verbal Compounds**

In this type, there are three kinds as noun as non-head, adjective as non-head, and verb as non-head to identified word. The result from the data shows only noun as non-head while adjective as non-head and verb as non-head cannot be found in ERP software terms. In this case, the verbal compound can be formed by joining noun and noun, such as:

- Rough Cut Capacity Planning: noun + noun + noun + noun + -ing

This word is combined by noun, noun, noun, and verbal noun in *-ing*. It is process of converting production plan (datum 10).

- Order Entry: noun + noun
- Supply Chain: noun + noun
- Master Scheduling: noun + noun
- Dispatch List: noun + noun

In the example above, the compounding created a new word by noun and noun. It means that the compound used noun as non-head (*registration of ordering, process from the initial acquisition raw material, drives material requirements planning, and listing of manufacturing*) (datum 15, 25, 27, and 68).

#### **4.1.3.4 Neoclassical compounds**

It is a kind of compound from Latin or Greek origin. From the data, there is no word included in neoclassical compound because no terms found are combined to form new combinations that are not indicated in the original languages.

## **4.2 Discussions**

There are types of word formation found in ERP software terms. The data found included into three categories of word formation by Plag's theory such as: affixation, non-affixation and compounding.

This section discusses the rules in creating a new word and making the purposes and the meaning of morphological terms based on the analysis. It also answers the



research problems namely the types and the mostly used word formation of ERP software terms.

#### **4.2.1 Types of the word formation of ERP software terms in www.wiley.com**

There are three categories on word formation of ERP software terms namely affixation, non-affixation and compounding.

##### **4.2.1.1 Affixation**

In this case, affixation can be found that ERP software terms which includes prefixes and suffixes.

##### **a. Prefixes**

Based on the data, the prefixes in ERP software terms consists of prefix *un-* and prefix *re-*.

The formula for prefix *un-* and *re-*

- Prefix *un-* + noun become noun
- Prefix *re-* + noun become noun

As the result of the rule, the word will be changed to another part of speech (derivational) or just changed to another meaning. In addition, the word is not change the meaning but we can see from the rule of the meaning in the formula above to decide whether prefix *un-* and prefix *re-* are derivative or not.

The meaning appeared could be as explanation that the base word as "loading" added by prefixes *un-*, usually expresses 'absence of X'. It means that the word

"unloading" create the meaning absence of loading. While, the base word as "reallocation" is the word that is combined from prefixes *re-* and "allocation". Thus, this word forms the sense of allocation again. Both of the examples show the combination of prefix *un-* and prefix *re-* with noun to produce noun.

## **b. Suffixes**

It is also found in ERP software terms that can derive nouns from verbs, adjectives and nouns. Based on the data, the suffixes are divided of four categories namely nominal, verbal, adjectival and adverbial but it is only found in nominal suffixes. There are nominal suffixes *-er*, *-ing*, and *-ion* with the formula below:

- Noun + suffix *-er* become noun
- Noun + derivational suffix *-er* + inflectional *-s* become noun
- Noun + suffix *-ing* become noun
- Verb + suffix *-ion* become noun
- Noun + suffix *-ate* + suffix *-ion* become noun

As the result of the rule, the word will be changed to another part of speech (derivational) or just changed to another meaning. In addition, the word is not changing the meaning but we can see from the rule of the meaning in the formula above to decide whether suffixes *-er*, *-ing*, and *-ion* are derivative or not.

### 1. The formula for nominal suffix *-er*

The meaning appeared could be as explanation that the examples of word as "supply" added by suffix *-er*, is usually active or volitional participants in an event. The second formula has different rule to explain the base word as "buy" which is added by

derivational suffix *-er* and inflectional *-s*. This word has similar meaning with the first formula that "buyer" added with inflectional *-s* means many buyer because inflectional *-s* means plural. Both formulas have equal word meaning which indicated on person nouns.

## 2. The formula of nominal suffixes *-ing*

As an example, the word "program" added by suffix *-ing*, usually denotes the processes or the results of something.

## 3. The formula of nominal suffixes *-ion*

This type has three allomorphs when attached to a verb in *-ify*, *-ate*, *-ation* then suffix *-ion* denote events or results of processes. As an example, the word "simulation" from the base word simulate added by *-ion*. Also the word "fabrication" from the base word "fabric" adding by suffix *-ate* + *-ion*. As we know, the examples have different pattern but they are similar in meaning.

### **4.2.1.2 Non-affixation**

The abbreviations found are made from association of initial letters or multi words. The examples are as follow: ERP: Enterprise Resource Planning, ES: Enterprise Systems, S&OP: Sales and Operations Planning. As we know, abbreviation is simple of word or called by blend which makes words shorten.

### **4.2.1.3 Compounding**

Compounding is joining two words or more to form a new word. In this type consists of nominal, adjectival and verbal compound such as the following.

#### a. The formula of nominal compounds

- Noun + noun
- Noun + noun + noun
- Noun + preposition + noun
- Adjective + noun
- Adjective + noun + noun
- Adjective + preposition + noun

As the result, there are six formulas related to the nominal compounds. In fact, nominal compounds are not only joining noun and noun but also three words of noun and noun can be combined by preposition and noun such as: “general ledger” as noun + noun, “enterprise resource planning” as noun + noun + noun, and “make – to – stock” as noun + preposition + noun. The examples include to the semantic head of the compounds, it is the reason why these compounds are called by *endocentric compounds*.

Additionally, “close loop” is made from adjective + noun, “just – in – time” is made from adjective + noun + noun, and “available – to – promise” is combining adjective + preposition + noun. The examples are included into the semantics which denotes an entity that is characterized (sometimes metaphorically) or usually called by *possessive compounds*.

In this case, the words formed by different formulas that produce noun. From the examples, we know the various formulas of the nominal compound which commonly formed by noun-noun compounds.

#### b. The formula of adjectival compounds

- Noun + adjective

- Noun + noun

As the result, there are two formulas found in adjectival compounds. The examples are as follow: “accounts receivable” is combining noun + adjective, “job – shop” is combining noun + noun. In this type, the formula is not only combining noun and adjective but also noun-noun compound which can form adjective.

#### c. The formula of verbal compounds

- Noun + noun
- Noun + noun + noun + noun + *-ing*

As the result, there are two formula found in verbal compounds. It showed the different formulas which join noun-noun compounds and four words of noun and joined by suffix *-ing* which can form verbal compounds. The examples are as follow: “order entry” is combining noun + noun, and “rough cut capacity planning” is combining noun + noun + noun + noun + *-ing*.

#### **4.2.2 Type of the word formation is mostly used**

In conclusion, ERP software terms in this study consist of seventy two words. It covers affixation of prefixes with two kinds namely *un-* and *re-* as in *unloading* and *reallocation*. Thus, suffixes only found in nominal suffixes *-er*, *-ing*, and *-ion* used by eleven words. Subsequently, non-affixation just initiates in abbreviation and acronyms with seventeen words as appear in findings. Furthermore, compounding becomes the dominant terms of ERP software with mostly used in forty two terms. This type is divided into three kinds namely nominal compound with 28 words of endocentric

compounds and 6 words of possessive compounds. In adjectival compounds there are three words and five words in verbal compounds.

The analysis show that the types of the word formation mostly appear is compounding. In this type there are words are joined between noun and noun. Moreover, the combined words become a new word and a new meaning. So, it makes this type mostly used in ERP software terms. In addition, compounding is divided into four types namely nominal, adjectival, verbal and neoclassical compounds. Yet, in this case, the type often used is nominal compound with 28 words from the findings.

## CHAPTER V

### CONCLUSIONS AND SUGGESTIONS

This chapter presents conclusions concerning the results of the analysis discussed in the previous chapter and suggestion based on significance of this study.

#### 5.1 Conclusions

There are types of word formation namely affixation, non-affixation and compounding. First is affixation which happened if the free morphemes or the base words are added by one or more bound morpheme. Affixation found in the data consists of prefixes and suffixes. Infix is a marginal or uncommon word in ERP software terms. In prefixes, there are two kinds found namely prefix *un-* and *re-* which consists of one word as *unloading* and *reallocation*. While, suffixes only found in nominal suffixes namely suffix *-er*, *-ing* and *-ion*. The second is non-affixation which does not belong to affixes but deriving the words from other words or morphemes. Moreover, it is divided into three categories such as conversions, prosody morphology, and abbreviations and acronyms. In addition, abbreviations become one category which is created and found. While, both of conversions and prosody morphology are uncommon words in ERP software terms. Finally, compounding is the third type of word formation that is found in this study. It is created by combining two or more words together to form new word and new meaning. Compounding consists of nominal, adjectival, verbal and neoclassical compound. In this type, neoclassical compound is not found.

The type of word formation mostly used is compounding. There is the dominant type of compounding are found in nominal compounds. Leading in endocentric compounds in which the meaning head of compound is inside the combined words.

## **5.2 Suggestions**

This study only discusses what the types and mostly type emerge in ERP software terms. However, it will propose some suggestions dealing with morphology study are:

1. For teacher, this study becomes additional empirical data about morphology study especially in software terms.
2. It is expected that students or others researcher who concern with word formation use Plag's theory on different software terms or in other fields as their interest.



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|          |     |                      |   |   |  |  |  |  |  |  |  |   |   |   |  |   |
|----------|-----|----------------------|---|---|--|--|--|--|--|--|--|---|---|---|--|---|
| <b>2</b> | 61. | Allocation           |   | x |  |  |  |  |  |  |  |   |   |   |  |   |
|          | 62. | Product Structure    |   |   |  |  |  |  |  |  |  |   | x |   |  |   |
|          | 63. | HARP                 |   |   |  |  |  |  |  |  |  | x |   |   |  |   |
|          | 64. | Available-to Promise |   |   |  |  |  |  |  |  |  |   |   |   |  |   |
|          | 65. | Work-in-Process      |   |   |  |  |  |  |  |  |  |   |   | x |  |   |
|          | 66. | Time Fence           |   |   |  |  |  |  |  |  |  |   |   | x |  |   |
|          | 67. | DC                   |   |   |  |  |  |  |  |  |  |   | x |   |  |   |
|          | 68. | Dispatch List        |   |   |  |  |  |  |  |  |  |   |   |   |  | x |
| <b>3</b> | 69. | Location             |   | x |  |  |  |  |  |  |  |   |   |   |  |   |
|          | 70. | Fabrication          |   | x |  |  |  |  |  |  |  |   |   |   |  |   |
| <b>4</b> | 71. | Reallocation         | x | x |  |  |  |  |  |  |  |   |   |   |  |   |
|          | 72. | EDI                  |   |   |  |  |  |  |  |  |  |   | x |   |  |   |

NB.

PR : Prefixes

SU : Suffixes

NS : Nominal Suffixes

VS : Verbal Suffixes

AS : Adjectival Suffixes

AdS : Adverbial Suffixes

IN : Infixation

CO : Conversions

PM : Prosody Morphology

TR : Truncations

BL : Blending

A&A : Abbreviations & Acronyms

NC : Nominal Compounds

AC : Adjectival Compound

VC : Verbal Compounds

NsC : Neoclassical Compound

## Appendix 2

### **ERP: Making It Happen** *The Implementers' Guide to Success with Enterprise Resource Planning*

Thomas F. Wallace  
Michael H. Kremzar  
John Wiley & Sons, Inc.  
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#### **Enterprise Resource Planning**

This is not a book about software. One more time: This is not a book about how to select software and install it on your computers. Rather, it's a book about how to implement superior business processes in your company—processes that yield a competitive advantage. Right now you might be thinking: "Wait a minute. The name of this book is ERP. How can it not be about software?" The answer is that Enterprise Resource Planning (ERP) is not software. One more time: ERP is not software. There's a lot of sloppy terminology flying around today in the business press, and one misnomer is to label enterprise-wide transaction processing software systems as ERP. These software packages support effective resource planning and make much of it feasible, but they don't truly do it. Plus these packages contain many business processes other than resource planning. Therefore, we need to trot out another acronym that does refer to software: ES. This stands for Enterprise System or Enterprise Software. In his book *Mission Critical*,<sup>i</sup> author Thomas H. Davenport describes enterprise systems as "packages of computer applications that support many, even most, aspects of a company's information needs. That makes sense to us. Now for another distinction: Not all ERP business functions are contained in the typical Enterprise Software (ES) suite. Similarly, the typical ES contains software support for business processes that are not a part of ERP. In Figure 1-1, we can see that distinction graphically. Please note the three areas on that diagram. The rightmost part of the figure refers to those functions contained within a typical ES that are not part of ERP; the leftmost area is for those ERP functions not normally supported by an ES; the area of overlap in the center references those ERP functions typically supported by Enterprise Software. Now let's take a look at just what this ERP thing is all about.

#### **WHAT IS ENTERPRISE RESOURCE PLANNING ANDWHAT DOES IT DO?**

Enterprise Resource Planning (ERP)—and its predecessor, Manufacturing Resource Planning (MRP II)—is helping to transform our industrial landscape. It's making possible profound improvements in

##### **ERP PROCESSES**

##### **NOT PART OF A**

##### **TYPICAL ES:**

Sales Forecasting, Sales and Operations Planning, Advanced Planning Systems, Supplier Rating Systems, Performance Metrics.

##### **ERP PROCESSES**

##### **FOUND IN A**

##### **TYPICAL ES:**

Master Production Scheduling, Rough-Cut Capacity Planning, Material Requirements Planning, Capacity Requirements Planning, Distribution Requirements Planning, Customer Order Entry and Promising.

