

Bridging Japanese and American Business Procedures using SMAD (Structured Manuals Analysis and Design) and its Effect on Knowledge Management & Enterprise Education

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Abstract

This paper discusses some results on the application of SMAD (Structured Manuals Analysis and Design Method) concerning Knowledge Management, and also tries to make philosophical and educational comments. Using a theory of transformation between a natural language and a systems language, i.e., DFDs (Data Flow Diagrams), ERDs (Entity Relationship Diagrams) and Mini-specs, SMAD has a unique methodology for analysis and design. SMAD structures business procedures, verbalizes the procedures as business manuals (natural language), converts the natural language into systems language and vice versa.

As a result of SMAD application to Japanese Enterprises, Japanese Ammokuchi (tacit knowledge) becomes more explicit. Therefore, Knowledge Management has been, to some extent, successfully built into Japanese. On the other hand, SMAD produces other side-effects such as reduction of traditionally preserved skills of clerks and managers' excessive confidence in computerized decision support systems. As such issues are related to human (business) procedures, a human-related, inter-disciplinary analysis is urgently required.

Chapter 1 Japanese and American Business Procedure and manuals

1-1 Traditional Japanese Companies' Business Procedures, Manuals and Training System

Business Procedures and Systems Categorization

Gorry and Scott Morton (1971) provided an influential categorization of Business Information Systems. G/S tried to explain an Information System in terms of matrix construction. This famous matrix is divided into two (three) classes and two (three) levels. The classes represent *structured* and *non-structured* processes of business procedures. G/S gave examples of these two classes such as the accounts receivable process for class 1(structured)

and PERT/COST (a method for project scheduling) management for class 2 (non-structured). H. Simon (1960) originally gave this classification.

The other phase of the matrix is composed of the two levels, i.e., operational and management, line and staff, or more easily, the clerks and management. For example, management level non-structured class business procedure might be R&D. The levels are R. Anthony's (1965) idea originally, according to the G/S paper. Strictly speaking, G/S gave another class, semi-structured and another level, strategic. I revised and simplified the classes and levels in order to make the discussion easier. (As a note about manuals in advance, operation manuals cover level 1 (*operational level*) and class 1 (*structured*).

The conclusion of G/S was "non- or semi-structured class and management or strategic level business should be supported by DSS (Decision Support System)." Remaining routine procedures can be computerized or performed by clerks using operation manuals.

American categorization

	<i>Structured</i>	<i>Semi-structured</i>	<i>Non-structured</i>
<i>Operational</i>	Manuals (Clerks)		
<i>Management</i>		Non-Manuals (Management)	
<i>Strategic</i>			

Fig. 1-1-1

Japanese categorization

	<i>Structured</i>	<i>Semi-structured</i>	<i>Non-structured</i>
<i>Operational</i>			
<i>Management</i>		Non-Manuals	
<i>Strategic</i>			

Fig. 1-1-2

Business Process

According to previous studies and my research of American companies (i.e. interviewing, sampling and analysis), the American way of business categorization resembles that of Info-sys classification (Gorry & Scott Morton 1971, Emery 1987, Synnott 1987, Davis & Hamilton 1993, Rockert & De Long 1988, Wiseman 1988). This is routine and non-routine, operation and management. Routine has procedure manuals; non-routine has no procedure manuals but management handbooks.

This categorization, however, actually doesn't work in Japanese business culture. Because of its group-oriented management, Japanese businesses don't have severe tensions between operations and management. Japanese business procedure focuses attention on workers' morale, responsibility and creativity, which are obtained through On-the-Job-Training and maintained implicitly as Ammokuchi. (Koike 1997, Nonaka 1990) The business procedure is widely known as TQC, Kaizen or other kinds of group-oriented ways of business processes. In theory, the processes help the workers to do a better job. In Toyota USA, contrary to traditional American practice, management allows the workers to stop the production line whenever they find defects or errors. This new practice resulted in doubled efficiency the following year partially because of increased worker morale. (Katayama 1998)

Japanese and American Business Manuals

According to the studies and research stated above, American management thinks manuals are only for clerical work. (Dallas 1975, Heyel 1972) The term "manuals" is synonymous with the famous McDonalds' operation manuals, which are needed for routine work. Thus the American way of business manual categorization resembles that of business procedure and information system's classification. This is routine and non-routine, operation and management. Routine has procedure manuals; non-routine has management handbooks.