##### **NON-ERP PROCESSES**

##### **FOUND IN A**

##### **TYPICAL ES:**

Accounts Receivable, Accounts Payable, General Ledger, Cash Management, Customer Relations Management, Human Resources, Data Warehousing.

## ERP Processes

The way manufacturing companies are managed. It is a strong contributor to America's amazing economic performance of the 1990s and the emergence of the New Economy. A half century from now, when the definitive industrial history of the twentieth century is written, the evolution of ERP will be viewed as a watershed event. Let's describe Enterprise Resource Planning as:

An enterprise-wide set of management tools that balances demand and supply, containing the ability to link customers and suppliers into a complete supply chain, employing proven business processes for decision-making, and providing high degrees of cross-functional integration among sales, marketing, manufacturing, operations, logistics, purchasing, finance, new product development, and human resources, thereby enabling people to run their business with high levels of customer service and productivity, and simultaneously lower costs and inventories; and providing the foundation for effective e-commerce. Here are some descriptions of ERP, not definitions but certainly good examples. Enterprise Resource Planning is a company increasing its sales by 20 percent in the face of an overall industry decline. Discussing how

this happened, the vice president of sales explained: "We're capturing lots of business from our competitors. We can out-deliver 'em. Thanks to (ERP), we can now ship quicker than our competition,

and we ship on time." Enterprise Resource Planning is a Fortune 50 corporation achieving enormous cost savings and acquiring a significant competitive advantage. The vice president of logistics stated: "ERP has provided the key to becoming a truly global company. Decisions can be made with accurate data and with a process that connects demand and supply across borders and oceans. This change is worth billions to us in sales worldwide. "Enterprise Resource Planning is a purchasing department generating enormous cost reductions while at the same time increasing its ability to truly partner with its suppliers. The director of purchasing claimed: "For the first time ever, we have a good handle on our future requirements for components raw and materials. When our customer demand changes, we ourselves and our suppliers—can manage changes to our schedules on a very coordinated and controlled basis. I don't see how any company can do effective supply chain management without ERP."

That's ERP. Here's how it came to be.

## THE EVOLUTION OF ENTERPRISE RESOURCE PLANNING

### Step One—Material Requirements Planning (MRP)

ERP began life in the 1960s as Material Requirements Planning (MRP), an outgrowth of early efforts in bill of material processing. MRP's inventors were looking for a better method of ordering material and components, and they found it in this technique. The logic of material requirements planning asks the following questions:

- What are we going to make?
- What does it take to make it?
- What do we have?
- What do we have to get?

This is called the universal manufacturing equation. Its logic applies wherever things are being produced whether they be jet aircraft, tin cans, machine tools, chemicals, cosmetics . . . or Thanksgiving dinner.

Material Requirements Planning simulates the universal manufacturing equation. It uses the master schedule (What are we going to make?), the bill of material (What does it take to make it?), and inventory records (What do we have?) to determine future requirements (What do we have to get?). For a visual depiction of this and the subsequent evolutionary steps, a modified version of a diagram in Carol Ptak's recent book on ERP.

### Step Two—Closed-Loop MRP

MRP quickly evolved, however, into something more than merely a better way to order. Early users soon found that Material Requirements Planning contained capabilities far greater than merely giving better signals for reordering. They learned this technique could help to *keep* order due dates valid *after* the orders had been released to production or to suppliers. MRP could detect when the *due date* of an order (when it's scheduled to arrive) was out of phase with its *need date* (when it's required). This was a breakthrough. For the first time ever in manufacturing, there was a formal mechanism for keeping priorities valid in a constantly changing environment. This is important, because in a manufacturing enterprise, change is not simply a possibility or even a probability. It's a certainty, the only constant, the only sure thing. The function of keeping order due dates valid and synchronized with these changes is known as *priority planning*. So, did this breakthrough regarding priorities solve all the problems? Was this all that was needed? Hardly. The issue of priority is only half the battle. Another factor—capacity—represents an equally challenging problem. Techniques for helping plan capacity requirements were tied in with Material Requirements Planning. Further, tools were developed to support the planning of aggregate sales and production levels (Sales & Operations Planning); the development of the specific build schedule (master scheduling); forecasting, sales planning, and customer-order promising (demand management); and high-level resource analysis (Rough-Cut Capacity Planning). Systems to aid in executing the plan were tied in: various plant scheduling techniques for the inside factory and supplier scheduling for the outside factory — the suppliers. These developments resulted in the second step in this evolution: closed-loop MRP. Closed-loop MRP has a number of important characteristics: It's a series of functions, not merely material requirements planning. It contains tools to address both priority and capacity, and to support

both planning and execution. It has provisions for feedback from the execution functions back to the planning functions. Plans can then be altered when necessary, thereby keeping priorities valid as conditions change.

### **Step Three—Manufacturing Resource Planning (MRP II)**

The next step in this evolution is called Manufacturing Resource Planning or MRP II (to distinguish it from Material Requirements Planning, MRP). A direct outgrowth and extension of closed-loop MRP, it involves three additional elements:

1. Sales & Operations Planning—a powerful process to balance demand and supply at the volume level, thereby providing top management with far greater control over operational aspects of the business.
2. Financial interface—the ability to translate the operating plan (in pieces, pounds, gallons, or other units) into financial terms (dollars).
3. Simulation—the ability to ask “what-if ” questions and to obtain actionable answers—in both units and dollars.

Initially this was done only on an aggregate, “rough-cut” basis, but today’s advanced planning systems (APS) enable effective simulation at very detailed levels.

Now it’s time to define Manufacturing Resource Planning. This definition, and the one to follow, come from APICS—The Educational Society for Resource Management. APICS is the leading professional society in this field, and its dictionary has set the standard for terminology over the years.

#### **MANUFACTURING RESOURCE PLANNING (MRP II)—**

A method for the effective planning of all resources of a manufacturing company. Ideally, it addresses operational planning in units, financial planning in dollars, and has a simulation capability to answer “what-if ” questions. It is made up of a variety of functions, each linked together: business planning, sales and operations planning, production planning, master scheduling, material requirements planning, capacity requirements planning, and the execution support systems for capacity and material. Output from these systems is integrated with financial reports such as the business plan, purchase commitment report, shipping budget, and inventory projections in dollars. Manufacturing resource planning is a direct outgrowth and extension of closed-loop MRP.<sup>iii</sup>

### **Step Four—Enterprise Resource Planning (ERP)**

The latest step in this evolution is Enterprise Resource Planning (ERP). The fundamentals of ERP are the same as with MRP II. However, thanks in large measure to enterprise software, ERP as a set of business processes is broader in scope, and more effective in dealing with multiple business units. Financial integration is even stronger. Supply chain tools, supporting business across company boundaries, are more robust. For a graphical view of ERP. Let’s now look at a complete definition of ERP, based on the description we saw a few pages back:

ENTERPRISE RESOURCE PLANNING (ERP) predicts and balances demand and supply. It is an enterprise-wide set of forecasting, planning, and scheduling tools, which:

#### **DEMAND SUPPLY**

#### **CAPACITY PLANNING**

#### **FORECASTING AND DEMAND MGMT**

#### **EXECUTION**

- Links customers and suppliers into a complete supply chain,
- Employs proven processes for decision-making, and
- Coordinates sales, marketing, operations, logistics, purchasing, finance, product development, and human resources.

Its goals include high levels of customer service, productivity, cost reduction, and inventory turnover, and it provides the foundation for effective supply chain management and e-commerce. It does this by developing plans and schedules so that the right resources— manpower, materials, machinery, and money—are available in the right amount when needed. Enterprise Resource Planning is a direct outgrowth and extension of Manufacturing Resource Planning and, as such, includes all of MRP II’s capabilities. ERP is more powerful in that it: a) applies a single set of resource planning tools across the entire enterprise, b) provides real-time integration of sales, operating, and financial data, and c) connects resource planning approaches to the extended supply chain of customers and suppliers. The primary purpose of implementing Enterprise Resource Planning is to run the business, in a rapidly changing and highly competitive environment, far better than before. How to make that happen is what this book is all about.

#### **THE APPLICABILITY OF ERP**

ERP and its predecessor, MRP II, have been successfully implemented in companies with the following characteristics: Make-to-stock, Make-to-order, Design-to-order, Complex product, Simple product, Multiple plants, Single plant, Contract manufacturers, Manufacturers with distribution networks, Sell direct to end users, Sell through distributors, Businesses heavily regulated by the government, Conventional manufacturing (fabrication and assembly), Process manufacturing, Repetitive manufacturing, Job shop, Flow shop, Fabrication only (no assembly), Assembly only (no fabrication), High-speed manufacturing, Low-speed manufacturing Within the universe of companies that make things—manufacturing enterprises—ERP has virtually universal application. This book deals with how to implement ERP in any of the above environments. Some people struggle with this applicability issue; they sometimes say: “We’re different, we’re unique, it won’t work for us.” We’ve heard that a lot over the years. What we have *never* heard is: “We’re different, we’re unique, Generally Accepted Accounting



Principles (GAAP) won't work for us." Well, ERP is the *logistics analog* of GAAP. It's a defined body of knowledge that contains the standard best practices for managing that part of the business. The main difference between the two is that ERP and its predecessors have been with us for about four decades; double-entry bookkeeping and its offshoots have been around for four centuries. More on this later.

### **ERP AS A FOUNDATION**

Today, there are a wide variety of tools and techniques that have been designed to help companies and their people produce their products better and more efficiently. These include Lean Manufacturing, Six Sigma Quality, Employee Involvement, Factory Automation, Design for Manufacturability, and many more. These are excellent tools with enormous potential. But . . . none of them will ever yield their full potential unless they're coupled with *effective forecasting, planning, and scheduling processes*. Here's why: It's not good enough to be extremely efficient . . . if you're making the wrong stuff. It's not good enough to make items at a very high level of quality . . . if they're not the ones needed. It's not good enough to reduce setup times and cut lot sizes . . . if bad schedules prevent knowing what's really needed and when. Back in the early 1980s, a new way of thinking about manufacturing came out of Japan, and it was truly revolutionary. In this country we've called it Just-In-Time (JIT), and more recently it has evolved into Lean Manufacturing.<sup>1</sup> As with most new tools and processes, its early adherents promoted JIT with a missionary zeal—and rightly so. This is great stuff. Some of them, however, took the approach that MRP/MRP II was no longer necessary for companies doing JIT. The MRP establishment pushed back and the result was a raging debate that generated a lot of heat and not much light. Today we can see the situation much more clearly, and we feel this view has been best articulated by Chris Gray, president of Gray Research in Wakefield, NH. Chris says that improvements to business processes take one of three forms:

1. Improving process reliability. Six Sigma and other Total Quality tools are predominant here. Also called Agile Manufacturing or Synchronous Flow Manufacturing.
2. Reducing process complexity. Lean Manufacturing is heavily used here.
3. Coordinating the individual elements of the overall set of business processes. ERP lives here.

Enterprise Resource Planning, when operating at a high level of effectiveness, will do several things for a company. First, it will enable the company's people to generate enormous benefits. Many companies have experienced, as a direct result of ERP (or MRP II) dramatic increases in responsiveness, productivity, on-time shipments and sales, along with substantial decreases in lead times, purchase costs, quality problems, and inventories. Further, ERP can provide the foundation upon which additional productivity and quality enhancements can be built—an environment where these other tools and techniques can reach their full potential. Effective forecasting, planning and scheduling—knowing routinely what is needed and when via the formal system—is fundamental to productivity. ERP is the vehicle for getting valid plans and schedules, but not just of materials and production. It also means valid schedules of shipments to customers, of personnel and equipment requirements, of required product development resources, and of cash flow and profit. Enterprise Resource Planning has proven itself to be the foundation, the bedrock, for supply chain management. It's the glue that helps bind the company together with its customers, distributors, and suppliers—all on a coordinated, cooperative basis.

### **MORE ABOUT SOFTWARE**

Now that we've kicked the ERP topic around a bit, let's double back on the software issue. Software for ERP is like a set of golf clubs. You could give the greatest, most expensive set of golf clubs ever made to either one of your friendly authors, but they wouldn't break 120. Why? It's simple; neither of us knows how to play golf. On the other hand, let's say we send Tiger Woods out on the pro tour with only a four-wood and a sand wedge. Would Tiger win any tournaments? Not a chance. He'd never even make the cut. The reason: To be competitive at the highest levels of the game, you need a full set of clubs in the bag.

Two principles flow from this analogy:

1. The acquisition of the tools, of and by itself, will not make you proficient in their use and thus will *not* provide a competitive advantage.
2. To be truly competitive, you need a good and reasonably complete set of tools.

Too many companies have bought an extremely expensive set of "golf clubs" (an enterprise software system) but haven't learned how to play golf. That's why we read about so many "ERP failures" in the business press. The fact of the matter is that ERP hasn't failed at all in those cases; it hasn't even been attempted. Saying that ERP failed in these cases is like saying that *golf failed* because one of your authors bought a \$2,000 set of golf clubs and didn't break 120. Golf failed? Makes no sense.

### **THE ABCS OF IMPLEMENTATION**

Let's look at the ABCs of implementing Enterprise Resource Planning. The concept is derived from the basic ABC approach to inventory control, in turn derived from Pareto's law. In that technique, the A items are considered very significant, costly, important, etc. Hence, they deserve the most attention and the most careful planning and control. The B items are of less significance than the A items, and, hence, less time is devoted to each of them. The C items, while essential, are of least overall significance and are given proportionate attention. This ABC approach, applied to implementation, states that *Item C is the computer*, both the hardware and software. It's essential since ERP can't be done manually, but it's of lesser significance overall than the other elements. *Item B is the data*: the inventory records, the bills of material, the routings, etc. They are more significant and require more of the company's overall attention

and managerial emphasis. *Item A is the people*, the most important element in making it happen. If the people part of the implementation process is managed properly, the people will understand the objectives and how to get there. They'll take care of getting and keeping the data accurate. They won't allow the "computer tail" to wag the "company dog," as has been the case far too often. People are the key.

#### **CLASS ABCD**

At the risk of getting into what might look like alphabet soup, we need to introduce another concept based on the letters A, B, and C plus one more. Here goes. By the mid-1970s the term MRP had become a buzzword. Almost everyone, it seemed, was "doing MRP." Many companies weren't happy with their results. On the other hand, some companies were achieving spectacular results. Companies' reactions to MRP ranged from: "It hasn't helped us at all." to "It's terrific; we couldn't run the business without it." It became obvious that there were profound differences in how well companies were using this set of tools. To help focus on this issue, Oliver Wight, the leading pioneer in this field, developed the ABCD classification. Class D installations have often been viewed as "another computer failure." This strikes us as a bum rap for the computer, because the computer is the only element that's doing its job. Has the computer failed? No, it's working. Has ERP failed? Not really; it hasn't.

Class A Effectively used company-wide; generating significant improvements in customer service, productivity, and costs.

Class B Supported by top management; used by middle management to achieve measurable quality improvements.

Class C Operated primarily as better methods for ordering materials; contributing to better inventory management.

Class D Information inaccurate and poorly understood by users; providing little help in running the business.

Had a chance. What has failed? The *people* in the company. They've failed to implement and operate this set of tools successfully. Class C means a company has reduced its inventories, in some cases substantially, and probably is better able to manage engineering changes. The return on investment (ROI) for Class C typically is very good. However, the company really hasn't changed the way it runs the business. The company operating ERP at a Class B level has dramatically improved its ability to deliver the product on time to its customers, minimize shortages in the plant, avoid unplanned overtime, reduce inventories, and cope with the myriad of changes that typically confront a manufacturing organization. Class A yields all of the Class B benefits and more. The business is managed with one consistent set of numbers, from top management's sales & operations plans down through the detailed schedules for the plant floor, the suppliers, the distribution centers and, most important, the customers. Financial plans and reports are developed from the highly accurate operational numbers used to run the business on a day-to-day basis. Extensive use is made of simulation, performing what-if analyses using the ERP data base, in both units and dollars. To evaluate their performance, many companies have used the

*Oliver Wight ABCD Checklist for Operational Excellence* (Fifth edition, 2000, John Wiley & Sons, New York, NY).

This checklist is a series of questions which an organization can self-administer to determine how effectively it's using the tools of ERP, and this process results in a letter grade (A,B, C, or D) and helps to determine the path for improvement.

#### **IMPLEMENTERS AND RE-IMPLEMENTERS**

This book deals with how to implement ERP at a Class A level. Further, it applies to both first-time implementers and to *reimplementers*, companies whose first implementation resulted in Class C or D results and who now want to get the full bang for their buck. For those of you who'll be re-implementing, be of good cheer: Many companies now getting Class A results got there via reimplementation.

The steps involved in a re-implementation are virtually identical to a first-time implementation; the main difference is that some of the necessary steps may have already been accomplished satisfactorily. Many companies today need to re-implement. Some of these are companies who, as we saw earlier, thought they were implementing ERP, but actually were only installing enterprise software. Their motivations were largely software-driven: Y2K compliance, legacy systems becoming unworkable, multiple hardware platforms supporting too many operational systems, etc. The problem is that, in many cases, the new software was installed but not much else changed.

Many companies' ERP implementations in the past started out with the best intentions in the world. Company S, for example, wanted to re-engineer and improve processes, to improve the way they managed the business, and to give far better customer service to an increasingly demanding customer base. During the implementation, however, they were overwhelmed by the software. Enterprise software tends to be highly complex, and complexity can make it very difficult to install. As the implementation project took longer and longer, and cost more and more, top management became more

and more impatient. The result: a decision to forget about implementing better business processes and just get the software running. Thus, Company S has new software but is still running the business in much the same old way, and thus they need to re-implement.<sup>2</sup> If you're in this category, this book is intended for you every bit as much as for the company implementing for the first time.

## THE IMPLEMENTERS' DILEMMA

In the chapters to come, we'll talk a lot about the "Proven Path," which is the implementation approach we recommend.

The company that follows the Proven Path can be virtually assured of a successful implementation. The dilemma is that some companies may not be able to follow the Proven Path, and the reason has to do with software. Let's look at the three types of companies wanting to implement

enterprise resource planning: 2 Some call this a "second wave" implementation. The first type of company has already installed enterprise software. Now it wants to improve its business processes by implementing ERP, and thus capitalizing on the ES investment. The second category of company has not yet installed a complete set of enterprise software (although it may have installed a few modules of an ES). ERP is a higher priority than ES; thus software issues will be subordinated to the ERP initiative. This company has what we call a "clean sheet of paper" and the Proven Path applies completely. In the third case, the company has already begun installing enterprise software or is about to do so. ES is the priority. This company may not be able to simultaneously implement ERP using the Proven Path. Here's the dilemma: workload. Installing enterprise software can be an enormous task. Even with lots of people from outside consulting firms, the time requirements for the company's people are very large. Later we'll discuss in detail why implementing ERP cannot be subcontracted to outsiders. For now, take it on faith: An ERP implementation is a do-it-yourself project; it requires intimate knowledge of your business. The essence of implementing ERP is to acquire better

business processes, and these must be implemented by the people operating the business. That said, if these folks are pretty much overwhelmed with a) doing their day-to-day jobs and b) participating heavily in an ES installation, they won't have the time or mental energy necessary to do the hard work involved in implementing ERP. Thus this company *will not be able to follow the Proven Path*. They may pay it lip service. They may pretend they're following it. But they can't. They don't have the horses. We call these companies "dilemma companies" and our advice to them is simple: Don't try to implement ERP simultaneously with installing an enterprise software system if you aren't convinced that your people have the time to do it justice. Rather, we recommend that you:

- recognize the dilemma,
- complete the ES installation,
- start to make a limited number of process improvements during the ES installation, ones that won't consume large amounts of peoples' time. (One excellent process that applies here is Sales & Operations Planning, covered in Chapter 8. Another opportunity is data integrity, discussed in Chapter 10.) As you make these improvements, recognize that you are not following the Proven Path, but rather that you are doing things that are consistent with it and that will make the task easier when you begin

an ERP implementation. Then, following the ES installation, you will have ceased being a dilemma company and have migrated to the Type 1 company previously identified. You have implemented ES software, and are now in a position to initiate a Proven Path implementation of ERP. Bob Stahl, a highly successful ERP consultant based in Attleboro, MA, says it well:

The Proven Path was sound 15 years ago, before the onset of enterprise software. It's every bit as sound today. However, given today's very complex, hard-to-install software, it's more important than ever to follow the Proven Path correctly and with the right timing.

### The Implementation Challenge

#### CATCH-22

There's an apparent catch-22 involved in implementing Enterprise Resource Planning successfully. It goes like this:

*1. It's a lot of work.*

Implementing ERP as a new set of decision-making processes is a major undertaking involving many people throughout the company, including general management. In essence, the entire company must learn how to deal with demand and supply issues in a new way. The speed of information flow with enterprise software combined with ERP's new approach to all of the planning and execution systems represents a major shift in company thinking—and that means a lot of work.

*2. It's a do-it-yourself project.*

Successful implementations are done internally. In other words, virtually all of the work involved must be done by the company's own people. The responsibility can't be turned over to outsiders, such as consultants or software suppliers. That's been tried repeatedly, and hasn't worked well at all. Consultants can have a real role in providing expertise but only company people know the company well enough and have the authority to change how things are done. When implementation responsibility is de-coupled from operational responsibility, who can be legitimately accountable for results?

If results aren't forthcoming, the implementers can claim the users aren't operating it properly, while the users can say that it wasn't implemented correctly. Almost without exception, the companies who have become Class A or B and have achieved the greatest bottom line benefits are the ones where the users implemented ERP themselves. Therefore, a key principle of implementation is:

## IMPLEMENTERS = USERS

The people who implement the various tools within Enterprise Resource Planning need to be the same folks who will operate those tools after they're implemented.

### 3. *It's not priority number one.*

The problem is, the people who need to do it are already very busy with their first priority: getting customer orders, making shipments, meeting payroll, keeping the equipment operating, running the business. All other activities must be subordinate. Implementing ERP can't be priority number one, but it does need to be pegged as a high priority within the company, preferably the number two priority, right below running the business. Well, who runs the business? People do. People starting with general

managers as well as department leaders in sales, manufacturing, finance, and marketing. Virtually everyone in the company has a stake, including those who plan, produce, and sell the product at every level in the business. Throughout this book, we'll use the term General Manager to refer to the senior executive in charge of the business unit. In this context, general manager can be synonymous with President, Chief Executive Officer, or Managing Director. It is the person to whom all the major disciplines report: Sales & Marketing, Operations, Product Development, Finance. This catch-22 is one of the reasons why many companies that implement ERP never get beyond Class C. Other reasons include:

#### *It's people-intensive.*

ERP is commonly misperceived as a computer system. Not so. It's a *people* system made possible by the computer software and hardware.

#### *It requires top management leadership and participation.*

If the goal is truly to run the business better, then the general manager and staff must be deeply involved because they and they alone have the real leverage over how the business is to be managed.

Changes made at a lower level in the organization won't matter much if it's business as usual at the top. Bob Stahl says:

"I find that priority comes from a leadership who understands that ERP is tied to

their future success. It becomes part of their defined 'strategic imperatives.'" *It involves virtually every department within the company.* It's not enough for just the manufacturing or logistics or materials departments to be on board. Virtually all departments in the company must be deeply involved in implementing ERP; those mentioned, plus marketing, engineering, sales, finance, and human resources.

#### *It requires people to do their jobs differently.*

Most companies implementing ERP must undergo massive behavior change to be successful. ERP requires a new set of values. Many things must be done differently, and this kind of transformation is never easy to achieve. Many people in general management will assume that a massive software change such as an ES is sufficient to achieve major results. In fact, this system simply moves more information faster and deeper in the company. If the actual work processes don't change, then bad information moves more quickly and with dangerous momentum across the company. ERP provides the work and people process to make sense out of this rapid flow of data. Experienced users say implementing ERP is more difficult than building a new plant, introducing a new product, or entering a whole new market. Breaking through the catch-22, overcoming the people problems, making it happen—these are the challenges.

That's the bad news. The good news is there's a way to meet these challenges. There's no mystery involved. Implementing ERP successfully can be almost a sure thing—if it's done right. Yes, it is a lot of work. However, ERP has never failed to work, not once, when correctly implemented. It will work and users will realize enormous benefits. Doing it right involves two major elements:

1. An aggressive implementation schedule, focused on achieving maximum benefits in minimum time.
2. The *Proven Path*. A set of steps that, if followed, will ensure a successful implementation.

## AN AGGRESSIVE IMPLEMENTATION SCHEDULE

The question arises: "How long should it take to implement all of the functions of Enterprise Resource Planning throughout the entire company, from when we start until we're fully implemented?" First of

all, it's difficult to implement all of ERP, company wide, in less than a year. Some companies have achieved Class A status in less than 12 months, but not many. Why? Simply because so many things need to be done: massive education, data integrity, changing the way the business is run. And, all the while, it's not the number one priority. On the other hand, for an average-sized or smaller company (division, business unit), if it's taking longer than two years, it's probably not being done correctly. As a matter of fact, if a given business unit takes longer than two years to implement, the odds for achieving superior results decrease sharply. It becomes more and more difficult to maintain the intensity, the enthusiasm, the drive and dedication necessary, and thus it's harder to keep ERP pegged as a very high priority. The world is simply changing too fast. Therefore, plan on the full implementation of Enterprise Resource Planning for a given business unit to take longer than one year, but less than two. For purposes of simplicity and consistency, let's routinely refer to an 18-month implementation. Now 18 months is a fairly long time. Therefore, during that period, early successes are important, and thus we recommend that they be identified and aggressively pursued. The most important early win is typically Sales & Operations Planning and another is inventory record

accuracy. On the other hand, some people feel an 18-month time frame is too aggressive or ambitious. It's not. It's a very practical matter, and also necessary. Here's why:

*Intensity and enthusiasm.*

Because ERP will be implemented by the people running the business, their first priority *must* be running the business, which is a fulltime job in itself. Now their responsibilities for implementing ERP will require more work and more hours above and beyond running the business.

With a long, extended project, these people will inevitably become discouraged. The payoff is too far in the future. There's no light at the end of the tunnel. However, with an aggressive schedule, these people can see progress being made early on. They can expect improvement within a relatively short time. In our experience, the operating people—sales and marketing people, foremen, buyers, engineers, planners, etc.—respond favorably to tangible gains.