These manuals are elaborately prepared not only for the workers, but also for the computers. To analyze and design the computer systems, one should draw diagrams, i.e., DFD and ERD. (Optner 1975, Gane & Sarson 1979, Senn 1993) Those manuals are easily translated into those diagrams since the diagrams are based on English grammar. (Chen 1983, Ross 1977) When it comes time to implement the ERPs or some sort of International Standards of operating applications, DFDs and ERDs are crucial. Therefore, American Manuals, having been written in English, have an advantage.

Especially signified by "Ammokuchi" (non-verbal or tacit knowledge, Nonaka 1990), Japanese rarely have manuals. According to my research in of three Japanese companies (i.e. interviewing, sampling and analysis), Japanese do not recognize a difference between operations and management, structured or non-structured, etc., so

preparation of operation manuals (especially routine manuals) is supposed to be difficult. There are elaborate documents in terms of regulations and standards in Japanese companies. These documents tell workers the "norms" and the "facts" but does not teach them "how to" perform the jobs.

Moreover, their "Ammokuchi" related workers' morale and creativity, is well reserved and incorporated in the regulations and standards or sometimes "ethical codes".

1-2 Current Situation of Japanese Companies

Recently, however, because of the now *de facto global standards* and ERP (Enterprise Resource Planning) computer application package which requires step-by-step job descriptions and contains some parts of these standards, Japanese enterprises have come to realize the importance of incorporating American style business manuals.

A Japanese company tried to implement the ERP (Enterprise Resource Planning) application package only to find that it was impossible. The analysis and design process of the implementation failed because of the lack of information about business procedures. A typical American company prepares its business procedure manuals before doing a systems analysis. A business manual in America, therefore, refers to a systems documentation, which describes business procedures in detail (Optner 1975, Kendall & Kendall 1995, Senn 1993).

The premise of this paper is that Japanese companies need to maintain structured manuals. The problem in implementing the software package is not the only reason why Japanese companies should prepare business manuals. International requirements with regard to quality control (ISO9000s), environment protection (ISO14000s), labor relations (ISO16000s), and accounting procedures (IAS) make business manuals all the more indispensable. Structured manuals are undoubtedly becoming an integral part of global business systems.

1-3 Non Manual Operation and Job Training—Its Philosophical Analysis

The reason why Japanese have no manuals is often discussed in relation to *business style* as stated above, or Japanese tradition which tries not to teach "how-to" or does not accept the verbalized way of thinking. This doesn't, however, explain Japanese companies' non-Manuals operation practically and sufficiently. Especially, the difference between Japanese business training procedure and that of the West cannot be fully explained merely by Japanese culture or tradition.

Japanese employee training is strongly related to "norm-acquisition", i.e., not teaching *how to* (skills) but teaching *act standards (norms)*. Thus no Japanese worker thinks of his senior colleagues as just a trainer but a "teacher (mentor)"; job descriptions are thought of not as business manuals but as ethical codes. Of course

computerized business procedures cannot be accepted in this sense simply because computers cannot provide any ethical or creative ideas. This must be discussed later in Chapter 3.

In order to explain the difference between the Japanese sense of a training or a teaching job (business procedures) and the American counterparts, a well prepared definition of the term “teach” is indispensable. To present the idea of teaching and telling, I.Scheffler introduces three pairs of schema which are :

- A. X tells Y that ... B. X teaches Y that ...
- C. X tells Y to ... D. X teaches Y to ...
- E. X tells Y how to ... F. X teaches Y how to ...

“The Language of Education” (1960 p.76)

The implications are :

“To learn to be honest is to acquire a certain norm, a “pattern of action” ... To teach someone that one ought to be honest thus involves not merely teaching him *to be* honest (even for the active interpretation), but also trying to have him acquire the benefit that one ought to be honest, (to acquire it within the restrictions of manner appropriate to teaching and discussed earlier). B statements may thus be said, in contrast to D statements, never to refer to the acquisition of norms solely, but also to some belief in the norm, some sort of intellectual acknowledgment of its authority. (p.94)”

Concerning the difference between skills and norm-acquisition, I.Scheffler also offers the following description in the same book:

“ F and D are distinct, we have said. For convenience, we may say (roughly) that D is concerned with norms and norm-acquisition, while F is concerned rather with skills and skill acquisition. (p.98)”

Using the definition and its implications, we could easily understand the deep meaning of Japanese job training which is performed without using written documents. The Japanese training system is supposed to be an example of norm-acquisition or “teach Y to ...” style of teaching. This style of teaching and its method cannot easily be documented or verbalized. On the contrary, the American skill-oriented way might prefer “teach Y how to ...” method which can be written down logically, and therefore, easily computerized.