*Priority.*

It's quite unlikely ERP can hold the necessary high priority over three or four years. (Companies are like people; their attention spans are limited.) As the project's priority drops, so do the odds for success.

The best approach is to establish ERP as a very high priority; implement it quickly and successfully. And then capitalize on it. Build on it. Use it to help run the business better and better.

*Unplanned change.*

Unforeseen changes come in two forms: changes in people and changes in operating environment. Each type represents a threat to the ERP project. Regarding people changes, take the case of a division whose general manager is ERP-knowledgeable, enthusiastic, and leading the implementation effort. Suppose this person is suddenly promoted to the corporate office. The new general manager is an unknown entity. That person's reaction to ERP will have a major impact on the project's chances for success. He or she may not be supportive of ERP (usually because of a lack of understanding), and the entire implementation effort will be at risk. Environmental change includes factors such as a sharp increase in business ("We're too busy to work on ERP"), a sharp decrease in business ("We can't afford ERP"), competitive pressures, new governmental regulations, etc.

While such changes can certainly occur during a short project, they're much more likely to occur over a long, stretched-out time period.

*Schedule slippage.*

In a major project like implementing ERP, it's easy for schedules to slip. If the enterprise software is being installed at the same time, software installation deadlines might suggest pushing back the planning portion of ERP. Throughout this book, we'll discuss ways to minimize slippage. For now, let us just point out an interesting phenomenon: In many cases, tight, aggressive schedules are actually less

likely to slip than loose, casual, non-aggressive schedules.

*Benefits.*

Taking longer than necessary to implement defers realizing the benefits. The lost-opportunity cost of only a one-month delay can, for many companies, exceed \$100,000. A one-year delay could easily range into the millions. An aggressive implementation schedule, therefore, is very desirable. But . . . is it practical? Yes, almost always. To understand how, we need to understand the concept of the three knobs.

**The Three Knobs**

In project management, there are three primary variables: the amount of *work* to be done; the amount of *time* available (calendar time, not person-years); and the amount of *resources* available to accomplish the work. Think of these as three knobs, which can be adjusted. It's possible to hold any two of these knobs constant by varying the third. For example, let's assume the following set of conditions:

1. The workload is considered to be a constant, a given. There is a certain amount of work that simply has to be done to implement ERP.

2. The time can also be considered a constant, and, in this example, let's say it's fixed at about 18 months.

3. The variable then becomes the resource knob. By adjusting it, by providing resources at the appropriate level, the company can accomplish the necessary amount of work in the defined time. (Developing a proper cost-benefit analysis can put the resource issue into clearer focus, and we'll return to that issue. But, what if a company can't increase the resource knob? Sometimes, it's simply not possible. Maybe there's not enough money, or the organization is stretched so thin already that consuming large blocks of employee time on an implementation just isn't in the cards. Well, there's good news. Within the Proven Path, provisions are made for:

**THE PROVEN PATH**

Today there is a tested, proven way to implement Enterprise Resource Planning. Thirty or so years ago, no one could say that. Back then, people said:

It should work. We really believe it'll work. It stands a good chance of working. It certainly ought to work.

Pareto's law refers to the principle of the "vital few—trivial many." For example, in many companies, 30 to 60 percent of their sales comes from 5 to 10 percent of their products. Pareto's law is also the basis for ABC inventory analysis, and is used extensively within Total Quality Management and Lean Manufacturing/Just-In-Time. No more. There's no longer any mystery about how to implement

ERP. There is a well-defined set of steps, which guarantees a highly successful implementation in a short time frame, if followed faithfully and with dedication. These steps are called the Proven Path. If you do it right, it will work. *Period*. And you can take that to the bank.

How can we be so certain? How did this become such a sure thing? The main reason centers on some executives and managers in certain North American manufacturing companies. They had several things in common: a dissatisfaction with the status quo, a belief that better tools to manage their business could be developed, and an ample supply of courage. These early implementers led the way. Naturally, they had some help. Consultants and educators were key to developing theory and practice. Computer companies, in the early days, developed generalized software packages for material requirements planning, capacity requirements planning, and plant floor control. But, fundamentally, the users did it themselves. Over the past 35 years, thousands of companies have implemented MRP/MRP II/ERP. Many have implemented very successfully (Class A or B); even more companies less so (Class C or D). By observing a great variety of these implementation attempts and their results, it's become very clear what works and what doesn't. The methods that have proven unworkable have been discarded. The things that work have been refined, developed, and synthesized into what we call the Proven Path. Today's version of the Proven Path is an evolutionary step over the prior ones; it has been refined for ERP but it is true to the history of proven success over a quarter century.

The Proven Path isn't theory; it's not blue sky or something dreamed up over a long weekend in Colorado Springs, where the air's really thin. Rather, it's a product of the school of hard knocks—built out of sweat, scar tissue, trial and error, learning, testing, refining. Surprising? Not really. The Proven Path evolved the same way ERP did—in a pragmatic, practical, and straightforward manner. It

wasn't created in an ivory tower or a laboratory, but on the floors of our factories, in our purchasing departments, in our sales and marketing departments, and on our shipping docks.

*Faithfully* and *with dedication* are important words. They mean that this is not a pick-and-choose kind of process. They mean skip no steps. This evolution has continued, right into the twenty-first century, triggered by three factors:

1. New opportunities for improvement.
2. Common goals and processes.
3. Time pressures to make improvements quickly.

Keep in mind, when the original Proven Path was developed by Darryl Landvater in the mid-1970s, what was then called closed-loop MRP was close to being “the only game in town” for major improvements

in manufacturing companies. Quality? In the United States that was viewed as the job of the quality control department, and people like W. Edwards Deming and others had to preach the gospel of Total Quality Control in other parts of the world. Just-in-Time, and its successor, Lean Manufacturing hadn't yet hit the North American continent in any meaningful way. Other important tools like Design for Manufacturability, Activity-Based Costing, and Gain sharing, hadn't been invented yet or existed in small and relatively unpublicized pockets of excellence. Today, it's a very different world. It is no longer good enough to implement any one major initiative and then stop. Tools like Enterprise Resource Planning, Lean Manufacturing, Total Quality Management, and others are all essential. Each one alone is insufficient. Companies must do them all, and do them very well, to be competitive in the global marketplace of the 2000s. Winning companies will find themselves constantly in implementation mode, first one initiative, then another, then another. Change, improvement, implementation—these have become a way of life. As competitive pressures have increased, so has the urgency to make rapid improvement. Time frames are being compressed, necessary not only for the introduction of new products, but also for new *processes* to improve the way the business is run.

The current Proven Path reflects all three of the aforementioned factors. It is broader and more flexible. It incorporates the learning from the early years and includes new knowledge gleaned from ERP.

Further, it offers an option on timing. The original Proven Path dealt with implementation on a company-wide basis only: all products, all components, all departments, and all functions to be addressed in one major implementation project. However, as we've just seen, the current Proven Path also includes the Quick-Slice implementation route,<sup>4</sup> which can enable a company to make major improvements in a short time.

The Proven Path consists of a number of discrete steps that will be covered one at a time. We'll take a brief look at each of these steps now, and discuss them more thoroughly in subsequent chapters. The steps, are defined as follows:

- *Audit/Assessment I.*

An analysis of the company's current situation, problems, opportunities, strategies, etc. It addresses questions such as: Is Enterprise Resource Planning the best step to take now to make us more competitive? If so, what is the best way to implement: company-wide or Quick-Slice? The analysis will serve as the basis for putting together a short-term action plan to bridge the time period until the detailed project schedule is developed.

- *First-cut Education.*

A group of executives and operating managers from within the company must learn, in general terms, how Enterprise Resource Planning works; what it consists of; how it operates; and what is required to implement and use it properly.

This is necessary to affirm the direction set by audit/assessment I and to effectively prepare the vision statement and cost/benefit analysis. It's essential for another reason:

These leaders need to learn their roles in the process, because all significant change begins with leadership. A word about sequence: Can first-cut education legitimately occur before audit/assessment I? Indeed it can. Should it? Possibly, in those cases where the executive team is already in "receive mode," in other words, ready to listen. Frequently, however, those folks are still in "transmit mode," not ready to listen, and audit/assessment I can help them to work through that. Further, the information gained in audit/assessment I can be used to tailor the first-cut education to be more meaningful and more relevant to the company's problems. 4 Quick-Slice ERP will be covered later in this book.

- *Cost/Benefit Analysis.*

A process to generate a written document that spells out the costs of implementation and the benefits of operating Enterprise Resource Planning successfully, and results in a formal decision whether or not to proceed with ERP.

- *Go/No-Go Decision.*

It's possible—but not very likely—that your business may be so well managed and so far ahead of competition that the Cost/Benefit Analysis may not indicate that ERP is for you. If not, then that data will lead you to go on to other projects. However, if ERP's benefits are compelling, then the decision to go ahead needs to be made clear

and made "official" from the top of the organization. The starter's gun should sound at the moment the leader agrees with the formal recommendation to go.

- *Vision Statement.*

A written document defining the desired operational environment to be achieved with the implementation of ERP. It answers the question: What do we want this company to look like after the implementation?

- *Performance Goals.*

Agreement as to which performance categories are expected to improve and what specific levels they are expected to reach.

- *Project Organization.*

Creation of an Executive Steering Committee; an operational-level project team, consisting mainly of the managers of operating departments throughout the company; and the selection of the fulltime project leader and other people who will work full time on the project.

- *Initial Education and Training.*

Ideally 100 percent, a minimum of 80 percent, of *all* of the people in the company need to receive some education on ERP as part of the implementation process. For ERP to succeed, many things will have to change, including the way that many people do their jobs—at all levels in the company. People need to know what, why, and how these changes will affect them. People need to see the reasons why they should do their jobs differently and the benefits that will result. Remember that skipping any or all of this step results in a bigger debt later. Companies that short-change education and training almost always find that they need to double back and do it right—after seeing that the new processes aren't working properly.

- *Implementing Sales & Operations Planning.*

Sales & Operations Planning, often called "top management's handle on the business," is an essential part of ERP. In fact, it may be *the most important element* of all. ERP simply won't work well without

it. Because it involves relatively few people and does not take a long time to implement, it makes sense to start this process early in the ERP implementation and to start getting benefits from it well before the other ERP processes are in place.

- *Demand Management, Planning, and Scheduling Processes.*

Sales & Operations Planning (S&OP) balances demand and supply at the *volume* level. Issues of *mix*—specific products, customers, orders, equipment—are handled in the area of demand management,

planning, and scheduling. Involved in this step of the Proven Path are two primary elements: One is to develop and define the new approaches to be used in forecasting, customer order entry, and detailed planning and scheduling.

The other is to implement these new processes via a pilot and a cutover approach.

- *Data Integrity.*

ERP, to be successful, requires levels of data integrity far higher than most companies have ever achieved—or even considered. Inventory records, bills of material, formulas, recipes, routings, and other data need to become highly accurate, complete, and properly structured.

- *Finance and Accounting Processes—Process Definition and Implementation.*

Financial and accounting processes must be defined and implemented with the same rigor as the demand and planning processes. But there's good news here: For most companies, this step will be less demanding and go more smoothly than dealing with demand management, planning, and scheduling (facing). The reason is that the finance and accounting body of knowledge is more mature, more developed, better codified, and—most importantly—better understood by more people.

- *Software Selection, and Software Configuration Installation.*

Companies that have already implemented an ES will find this step to be relatively painless. There may be some additional “bolt-on” software to acquire, but typically, these are not major stumbling blocks. For companies doing a combined ERP/ES implementation, these software steps are, of course, major and must be managed very carefully to avoid having “the computer tail wag the company dog.”

- *Audit/Assessment II.*

A focused evaluation of the company’s situation, problems, opportunities, and strategies following the implementation. It is the driver via which the company moves into its next improvement initiative.

- *Ongoing Education.*

Initial education for new people coming into the company and refresher education for continuing employees. This is necessary so that ERP can continue to be operated very well, and made even better as the company continuously improves further in every other area. Those companies that maintain Class A status beyond the first two years are those that have solid ongoing education programs.

### **WHY THE PROVEN PATH IS PROVEN**

There are three main reasons why the Proven Path is so effective. The first is its tight alignment with the ABC’s of ERP—people, data, computer. It mirrors those priorities, reflecting the intensive need for education to address the people issue. The second reason also concerns alignment with the logical construct of Enterprise Resource Planning. The Proven Path methodology is in sync with ERP’s structure. Third, the Proven Path is based completely on demonstrated results. One more time: It is a lot of work but virtually no risk. If a company follows the Proven Path faithfully, sincerely, and vigorously, it

will become Class A—and it won’t take forever. “Oh, really,” you might be thinking, “how can you be so certain? What about all the ‘ERP failures’ I’ve heard about? You yourselves said just a few pages ago there were more Class C and D users than Class A and B. That indicates that our odds for high success are less than 50 percent.” Our response: It’s up to you. If you want to have the odds for Class A or B less than 50 percent, you have that choice. On the other hand, if you want the odds for success to be near 100 percent, you can do so. Here’s why. The total population of Class C and D users includes

virtually zero companies who followed the Proven Path closely and faithfully. Most of them are companies who felt that ERP was a computer deal to order parts and help close the books faster, and that’s what they wound up with. Others in this category tried to do it without educating their people and/or without getting their data accurate. Others got diverted by software issues. Or politics, here’s the bottom line: Of the companies who’ve implemented via the Proven Path, who’ve sincerely and rigorously gone at it the right way, virtually all of them have achieved a Class A or high Class B level of success with ERP. And they’ve realized enormous benefits as a result. There are no sure things in life. Achieving superior results with ERP, from following the Proven Path, is about as close as it gets.