Chapter 2 The Structured Manuals Analysis and Design Theory, SMAD

2-1 The Concept of SMAD

The concept of SMAD system and its theory of conversion, i.e., from natural language into systems language and vice versa (Masuzawa 1999, 2000a) should be discussed first.

A natural language description (a sentence of a manual) describes a unit of a job or task to do. The description (sentence) should be converted into a logical formula for analysis. As each job (j) and its performer (p) accepts inputs (i) from preceding performer (pp) and produces outputs (o) for forwarding to the next performer (pp), the notation can be described as a mathematical formula like:

$$f_j(i)=o$$

which says: the function of job (j) is to convert input (i) into output (o). The notation can be described more directly as below:

$$[pp]-i-(j/p)-o-[np]$$

To be read: the performer (p) of the job (j) converts the input (i) from the preceding performer (pp) into output (o) which then is forwarded to the next performer (np).

For example, typical American and Japanese business manual sentences are written as follows:

(American Manual):

“Orders from a customer will be received over the phone by a sales clerk in Tokyo H.Q. and an order memo is prepared for a voucher clerk in Yokohama office.”

(Japanese Equivalent):

”To accept with utmost care and gratitude to customers.”

These two are combined and fed to SMAD software which analyzes sentence structure and converts the natural language sentence (manuals sentences) into “structured” inter-language using famous *Brill Tagger* (MIT) software and linguistic theories such as Functional, Case, and Cognitive grammar (Thompson 1997, Cook 1998, Langacker 1991), especially, C.Fillmore’s Case Theory (1966, 1967, 1968a, 1968b, 1968c, 1971). The actual text of the computer output is as follows:

[Customer] -order- (to accept order/ sales clerk, Tokyo)-order memo- [voucher clerk, Yokohama]

As regards Ammokuchi, which is typical in a Japanese working environment, SMAD clarifies and examines the Ammokuchi related parts of manuals in order to make *some part* of them explicit. However, most of the Japanese original sentences should be reworded in pursuant to modified case theory because of the weak structure of the sentences. This is called “preprocessing” of SMAD application. Once the structured inter-language is properly prepared by sentence analysis and SMAD as described above, a computer algorithm could easily produce systems languages, such as DFDs and ERDs in pursuant to DFDs and ERDs grammar (DeMarco 1979, Ross 1977, Gane & Sarson 1979, Chen 1983). For example, above structured inter-language sentence is converted into DFD as Fig. 2-1-1(single job DFD) and Appendix (three jobs DFD with its original Japanese sentences, Japanese and English structured inter-language and English sentences retranslated from DFD) of this paper.

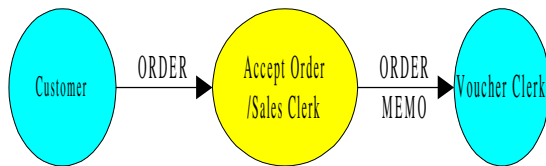


Fig 2-1-1 A Sample of DFD produced by SMAD

Thus the viability of the “natural-systems language conversion” theory has also been confirmed in the form of a computer software package named SMAD as it has been tested and verified in the actual business world. The SMAD theory and its system have established a process for Japanese companies to acquire “explicit” knowledge in terms of business procedure.

2-2 Philosophical Analysis of Japanese Business Procedures Description

The job-describing formulae which this paper calls “structured inter language” are organized and related to each other such that they finally form a net (see Appendix). The idea is similar to the “fact net” consisting of “formal language” sentences of Leibniz (Churchman 1971). Western languages and its way of describing systems could easily be connected to structured inter-language or data-flow-oriented (method or means oriented) diagram which is called DFD(Data Flow Diagram). Although there are many types of DFDs, DFD essentially clarifies the process and means of the job, i.e., performer, data, tool and so on.