### **Company-Wide Implementation—Overview**

For now, let’s look at how to implement ERP on a company-wide basis. To get started, consider the following: It’s possible to swallow an elephant . . . one chunk at a time. Be aggressive. Make deliberate haste. Implement in about 18 months or less. Those two concepts may sound contradictory, but they’re not. There’s a way to “swallow the elephant one chunk at a time” and still

get there in a reasonable time frame. Here’s the strategy:

1. Divide the total ERP implementation project into several major phases to be done *serially*—one after another.

2. Within each phase, accomplish a variety of individual tasks *simultaneously*.

For almost any company, implementing all of ERP is simply too much to handle at one time. The sum of the chunks is too much to digest all together. That’s one reason for the multiphase approach. Further, in many cases, activities in the subsequent phase are dependent on the prior phase being completed. The use of simultaneous tasks within each phase is based on the need for an aggressive implementation cycle of typically one year to 18 months for a business unit of average size. Doing each of the many tasks involved serially would simply take too long. For the time being, let’s assume a three-phase project. Let’s examine what’s to be done in each of the three phases:

#### *Phase I—Basic ERP:*

This includes Sales & Operations Planning, demand management, Rough-Cut Capacity Planning, master scheduling, Material Requirements Planning, plant scheduling where practical, and necessary applications for finance and accounting. Also included here are the support functions of inventory accuracy, bill of material accuracy and structure, plus activating the feedback loops from the plant floor and purchasing. Basic ERP is not all of Enterprise Resource Planning. Of and by itself, it will produce substantial results; however, key elements remain to be implemented. This phase normally takes about nine to twelve months to complete.

#### *Phase II—Supply Chain Integration:*

Included here are the processes that extend ERP both backward and forward into the supply chain: backward to the suppliers’ via techniques such as supplier scheduling and Internet-based business to-



business e-commerce; forward toward the customers via distribution requirements planning and vendor managed inventories (VMI).<sup>1</sup> This phase usually requires three to six months, possibly more depending on the scope and intensity of the applications. Many people use the term VMI to refer to linking with their suppliers and refer to customer linking as Continuous Replenishment (CR). With either term, the processes are the same.

#### *Phase III—Extensions and Enhancements to Support Corporate*

##### *Strategy:*

This phase covers the extension of ERP software capabilities further throughout the total organization. It can include completion of any finance and accounting elements not yet implemented, linkages to other business units within the global organization, HR applications, maintenance, product development, and so on. Also included here may be enhancements that were identified earlier as desirable but not absolutely necessary for phases I or II to become operational. This could include full simulation capabilities, advanced planning systems (APS), manufacturing execution systems (MES), enhanced customer order entry processes, development of a supplier rating system, and so forth.

Time required for phase III could range from several months to more than a year, reflecting the fact that this phase is less defined and more “free form” than the prior two phases. In fact, there’s a progression here: phase I is somewhat more structured than phase II, and phase II more so than phase III.

Let’s consider elapsed time for a moment. From the above, we can see that phase I (Basic ERP) begins at time zero and continues through months 9 to 12, phase II (Supply Chain Integration) through months 12 to 18, and phase III (Extensions and Enhancements) through about months 18 to 30.

This says that the total project’s time can range from a bit more than a year up to between two and three years. Why the broad time span? It’s mainly a function of several things; one factor is the size and complexity of the organization, another of course, is the resources, and perhaps the most important element is the scope of the overall project, that is, how extensively the supply chain tools are to be deployed and how far extensions and enhancements will be pursued. Here’s the critical point regarding timing: Implementing Basic ERP successfully (the phase I task) will generate enormous benefits for the company. And, *if you do it right*, you can get it done in nine to twelve months. Part of *doing it right* is to avoid “scope creep,” i.e., laying non-critical tasks into phase I. It’s necessary here to adopt a hard-nosed attitude that says: “We’re not going to tackle anything in phase I that’s not necessary for Basic ERP. When we come across ‘nice-to’s’ (opportunities that aren’t essential for Basic ERP), we’ll slot them into phase II or III. All we’ll work on during phase I are the ‘have-to’s’—stuff that’s essential for Basic ERP.” On occasion, people question the location of time zero—the day the clock starts ticking. Should it follow the early and preliminary steps, as shown on the phase I bar chart? Or should it be at the very beginning of audit/assessment I? We prefer it where it is, because that facilitates the consensus building, which is so important. Some companies move through these early steps quickly, so for them the precise location of time zero is not terribly important. Other companies, however, find they need more time for these early activities than the several months implied by the chart. The principles to be considered are:

1. Take as much time as needed to learn about ERP, and build a consensus among the management team. Set the vision statement and the performance goals. Do the cost/benefit analysis. Make sure this is the direction the company wants to go. Then commit to the project.

2. Once the decision is made to go for it, pursue it aggressively. Occasionally, people have questions on the functional content of each of the three phases, such as: “Why isn’t supplier scheduling in phase I? Can we move MRP to phase II and Sales & Operations Planning to phase III?” The timing of this implementation plan is structured to get the basic ERP planning tools in place early. For example, companies that implement advanced supplier scheduling—possibly via the Internet—before material requirements planning, may save a few bucks on reduced paperwork and get a better handle on order status, but probably not much else. This is because most companies, prior to successful ERP, can’t give their suppliers good schedules. The reason is their current systems can’t generate *and maintain* valid order due dates as conditions change. (These companies schedule their suppliers via the shortage list, which is almost always wrong, contradictory, and/or incomplete.)

The biggest benefit from effective supplier scheduling comes from its ability to give the suppliers valid and complete schedules—statements of what’s really needed and when. It simply can’t do that without valid order due dates, which come from Material Requirements Planning (MRP).

Further, material requirements planning can’t do its job without a valid master schedule, which must be in balance with the sales & operations plan. That’s why these functions are in phase I, and certain “downstream” functions are in phase II.

#### **SCHEDULE BY FUNCTION, NOT SOFTWAREMODULES**

Business functions and software modules are not the same. A business function is just that—something that needs to be done to run the business effectively. Examples include planning for future capacity needs; maintaining accurate inventory records, bills of material, and routings; customer order entry and delivery promising; and so on. Software modules are pieces of computer software that support people in the effective execution of business functions. Frequently we see companies involved in an ERP implementation scheduling their project around tasks like:

“Implement the SOE (Sales Order Entry) module,” “Implement the ITP (Inventory Transaction Processing) module,” or “Implement the PDC (Product Data Control) module.” This is a misguided approach for two reasons: sequence and message.

Companies that build their project plan around implementing software modules often do so based on their software vendor’s recommendation. This sequence may or may not be the best one to follow. In some cases, it merely slows down the project, which is serious enough. In others, it can greatly reduce the odds for success. One such plan recommended the company first install the MRP module, then the plant floor control module, then the master scheduling module. Well, that’s backward. MRP can’t work properly without the master schedule, and plant floor control can’t work properly without MRP working properly. To follow such a plan would have not only slowed down the project but also would have substantially decreased the odds for success. The second problem concerns the message that’s sent out when the implementation effort is focused on software modules. Concentrating on implementing software modules sends exactly the wrong message to the people in the company. The primary emphasis is on the wrong thing—the computer. ERP is *not* a computer system; it’s a *people* system made possible by the computer. Implementing it is not a computer project or a systems project; it’s a *management* project. The people in the company are changing the way they manage the business, so that they can manage it better than they ever could before. Keep those ABC’s of implementation firmly in mind: the C item is the computer; the B item is the data; the A item is the people.

#### **CUT THE CLOTH TO FIT THE PATTERN**

ERP is a generalized set of tools that applies to any manufacturing company. Part of the A-item implementation task is to help people break through the “we’re-unique” syndrome that we talked about

earlier. When people recognize that there is a well-defined, universally applicable body of knowledge in this field, they’ll be able to use it to solve fundamental problems. On the other hand, ERP is a set of tools that must be tailored to fit individual companies. The implementation project must also reflect the individual company, its environment, its people, its processes, its history, and so on. Here are some examples of special situations that can affect the specifics of implementation:

##### *Flow shops.*

Flow shop is the term we give companies with manufacturing methods that can be described as purely process (chemicals, food, plastics, etc.) or as highly repetitive (tin cans, automobiles, razor blades, etc.). The overall concept of ERP definitely applies to these kinds of manufacturing environments. However, each and every function within ERP may not be necessary. One good example is shop floor dispatching on an operation-by-operation basis, which is typically needed only in a functional, job-shop form of organization.<sup>2</sup> The technique known as detailed Capacity Requirements Planning (CRP) is another. In most flow shops, all of the necessary capacity For an explanation of the job shop/flow shop differences, see Appendix B. planning can be done at the rough-cut level. Simple output tracking can be used instead of the more complex input-output control. A company in this situation, not needing detailed shop dispatching and CRP, should exclude them from its implementation plan. Simple plant schedules (plant sequence lists, not shop dispatch lists) can usually be generated directly from the master schedule or Material Requirements Planning as a part of phase 1. And that’s good news. It’ll be easier and quicker to get to Class A.

##### *Financials already integrated.*

Some companies, prior to implementing ERP, already use operational data to drive much of their financial reporting. Numbers from the operating system are converted to dollars for certain financial planning and control purposes; product costing and inventory valuation are two functions often already integrated. At a minimum, of course, the current degree of financial integration must be implemented as part of phase I, not phase III.

Companies with high degrees of financial integration, prior to ERP, are often seen in the process world (i.e., flow shops). For many of these companies, virtually all of their financial system implementation will occur in phase 1.

##### *Re-implementers.*

Some companies have already attempted to implement ERP, but it’s not working properly. They have some or all of the pieces in place, yet they’re not getting the results they should. Now they need to *reimplement*, but this time to do it right. Darryl Landvater said it well: “The jobs involved in *improving* an (ERP) system are the same as

those in implementing it correctly.” As we said earlier, the difference is that, for re-implementers, some of the tasks may already be done. That’s perhaps the good news. However, in a re-implementation, there’s one big issue that makes it tougher: how to convince all the people that it’ll work the second time around<sup>3</sup> when it didn’t work 3 Or third possibly? We’ve talked to people whose companies were in their third or fourth implementation. This gets really tough. The best number of times to implement ERP is once. Do it right the first time. well after the first try. This will put more pressure on the education process, which we’ll discuss later, and on top management’s actions. Words alone won’t do it. Their feet and their mouths must be moving in the same direction.

##### *ES/No ERP.*

Here are the many companies that have installed Enterprise Software but not done much about improving business processes. In most respects, they’re quite similar to re-implementers: Some of the implementation tasks have been done—mostly software-related—so those steps can largely be dropped from their plans.

### *Multiplant.*

How about a company or division with more than one plant? How should it approach implementation? Broadly, there are three choices: serial, simultaneous, or staggered. Take the case of the Jones Company, with four plants. Each plant employs hundreds of people, and has a reasonably complete support staff. The company wants to implement ERP in all four plants. The *serial* approach to implementation calls for implementing completely in a given plant, then starting in the second plant and implementing completely there, and so forth.

#### **Serial Approach**

This approach looks good because the entire project is finished in 15 months. However, there may be some problems. One would be availability of centralized resources such as Information Systems, overall project management, and so forth. It may be impractical to support all four plants simultaneously.

Another potential problem gets back to the catch-22 of ERP. Implementing ERP is not the first priority. Some companies may wisely conclude that implementing simultaneously in all plants could be more than they want to bite off at one time. The effort and intensity required may be more than desired.

This approach has several advantages

1. ERP gets implemented throughout the entire company fairly quickly (in this case, in slightly over two years for four plants).
2. The impact on centralized resources is lessened.
3. Only one plant is piloting and cutting over onto master scheduling (MS) and Material Requirements Planning (MRP) at a time, so the overall level of effort and intensity is reduced.
4. Plant personnel can teach each other. For example, users from plant 2 may participate in the pilot and cutover at plant 1. In so doing, they can learn from the first plant's mistakes and avoid them. Plant 3 people can learn and help at plant 2, and so on.

One company we worked with brought all nine of its plants from time zero to Class A in less than three years. This was a very complex implementation, and the staggered method served them very well.

Please note: Even though their implementation was staggered, Sales & Operations Planning was implemented *across the board* and was done early. The reasons:

1. S&OP only really works well when it operates across the entire business unit.
2. Implementing S&OP does not typically involve major resources.
3. In a combined ERP/ES implementation, S&OP can be implemented independently of software considerations. It doesn't need to "wait for the software."
4. It's an early win.

We recommend you follow this company's example, and implement S&OP across the board—early.

### *Multiple business units.*

Many organizations have more than one business unit. These could be corporations with multiple divisions, or perhaps divisions containing more than one business. The Acme Widget company, for example, is a stand-alone corporation with three divisions: industrial, consumer, and aerospace and defense. Each division is self-contained and has its own plant. If centralized, corporate resources will be involved in the ERP implementation, then Acme should follow the approach outlined above in the multiplant section. On the other hand, if Acme's divisions are highly self-contained with ample resources, then there may be no need for Corporate to force fit the divisions into a centralized implementation schedule. They may feel more accountability, and implement faster, if they're calling the shots on their schedule. Obviously, it doesn't matter if Acme Widget were a stand-alone corporation or, alternatively, part of a larger corporation. The approach we've outlined here would apply in either case.

### *Necessary nonstandard functions.*

Here, we're referring to functions necessary to run the business, but which are peculiar to a given company or industry. Some examples are:

1. The pharmaceutical industry, among many others, requires lot traceability and lot number inventory control.
2. Firms supplying the U.S. Department of Defense must adhere to special contract accounting requirements.
3. Product shelf life is a major issue in many companies producing consumer packaged goods.

There are many other examples. The message here is obvious: Look very closely at the company, its industry and marketplace, its position within them, and its overall strategy. Don't make the serious error of assuming that if a given function isn't in the software package, it's not needed for your company. The new software may need to be modified to support the function in question, ideally enabling it to be done even better. Perhaps the software will need modification merely to allow the function to be done as before. Or perhaps no software changes will be necessary for a given

function. It's important for companies to do their homework on such issues. They need to ask: "What special things are we doing today that we'll continue to do in the future after ERP is operational? Are they essential? If so, will they be handled within ERP or not? If not, how will we do them?" Part of getting a better set of tools to run the business is to make certain that all of the necessary tools are in place.

#### **TIMEWASTERS**

Nowhere on the Proven Path does one see things like:

- Document the current system in detail.
- Design the new system.

That's because these things are time wasters when done as separate activities. Yes, it is necessary to identify those elements of today's operations that need to be blended into ERP. What's *not* necessary is to spend time doing a detailed documentation of the current system, with piles of paper and flow charts covering many square yards of wall space. After all, the current system is going to be replaced.

And, yes, it's necessary to ensure that the details of how ERP will be operated support the company's goals, operating environment, and necessary functions. What's *not* necessary is to spend time reinventing the wheel. The set of tools is already designed; it's called ERP. The issue is how, specifically and in detail, will the tools of ERP be used to run the business? The Proven Path approach makes provisions for these things, to occur not as separate steps, but as part of an integrated, logical process of managing the implementation of ERP.

#### **Software**

Back in Chapter 1, we talked about how software for ERP is like a set of golf clubs. We said that owning a fine set of clubs does not by itself make a good golfer. On the other hand, playing golf at a worldclass, competitive level requires a full set of clubs, even if your name happens to be Tiger Woods. The same is true for companies: Owning good software and by itself won't make you more competitive, but to be competitive requires a reasonably complete set of software. The emergence of Enterprise Software over the past ten years has revolutionized not just how computers are used but the very way companies think. In the past, a typical company would design its own software for individual operations or would purchase "off the shelf" software for specific tasks. This led to a complex mix of nonmatching systems that rarely communicated well and led to extensive maintenance of systems. Companies had large IS (information systems) or IT (information technology) organizations that wrote software, provided the linkages to purchased systems, and maintained the system. Because these software experts were often located inside individual business units, it sometimes happened that different units could not communicate with each other except through written reports. The development of the Enterprise Software systems offered the clear advantage of connecting every transaction in the company to a central database that could be accessed by the appropriate corporate systems.

Unloading a truckload of chemicals in any part of the company became a corporate piece of data, not just an isolated act to be observed only locally. This also means that the company financial books can be adjusted for the cost of this transaction immediately. There is no delay for passing data from point to point or clerk to clerk. This is good stuff; it offers enormous benefits. What has happened here is that companies are moving from a wide variety of relatively simple systems but with complex interfaces, to a single complex system with simple interfaces. This clear choice offers major benefits to the corporation but is seen as painful by each unit of the company. For most, this is the proper trade-off. However, the choice does have a major impact. We said in Chapter 1 that this is not a software book. Then why include this chapter on software? Simply because every manufacturing company needs ERP and there are big decisions to be made about software interactions. A company implementing ERP will be in one of three categories regarding software: The Enterprise System software (ES) has already been installed. Now the company wants to improve its business processes by implementing ERP. The company plans to install an ES simultaneously with implementing ERP. The company has no ES and presently has no plans to install one. It wants to implement ERP, perhaps using a legacy system or possibly by acquiring low-cost software to support the core ERP functions of demand management, master scheduling, Material Requirements Planning, and so on. We'll look at each one of these conditions individually and then, towards the end of this chapter, we'll discuss the issue of "bolt-ons." This is software from outside the ES, which performs certain specific functions.

**CATEGORY 1: ES ALREADY INSTALLED** The typical company in this category has, with substantial pain and expense, installed an Enterprise System and not gotten much back in return for its efforts. The ES enabled it to become Y2K compliant and it can close the books better, faster and cheaper than before—but that may be about it in terms of benefits. Many companies think they are ES capable simply because they survived Y2K. Of course, they may have only installed some of the ES modules and may be limping along with mediocre results. The people are a bit bummed and a bit burned out; they spent endless hours sitting in meetings and in training session but they find that things haven't gotten any easier. The good news is that having the software already installed certainly makes life easier in some important respects. First, can pretty much be dropped. The bulk of the software has already been selected, with the possible exception of one or several bolt-ons. Second, the software installation and enhancement step on the Proven Path should be straightforward. Most of the work here will involve nothing more than re-setting some of the switches in the ES, to enable the core ERP functions to operate correctly. During this step, it's important to involve people with a good knowledge of the ES in order to help identify and facilitate this process of "tweaking" the system. A caveat: This requires real expertise and great care. Remember that the linkages in ES are so extensive that even a minor change involving a few switches can have far-reaching effects. In Chapter 7, which deals with education, we'll discuss a

process involving a series of business meetings; these can be an important forum for identifying necessary changes to the ES configuration. One last point: Companies that have already installed an ES are strong candidates for a Quick-Slice ERP implementation..

#### **CATEGORY 2: INSTALLING ES SIMULTANEOUSLY WITH ERP**

Frequently companies in this category do so because of an interest in ERP. They want to do ERP; they know they need software to do that, so they go out and buy an ES. Unfortunately, companies attempting this almost always get overwhelmed by the complexity and magnitude of the software. The result: The software gets installed but the ERP business processes are not implemented well or at all; the company is at a Class D level or maybe Class C if they got lucky. The sad fact is that very few companies have successfully implemented both ERP and an ES at the same time. It's just too big a job. Therefore, we offer the following warning:

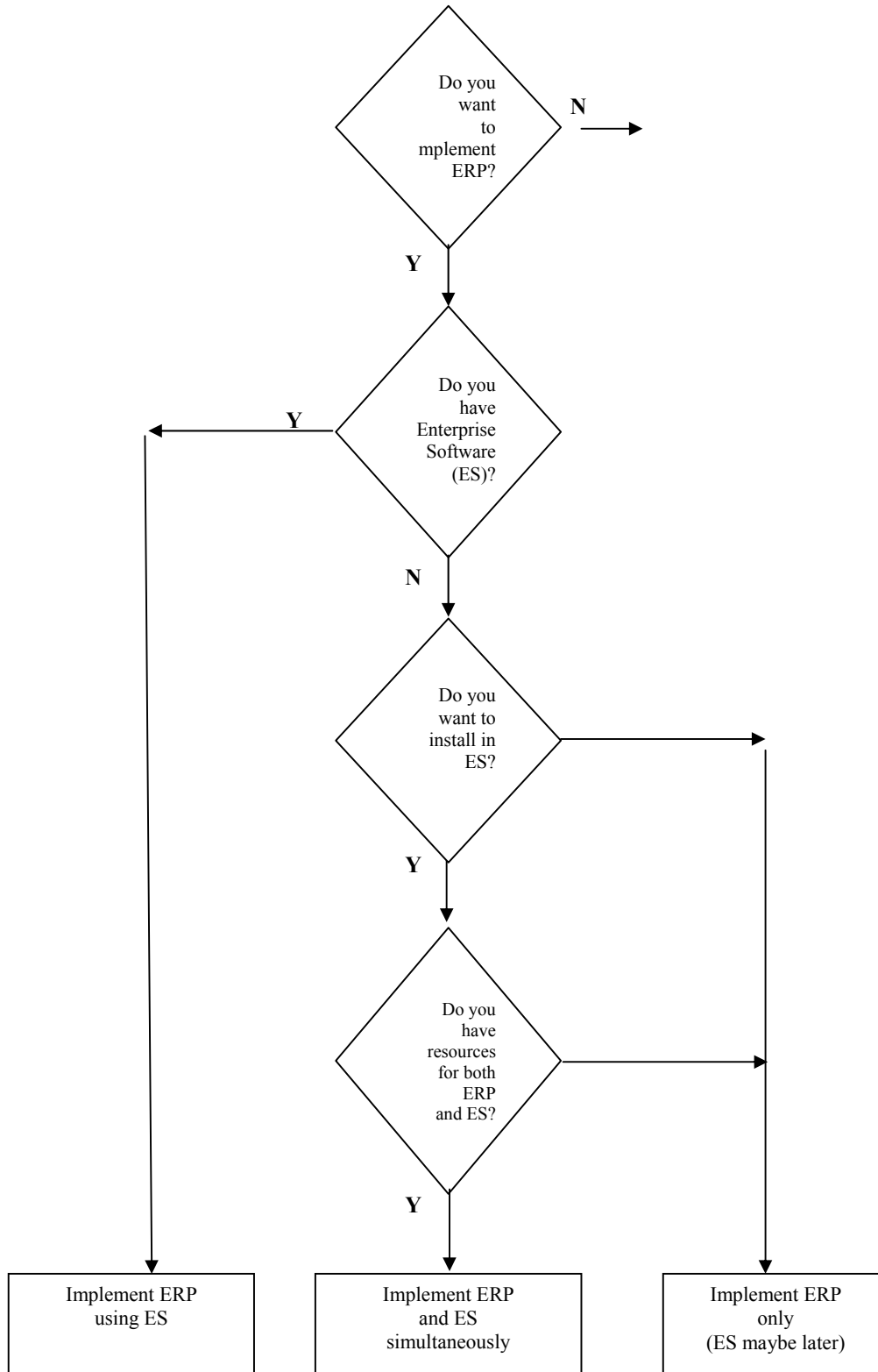
**Before you attempt a combined ERP/ES implementation, evaluate your resources very carefully. Make certain that you are one of the few companies that have enough resources and organizational bandwidth to get the job done successfully. If you conclude otherwise, then your best route is probably to implement ERP first and then ES.**

If you decide that you can succeed with a combined ERP/ES implementation, then the section that follows applies to you. (It may also be of interest to companies that decide to install their ES prior to ERP.) An excellent source of information on installing ES software is the book we mentioned in the first chapter: *Mission Critical* i by Thomas H. Davenport. When installing an Enterprise System, you'll need all the good information you can get. Let's be clear on the ERP/ES implementation concept. It is clearly the most efficient way to handle these two major changes. However, very few companies can provide the resources to pull it off. The resource drain is huge and hiring armies of outsiders to help is not the answer. Most who have tried to do both have stopped in mid-project and done one or the other. Typically, the nature of the ES installation requires that the company finish ES and then get back to ERP later. Danger lurks among the rewards! Threatening? You bet.

#### **CATEGORY 3: NO ES AND NO PLANS TO GET ONE**

The typical company here has neither ERP nor an Enterprise Software system. It wants to implement ERP but is not interested in going through the blood, sweat, tears, and expense of an ES installation. Regarding software for its ERP implementation, it either has it or it doesn't. (Hard to argue with that, right?)

## Implementing ERP



In the first case, “having it” usually means that it has an older, pre-ES set of software for MRP II. Perhaps the company took an earlier stab at implementing the resource planning processes—master scheduling, MRP, Plant and Supplier Scheduling, etc.—but didn’t succeed. Or possibly it never attempted to do so. In either case, it has software. Now the people might not like it; they might be saying things like, “Our software stinks.” But the odds are quite high that it’ll be good enough to enable the basic ERP processes to work. The moral of this story: use what you have if it’s workable. An excellent resource here is the MRP II Standard System, which details the features and functions that software must contain to support effective resource planning processes. As of this writing, this document is available via the Gray Research web site listed in Appendix D. The second case states that the company doesn’t have software to support ERP. Perhaps its legacy systems are home grown, and they contain logic that simply won’t work in an ERP environment. In this case, we recommend you buy one of the many low-cost PC-based ERP/MRP II packages that are available today. You can probably get everything you need for less than \$100,000. And most of it is quite good—fairly complete functionally and very user friendly. Since the price is relatively low, you can buy it and use it for a year or so, and then if need be, replace it with a full-blown set of ES software if you wish to head in that direction. Please keep in mind that this ERP/ MRP II software is not an ES; it won’t be truly stand-alone software; and it will in effect be “bolted-on” to your existing software.

### **ENTERPRISE SOFTWARE**

Now that we have talked about the choices, it is time to discuss a bit more about Enterprise Software. We’ll take you through our thoughts on ES in four steps: *Selection, Configuration and Enhancement, Installation, and Ongoing Support*. The *Selection* step is the beginning of the project when the company must decide which software company will best handle the information transactions for its business. *Configuration and enhancement* are handled by design teams. These are the internal teams that make sure that the right switches are thrown for each decision process and identify needed enhancements and extensions. *Installation* is probably the most obvious step since whatever is chosen must be put in place. The opportunities and challenges are in maximizing learning during implementation and minimizing crashes. *Ongoing support* refers to the maintenance and improvement of the system after start-up. Those who have looked at the ES initiative as a one-time project with no follow-up care and feeding have been very disappointed.

#### **Software Selection**

There are lots of software choices available. The key point here is that there is not a single right software choice. There are good choices and not so good choices for your business. OK, how to proceed? First, understand your business and the opportunities for change. Yeah, this sounds insulting. Of course, you know your business. But do you know where the real weaknesses are in the business? Are you having trouble with delivery timeliness and accuracy for your customers? Are cost projections erratic and unreliable? Do customer orders “get lost” inside the system, requiring massive human intervention? Does the supplier interaction become so complex that the supply chain resembles a pretzel? Are human resource systems clogged with massive data that cannot be assessed to answer basic employee demographic questions? Understanding these and other questions will tell you what areas are of most importance to you in choosing a software provider. Each of these questions impacts a different software module and each software provider offers different approaches to those areas. Without this knowledge of the company’s strategic and tactical needs, you’re subjected to sales presentations by the software vendors without knowing which areas of the pitch are most important. You need to know that the vendor you choose has solid offerings in the areas where you have the most need. A good question to ask is this: “If we have software from this provider, can we make a competitive breakthrough?” This question and its answer will typically point you to the ERP related modules that deal with demand management, master scheduling, MRP, plant and supplier scheduling, warehouse management, etc. Also, you need to consider which vendor’s approach best matches your present environment. Invite them to an extensive tour of your operations and provide a candid appraisal of your business needs. If the software provider seems to have software organized most like your current systems, then they win this part of the sweepstakes for your vote. This would include the possibility that one part of your company has already installed systems from a specific provider. If this unit has a good experience with the software, you are part way home in having a real live test in full operation. A key deciding point for any software, particularly ES, is simplicity. Standardizing on one approach across the company is the big hitter here and not the sophistication of the software. Remember that people are going to use and maintain the software, so make sure that system is as simple as possible. Don’t confuse features with functions and don’t assume that more features means easier implementation.

Actually it’s usually the reverse: More features equal more complexity, and more complexity equals more chance for problems. One of the advantages of installing an ES today versus ten years ago is that there are many companies in all parts of the world who have installed Enterprise Systems—some are actually using ERP at a Class A or B level. Each vendor should be able to arrange a meeting with some of their customers so you can learn from their experiences. If they can’t provide references, drop them immediately. Check the business press for articles about failed installations—these always make the press since the business impact is similar to a plane crash. A few calls can get you information about the provider from these troubled installations as well as those being bragged about. There are several excellent sources for information about ES software vendors. You may have others, and certainly there are numerous consultants who can help you locate likely candidates.

#### **Configuration and Enhancement**

Following the selection of the software vendor, it is time to install the software. Right? Well, not exactly. The software will be excellent but it now must be adapted to your operations. Remember, Enterprise Software connects every facet of the company in such a way that every transaction becomes an available piece of data for the corporation. The software is not “one size fits all” but rather “one system adaptable to your business.” Chris Gray says: “ES systems are flexible in the same way that concrete is flexible when it is poured. However once it hardens, it takes a jack hammer to change it.” Typically, for convenience in programming and use, the software will be in a number of modules that focus on particular parts of the company. Although there is variation among the providers, there will be seven to ten modules with titles like Finance and Accounting, Master Scheduling, Human Resources, Warehouse Management, and so on. Each of these must be tailored to your particular operations and business needs. Most of this tailoring will involve setting switches to control data flow and processing steps. However, in some cases, enhancements to the software package are necessary in order to support critical business functions. (We’ll go into more detail on enhancements later in this chapter because what we have to say applies to both ES and to bolt-ons.) Each module should have an assigned ES design team that reflects the company functions most involved in that area. These groups are different from the ERP project team and task forces. In a combine ERP/ES implementation, one of the challenges is keeping the ES design teams aligned with the ERP teams, and one of the best ways to accomplish this is with some degree of common membership. One or several members of a given ES design team are assigned to the related ERP organization and vice versa. The big difference between an ERP team and an ES team is that the *ERP team focuses primarily on people and data integrity while the ES team focuses primarily on the software and hardware*. However, both are involved in re-designing business processes, and thus it’s critical that these processes be a joint effort. So what do the ES design teams do? Well, think of the data flow in the company as hundreds or thousands of trains moving along myriad of tracks toward one station—the central database. You must decide if those trains only go to the final station or if the data can be switched to a different track along the way, in order to serve a particular function. Also, once the train arrives at the station, the passengers or freight can be re-routed to other destinations. Deciding where all these switches should be located and where the data should go is the job of the design team, and it’s a major task requiring knowledgeable people. Choosing the design team is a delicate but essential task. For some individuals, their expertise will be critical to the design full time, for at least six to eighteen months. Others could be part timers called into meetings to provide their knowledge regarding specific questions. However, plan to err on the side of greater rather than lesser involvement, as this is very important work. Most units inside the company will resist putting their top people on teams like this. It seems to be too far removed from “real work” and good people are always scarce. Also, they may have become accustomed to having their software custom-written for them, so they will assume that they can rewrite whatever comes from the team later. This obviously is an erroneous assumption, but they won’t know that unless they’re told. We recommend that the CEO/president/ general manager take charge of this debate early in the process and let everyone know that the work will be done only once, via the ES design teams. Individual business units will no longer be able to develop software—except as part of the design teams. A key requirement for membership on these teams is that all individuals must be able to make decisions for their organizations. They can’t simply report back to their business units and ask, “Mother, may I?” on each decision that needs to be made. If you don’t think that a unit is providing sufficiently senior and skillful people, one technique is simply to ask the business unit leader if this individual can speak for the organization on issues important to the leader’s promotion. Obviously, team members must work out a way to keep in touch with their home units and get appropriate advice and counsel, but they must be able to represent that unit completely and make decisions on its behalf. Of course, this raises the question about how big a team should be. Our response: It depends. The smaller the team the better, but teams have run successfully with up to 20 people. Obviously, the larger the team, the tougher the role for its leader. However, we have seen small teams struggle if the purpose and intent is not clear and leadership from the top is missing. What about the leader? Teams for some of the software modules will have a leader from the IT area, as that is clearly the key business function for corporate software. In other cases, it can be effective to recruit the leader from the key function. For example, someone from sales could be very effective in leading the design team for the Demand Management module. The function in question—Sales, in our example—will have very clear ownership of the design result so it makes sense to put them in charge of the work. At this point, some of you may have a growing concern about the number of people who will need to be committed to the design teams. This is very perceptive. This work is substantial, critical, and time consuming. In an ERP/ES implementation, if you find that your company can’t staff all the design teams necessary, then you have two choices:

1. Combine ES design teams with ERP project groups, thus minimizing the head count required, or
2. Decide to go to an ES only project now, with ERP to follow. Let’s consider an ES installation without ERP, but with the inability to staff all the necessary design teams. Your best choice here is to decide how many teams you can staff and do a multi-phase project.

Choose the most important two or three modules and set up teams for them alone. The rest of the modules will have to arrive later. It’s far better to do a small number of modules well than a halfhearted job on all. Software consultants can help with this process, but they simple can’t replace your own knowledgeable people who understand the company so deeply. In fact, there is a danger that consultants can cause a bigger time demand on your people because they do interviews across the company to learn your business. A good middle-of-the-road option would be to have a few



software consultants involved who can help facilitate the team decision process without having to be complete experts in your operation.

### **Installation**

Now, let's consider the task of installing the software. Much of the really heavy-duty work is completed as the design phase has shaped the nature of data flow in the company. Now it's time to start to run the software, and this is normally a rather intense activity. So here are some hard and fast recommendations from your friendly authors about this installation process:

*Be flexible.* If the installation is a rigid process to install exactly what the design teams specified, then there may be considerable difficulty. It may not work, because the collective effort of the ES design teams may not be compatible. This incompatibility could exist among the ES design teams, or with the ERP project team. However, if you take the problems that arise as true learning opportunities, then the software configuration can be modified as you go, both to fit your business requirements and to work well. Thus, the seeds are sewn for continued growth and learning in the future.

*Pilot the software before going live.* An early step here should be to make pilot runs of the software using a typical business unit as a model. These computer and conference room pilots will go a long way to verify that the design teams' designs are working properly, and we'll cover them in more detail in Chapter 11. Although these pilot tests cannot confirm everything, don't even think of going forward without them. Every pilot like this that we've seen has turned up major adjustments that need to be made before going live. At this early stage, the software can be readily changed without business results at risk.

*Make deliberate haste.* Never, ever try to start up the ES across the entire company at one time. Even if the pilot gave everyone great enthusiasm and confidence, do not risk the entire business by cutting over all at once. This so-called "Big Bang" approach could describe the sound made by your business imploding. The best way to install the system is to choose a part of the business as the live pilot because this represents substantially lower risk than doing it all at once. You need an aggressive schedule to keep momentum on the project as a whole, but you need to protect your business at the same time. It is key to develop some early wins that build enthusiasm. But, in any case, get moving! More on this topic as well in Chapter 11. Some companies attempt to minimize the risk by turning on only one or two modules across the entire company. We don't think this is the way to go, because the total risk can be very high if even just one module is installed across the entire corporation. For example, installing only the Warehouse or Distribution module for the corporation may seem like low risk. After all, it's just one module and the full design team can support it. The problem is that errors in the setting of the switches could stop the company from shipping—possibly for an extended time. It goes without saying that this could be devastating. The business press has reported on companies that did this, found themselves unable to ship the product, alienated many customers, and took a major earning hit for the quarter and possibly the fiscal year. Wow. The pilot test risk is reduced by several important factors. One is that it is only a piece of the business, and the second is that you put

all resources available against the test area. The people in the pilot area may like being guinea pigs, since they get a chance to shape the corporate software to their specifications. Also, there will be a lot more help available for the test installation than there will be later. The pilot test unit should have been involved in the conference room pilot and their people will be among the most knowledgeable in the company. Even a very risk-averse general manager should understand the value of leading the test. After the pilot is up and running, the rest of the company rollout of the ES can proceed as with any other project. Some will want to move with consecutive business units, others may do a geographic region, and still others may install by function. There is no magic answer except to understand what was learned from the pilot and apply that learning to the rollout. As is true of any big project, it's always smart to avoid too big a rollout at the busiest time of the year.

What about the design teams? The design teams should stay intact during the entire process from conference room pilot to company rollout. They normally don't need to be deeply involved during this installation step, but they do need to be available for advice. There is no one who knows more about the functionality of the modules than the teams that designed them. In some cases, the questions or changes are routine enough that they can stay connected via email or conference calls. In others, they may need to meet to review the status. Regardless, design team members need to realize that they are critical to the success of the total project—not just the design phase. This is another place where a few words from the general manager can make a real difference.

### **On-Going Support**

One big mistake made on major software installations is to consider the project finished once the software is up and running. Although project completion is certainly a time for champagne and parties, this software is now a living, breathing part of the company. As the company changes, so should the software that connects it. As we said earlier, the folks in the IT department have become information managers and not software writers. How do they do this? The big change from old, fragmented systems to this new company-wide, transactional software is that it becomes the central nervous system for the company. As such, it's hard to think of this system as ever "finished." Besides the changes in business strategy that need to be reflected, there may be acquisitions, spin-offs, or consolidations that change the nature of data flow. Also, the software provider will routinely release new versions of their software, some of which may be quite worthwhile for your business. This brings up a critical point about information technology resources. In the old days, many business units had control of their own IT people. This was essential to keep the localized systems alive and well. However, ESs have a central corporate database, and thus the need for high system reliability and clear networks. This certainly speaks to the need for very central direction of IT

resources. Let's not mince words. We strongly favor central control of IT resources to avoid fragmenting this critically important set of software. If local units have control of their own IT resources, the odds are very high that they will gradually start to chip away at the corporate-wide nature of the ES. Certainly the local units need IT resources to make sure that they're using the information system effectively and to deal with ever changing business requirements; however, these IT people should have the central IT group as their organizational home.

#### **BOLT-ON SOFTWARE**

This is the name given to software that's outside of the main ES suite or legacy system, typically coming from a third-party software supplier. Companies usually add bolt-ons to the main system to perform specific functions because the existing ES or legacy systems don't do them well or don't do them at all. Many bolt-on software packages are considered "best of breed" because they are seen as so superior to their counterpart modules within the Enterprise System suite. Davenport, in his book on enterprise systems,<sup>ii</sup> identifies supply chain support tools for demand and supply planning, plant scheduling, and logistics systems as being primary candidates for bolt-ons: "Given the existence of best-of-breed packaged solutions in so many of these areas, the favored approach for most firms has been to go with a major vendor for core ES and then bolt on supply chain software developed by multiple other vendors." Downsides to bolt-ons include a degradation in the ability of ES to integrate information and process, the need for additional files not linked to the central database, the effort required to integrate the bolt-on, and a maintenance task over time as changes occur to the enterprise system and/or to the bolt-on. These negatives are not insignificant, and we feel that bolt-ons should be used judiciously and only when clearly needed.

The good news is that bolt-ons typically do provide users with a superior tool. (If not, why use a bolt-on?) Sometimes these packages are brought forward from the legacy environment and get bolted onto the new ES, because it's so obviously the right thing to do for the users. More on this in a bit, when we talk about pockets of excellence. Most bolt-ons we've seen in ERP environments come in three categories:

*Resource planning enablers.* This is the type of thing we've just been talking about: getting outside software (for Master Scheduling, MRP, etc.) and plugging it in to your existing system. *Front-end/back end.* These are applications that focus on the front end of the resource planning process (sales forecasting, Sales & Operations Planning, vendor-managed inventories) or back end, such as finite scheduling packages for the plants. Bolt-ons generally cause the least difficulty when they're at the front or the back. For example, there are several excellent forecasting packages on the market, which do a far better job than most ES vendor's offerings. For companies where forecasting is a problem—and there are more than a few of these—a forecasting bolt-on might make a lot of sense.

*Supply chain optimization/advanced planning systems.* This category of packages attempts a better fine-tuning of the detailed demand-supply relationships addressed by master scheduling, Material Requirements Planning, and so forth. When used properly, these packages typically can do a superior job. Through advanced logic and strong simulation capabilities, they can give superior recommendations to demand managers, planners, and schedulers regarding the best fit between customer demands and resource utilization. In summary, bolt-ons can be quite valuable, but they come at a cost—not only in dollars of course, but in loss of integration and increases in maintenance. Using them indiscriminately will cause more trouble than they're worth. Using them on a very specific basis, to do a superior job in one or another given function, is frequently the way to go.

#### **SELECTING BOLT-ON SOFTWARE**

Here are some thoughts about selecting bolt-on software, whether it is a resource planning enabler, a front-end or back-end module, or a supply chain optimization package. (These may also have relevance in selecting an ES for those of you who'll be doing a combined ERP/ES project.) Here goes:

##### **Don't be premature.**

Some companies' first exposure to a given set of software is through the software salesman who sells them the package. Often, these people regret having made the purchase after they have gone to early education and learned about ERP and its better tools. The right way is to learn about ERP first, and get the software shortly after the company has made an informed decision and commitment to ERP.

##### **Don't procrastinate.**

This isn't as contradictory as it sounds. Don't make the mistake of trying to find the perfect software package. That's like searching for the Holy Grail or the perfect wave. There is no best software package. The correct approach, after learning about ERP and deciding to do it, is to decide which bolt-on packages, if any, you'll need for phase I. Go after those and get a good workable set of software. Then repeat the process for phase II. It's important to move through these selection phases with deliberate haste, so the company can get on with implementing ERP and getting paybacks.

##### **Don't pioneer.**

People who get too far out in front, pioneers, often get arrows in their backs. This certainly applies to software for ERP. Why buy untested, unproven software? You have enough change underway with people systems to worry about software glitches. Insist on seeing the package working in a company that operates at a Class A or high Class B level. If the prospective software supplier can't name a Class A or B user of their product, we recommend that you look elsewhere.

##### **Save the pockets of excellence.**

Many companies do some things very well. An example of this would be a company with an excellent shop floor or work unit control system, but little else. The computer part of this system may have been programmed in-house, and may contain some excellent features for the users. Let's assume that the supply chain software package selected by this

company contains a shop floor control module that's workable, but not as good as the current system. This company should not blindly replace its superior system with the new, inferior one. Save the good stuff. Don't throw the baby out with the bath water.

### **MANAGING REQUESTS FOR CHANGES**

Whether you choose to go after ERP/ES or ERP only, you will have requests for changes to the software. In fact, making changes to software packages seems to have risen to the level of a national sport, sort of an X-Games of business. Over the years, billions and billions of dollars have been paid to consultants, software people, and contract programmers to modify packaged software. This has developed from a history of fragmented systems in companies with software systems designed for local applications. Now that we are moving to a common approach to business processes (ERP) and common software (either ES or supply chain support software) there is a real challenge to keep changes under control. Requests for changes will be minimized if the company does a good job of ERP education. This will help the users solve their problems within the overall framework of ERP. Add to this a set of standard software, relatively complete in terms of functionality. Then the users will have learned why the software is configured to support the valid needs of ERP. However, even with excellent education and good software, requests for software modifications will still come rolling along. This is where effective management enters the picture.

Key people, particularly members of the steering committee and project team, need to:

- Principle 1—Resist isolated changes.

The mind-set of management must be to resist changes to the software that are isolated to a local need that is not essential for running the business and/or implementing ERP. They need to understand that too many changes during implementation will delay the project and changes after project initiation will confuse the users.

- Principle 2—Always follow a recognized change process.

What's this? Another contradiction? Nope—this is a clear and complementary principle. The way to avoid violating Principle 1 is to have a recognized process for change. Most attempts at any sort of standardization in a company fail because there is no recognized change process. This means that either too many changes are made or the system is stifling due to stagnation.

Management needs to establish

a clear change process focused on who can recommend change, what are the key points to be considered, and who approves the change. People can play the game—as long as they play by the rules. Even the X-Games have rules. Those are the principles. Here's the procedure:

1. The IT department is geared up to provide modifications, changes, enhancements, and so on.

This includes both those that are made internally and those that can be done by the software vendor. The necessary funds have been budgeted in the cost benefit analysis.

2. Requests for changes are submitted first to the IT department for an evaluation of the amount of work involved.

There should be an understood dividing line between minor and major project changes and the request should be classified accordingly. IT also adds any other comments about the technical nature of the change but does not comment on the business validity.

3. The request then goes to the project team. If the request is for a minor change, the project team decides whether to grant the request or defer it until phase III.

4. If the request is for a major change, the project team reviews it and makes a decision. The key issue here: Is this change necessary in function in question require the computer or can it be done manually? If the answers verify that the change is important for the business and requires the computer, then it must be done either now or very soon. If not, defer it to phase III.

5. At times, those proposing the change may have a very strong disagreement over rejection by the project team. In this case, there needs to be a process for the change idea to go to the steering committee. The steering committee needs to be prepared to hear both sides of the issue and then make the final decision. Using a process such as this can keep the modifications down to the (important) few and not the (nuisance) many. There are no guarantees that will protect a management team under all circumstances. However, failure to establish a process like this is one of the most notable reasons for projects to get out of control.

### **NEW RELEASES**

To continue the golf analogy that began this chapter, golf clubs are always changing. New shafts and club heads are developed and touted as “revolutionary.” Software development has the same pattern. New releases are always coming from vendors promising major improvements in functionality. The difference is that you can probably play with the new golf clubs the day you buy them, and they may or may not make a difference in your game. With software, the new release can represent a major investment of resources and may not only *not* provide benefits to your business but may interfere with your operation. There is no sin in passing up the most recent “new release” unless you are absolutely confident that the enhancements are important to your business. One last word about software changes. It is always easier to make changes on the output and the input than it is on the internal logic of the system. Any changes to the internal logic of either ES or supply chain software should be considered as major and thus, kept to a minimum. Many changes at the heart of the software are a good indication that you have the wrong software. This is usually more of a problem with supply chain add-on software than Enterprise Software. ESs are built to adjust the switches that control data flow so it is more common to find that there are “work arounds” built into an ES.

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|                               | 1998-1999    | UNIVERSITAS NEGERI JAKARTA (UNJ) | Mechanical Engineering Education |
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*CURRICULUM VITAE – SYAHRIL DIAN PURWONO, ST*

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|------------------------|---|
| <b>DATES</b>           | <b>ACTIVITIES</b>   |
| 2005,<br>July –<br>now | <b>ERP – Maintenance Management - CMMS Consultant</b> at<br><b>PT. IRIS Sistem Inforindo</b> , www.iris.co.id<br>programs :<br>1. <b>QAD-MFG/Pro</b> & <b>QAD-EAM</b> (www.qad.com),<br>2. <b>ImpactXP</b> (www.impactxp.com)<br>3. <b>ArisToolset</b> for Business Process Management<br>4. <b>CorVu</b> for Business Intelligence |
| 2003 –<br>2005         | <b>Assistant for Laboratory of CNC/CAD-CAM</b> ,<br>Mechanical Engineering Department, Diponegoro University  |
| 2002 –<br>2004         | Research about "Adoption and Modification of Press Machine in<br>Designing Wafer's Press Machine of Animal Feedstuff"<br>(predicated as <b>National Level Presenter in PIMNAS XVII, 2004</b> )  |
| 2003,<br>January       | Job Training at <b>PT. Semen Gresik</b> , unit of Raw Mill of Tuban 1,<br>Tuban, East Java  |
| 2002,<br>February      | Job Training at <b>Garuda Maintenance Facilities</b> , department of<br>Structure Engineering, Soekarno-Hatta Airport   |
| 2001,<br>August        | Job Training at <b>PT. Kereta Api Indonesia (Indonesian Railway)</b> ,<br>Operational Region 1, Jatinegara Railway Station, Jakarta   |
| 2000,<br>August        | Job Training at MV. Bimasakti, <b>Balai Teknologi Keselamatan<br/>Pelayaran</b> , Port of Tanjung Priok, Jakarta  |

| <b>TRAINING / SEMINAR EXPERIENCES</b> |   |
|---------------------------------------|---|
| <b>DATES</b>                          | <b>ACTIVITIES</b>   |
| 2008, July,<br>9 - 10                 | <b>Autonomous Maintenance</b> , by PQM Consultant   |
| 2007, May,<br>1 - 2                   | <b>Effective Planned Maintenance</b> , by PQM Consultant  |
| 2007, April,<br>4 - 5                 | <b>Total Productive Maintenance</b> , by PQM Consultant   |
| 2006, Mar<br>15 - May 31              | <b>Fundamental Leadership Program</b> , Dale Carnegie Training  |
| 2005, Aug,<br>30 - 31                 | <b>Designing Training Program</b> , by PQM Consultant   |
| 2005, Aug,<br>23 - 24                 | <b>Handling Customer Complaint</b> , by PQM Consultant  |
| 2005, Aug,<br>9 - 11                  | <b>Project Management Training</b> , by PQM Consultant  |
| 2004, Sept<br>- Nov                   | Short Course of TOEFL at Service English Unit, UNDIP 2004   |
| 2003,<br>October                      | MS Visual Basic 6, at Computer Laboratory, Mechanical Engineering<br>Department, UNDIP                    |
| 2001,<br>January                      | A 175-hour Course of Mechanic for Gasoline Motor ; Car and<br>Motorcycle, 2 & 4 strokes at BLKI, Semarang |

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| <b>ORGANIZATIONAL EXPERIENCES</b>  |  |
|--|--|
| <b>NAME</b>  | <b>POST</b>                            |
| Volunteer Corps – Indonesian Red Cross, UNDIP 2002                         | Chief of Education & Training Division |
| INSET (Innovation, Science and Technology), UNDIP, 2001 - 2002             | Member                                 |
| 4th Division of Mechanical Engineering Student Society, UNDIP, 2000 - 2001 | Member                                 |
| Youth Science Club, SMUN 36  | Vice of Chairman                       |

| <b>SPECIAL SKILLS / QUALIFICATIONS</b>   |
|--|
| Mechanic for Gasoline Motor, 2 & 4 Strokes   |
| Computer Literate (MS Windows, Auto CAD, ERP - MFG/Pro, CMMS – QAD-EAM & IMPACTxp, ArisToolset, CorVu)                                     |
| Instructor Course of Operating EMCO CNC/CAD-CAM machine (certified)  |
| <b>ACHIEVEMENTS</b>  |
| National Level Presenter of PIMNAS XVII in STT Telkom, Bandung, July 2004 by DIKTI – Ministry of National Education, Republic of Indonesia |

| <b>INTERESTS / HOBBIES</b>   |
|--|
| Automotive (motorcycle), listening music, computer & internet browsing |



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Judul Skripsi : A Morphological Study on Word Formation of ERP Software Terms in  
www.wiley.com  
Pembimbing : Hj. Rohmani Nur Indah, M.Pd.

| No | Tanggal           | Materi                                   | Tanda Tangan |
|----|-------------------|--|--------------|
| 1  | 8 Maret 2008      | Pengajuan Judul dan ACC Judul            | 1.           |
| 2  | 25 Maret 2008     | Pengajuan Proposal                       | 2.           |
| 3  | 31 Maret 2008     | ACC Proposal                             | 3.           |
| 4  | 18 April 2008     | Seminar Proposal                         | 4.           |
| 5  | 21 April 2008     | Konsultasi BAB I                         | 5.           |
| 6  | 28 April 2008     | Pengajuan BAB I & Konsultasi<br>BAB III  | 6.           |
| 7  | 5 Mei 2008        | Pengajuan BAB III & Konsultasi<br>BAB II | 7.           |
| 8  | 23 Agustus 2008   | ACC BAB I & BAB III                      | 8.           |
| 9  | 25 Agustus 2008   | Konsultasi BAB II                        | 9.           |
| 10 | 6 September 2008  | ACC BAB II & Konsultasi BAB IV           | 10.          |
| 11 | 9 September 2008  | Revisi BAB IV & Konsultasi BAB V         | 11.          |
| 12 | 12 September 2008 | ACC BAB IV & BAB V                       | 12.          |
| 13 | 15 September 2008 | ACC Keseluruhan & Abstract               | 13.          |

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Hereby, I certify that the thesis I wrote to fulfill the requirement for Sarjana Sastra (S.S) entitled “A Morphological Study on Word Formation of ERP Software Terms in www.wiley.com” is truly my original work. It does not incorporate any materials previously written or published by another person, except those indicated in quotation and bibliography. Due to the fact, I am the only person responsible for the thesis if there is any objection or claim from others.

Malang, 23<sup>rd</sup> October 2008,

Nurrahmi Hindiyati