On the contrary, Japanese description is related to job (function or purpose) flow, which is widely known as Flow Charts. In this chart, each job is followed by the next job, not by the next performer or the output of the job. (see fig. 2-2-2 below)

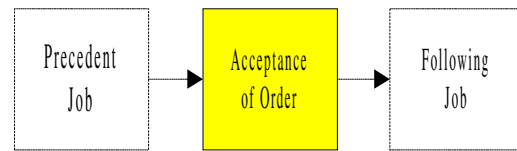


Fig. 2-2-2 A Sample of Flow Chart (Purpose Flow)

The difference between Western data flow and Japanese job (function or purpose) flow has been explained by the Japanese traditional way of thinking. Typical explanation says that, owing to Japanese tradition of tacit knowledge, most of the Japanese business writings need not state such implicitly shared knowledge, i.e., performers, data and tools, but should focus only on the purpose or goal of the job using “verbs.”

Another explanation has been made by linguistics. Japanese daily language, i.e., surface structure of natural language (Chomsky 1965), usually does not clarify subject (performer) or other elements of sentences. Verbs, however, which mainly signify the purpose of the sentences, are never deleted. (see the example of Japanese Manual above stated). This is the reason why the formula stated above is especially called “structured”. To properly acquire structured sentences, the SMAD application utilizes some linguistic theories such as “deep structure” of N.Chomsky and C.Fillmore’s (Masuzawa 2000a) in order to preprocess the natural language.

To explain, however, the implication and meaning of verb-oriented, or wider, purpose-oriented way, linguistics cannot substantially contribute further. This is why significant conceptual difference such as data flow and purpose flow should be studied deeper utilizing analytical and philosophical ideas such as “teleology.”

Chapter 3 The Result and Effect of SMAD application on Japanese Companies

3-1 Results of SMAD application

The results of SMAD application are discussed here from view points of two pairs of important business concepts, i.e., User and IS (information systems) department, and Managers and Clerks.

IS departments are definitely satisfied with the results of SMAD because of well structured systems documentation and improved understanding of the business process which has not been provided by users before. The natural and systems language documentation also expedite the systems analysis and development procedures. Within the IS departments, SMAD results have been effectively utilized

for education for novices; since novices tend to pursue cutting edge IT know-how paying lesser attention to a user's *implicit* business procedures (Masuzawa 2000b). Managers' understanding of operation has also been considerably improved.

Overall, the exchange of knowledge from expert to novice, User to IS department and managers' understanding of a clerk's job has been improved. This means Knowledge Management on one side was successful. But from weaker to stronger, things are much different. Especially in terms of a clerk's job whose work is reduced to machine operation causing a loss of company-specific tacit knowledge. The minute definition of job procedures created conflicts among workers as well. Managers, moreover, have too much confidence in terms of computerizing business processes not only for routine work but also for managers' work such as the decision making process. As all these problems are closely related to the basic concept of business procedures and systems, current knowledge of systems science, such as SMAD theory, cannot contribute any further.

Therefore, to solve these problems, it must be high time for us to redefine the basic knowledge in terms of business procedure such as job, process, training and the information system itself. Thus the application of philosophical findings for information systems is becoming more and more indispensable for analyzing daily business procedures, job training or widely, enterprise "education."

3-2 Philosophical Analysis

In the course of reduction human process (purpose) to machine process (purpose), the worker should loose some of the well reserved legacy knowledge. Besides that, for the clerical work, the most basic question is "Can a business process be computerized?"

Here is an historical answer to the question in the pioneering paper of A.Rosenbleuth et al. (1943) which notes: "The broad class of behavior are the same in machines and living organisms.(p.22)"

From a philosophical point of view, I.Scheffler(1986 p.528) comments on the paper that "But in my view, the claim to reduce human purpose to machine purpose by their method can achieve plausibility only by so enriching the latter as to encompass the former. " In this sense, it is obvious that, since SMAD only verbalizes limited parts of the business procedures, we are now far from "encompassing the human purpose." And for the Management, or decision making purpose, it is often said that:

" the computer should be used to help develop creative problem-solving abilities. Rather than serving primarily as an adjunct to the traditional academic subjects, the computer is to be used to

promote logical, cognitive, and reasoning abilities – what may be called, speaking generally, critical thinking, inclusive of inventive approaches to problems".
I.Scheffler(1986 p.520)

Of course the present situation is far from that and:

"But empirical evaluation remains to be dealt with, that is, are there determinate criteria of success by which the computer can be shown to offer advantages in promoting creative problem solving capacities? (p.520)"

The capacities can only be shown when we could successfully and fully compile the problem-solving algorithm. SMAD is a primitive program but it firstly distinguished and extracted the machine process from the human process automatically. It should be noted that the extracted process is just a small part of total procedures or knowledge, and once the procedures are verbalized and computerized, no matter how small they are, the procedures would occupy the "whole" business process. This means, the crucial remaining parts are all abandoned simply because they cannot be verbalized. This is far from encompassing of *human purpose* by *machine purpose*. So far SMAD can only contribute to realize this problem, not to solve this problem. The philosophical study should be accompanied by further development of SMAD and computerized business procedure.

Current discussions of Philosophy as a foundation of information systems, however, are mainly focused on systems classification. C.Churchman (1971) in his pioneering book of philosophical systems analysis says, "The book develops a classification of systems, based on a conversation with five historical figures – Leibniz, Locke, Kant, Hegel, and Singer, along with their allies and enemies. The reader will naturally gain the impression that this classification is an evolution, from the primitive forms of inquiring systems to the more advanced.(p.viii)"

Conclusion

The viability of the SMAD theory has been confirmed in the form of a computer software package as it has been tested and verified in the actual business world. Thus the SMAD theory and system established a process for Japanese companies to acquire *some* "explicit" knowledge in terms of business procedures. SMAD and its results, however, have created conflicts and difficulties as well. These difficulties and troubles are related to human business systems in relation to the deep sense of "knowledge," "training," and "decision." SMAD played an important role to identify and clarify the issues by extracting machine process, i.e., verbalized process from

tacit knowledge. SMAD, however, cannot solve the problem. The only solution might be “encompassing of human purpose by machine purpose.”

To realize the encompassing, we have to start with exhaustive reconsideration of the whole structure of systems analysis in order to restructure and redefine the basic knowledge in terms of systems language, business procedure such as job, process, training and finally, the *information system* itself. Thus the application of philosophical findings to information systems is becoming more and more indispensable.

Finally, this paper strongly emphasizes that training in a company should be deemed as “education” to teach implicit and explicit knowledge, not as a “drill” to teach how-to skills. “*Philosophy of education*” plays an important role in this area. In this sense, SMAD application should be studied philosophically and be developed as a pioneering system of computerized education.

Appendix :Result of SMAD Operation

Here is an example of SMAD sentence generation. About this example, the original natural language sentences are written in Japanese (Sample 1). Structured inter-language in Japanese (Sample 2) then converted into English inter-language (Sample 3). English inter-language produces systems language (Data Flow Diagram: Sample 4) and the natural English sentences (Sample 5).

(Sample 1) Original Japanese sentences

- 1-0. Tokuisaki -karano chumon -niyori juchujimugakari -wa juchumemo -wo sakuseishi, juchumemofairu -ni hozonsuru.
- 1-1. Tokuisaki -karano chumon -niyori juchujimugakari -wa juchukahi -wo tokuisaki -ni kaitousuru.
- 1-2. Shinagire shinausujoho -karano shinagire shinausu memo -niyori, juchujimugakari -wa juchukahi -wo tokuisaki -ni kaitousuru.
- 1-3. Juchujimugakari -wa shohinkanrigakari -karano shinagire shinausumemo -niyori, shinagire shinausu memo -wo shinagire shinausu jouho -ni irekaesuru.
- 1-4. Juchugakari -wa tokuisakidaicho -karano tokuisakijoho -niyori, yokujitsu haitatsubun -nitsuite uriage denpyo -wo sakuseishi, shukkagakari -ni souhusuru.
- 1-5. Juchugakari -wa shohindaicho -karano shohinjoho -niyori yokujitsu haitatsubun -nitsuite uriagedenpyo -wo sakuseishi, shukkagakari -ni souhusuru.
- 1-6. Juchugakari -wa juchumemo fairu -karano juchumemo -niyori, yokujitsu haitatsubun -nitsuite uriagedenpyo -wo sakuseishite, shukkagarari -ni souhusuru.
- 1-7. Juchugakari -wa juchumemo fairu -karano juchumemo -niyori, uriagedenpyo -wo uriagedenpyo

hikae fairu -ni hozonsuru.

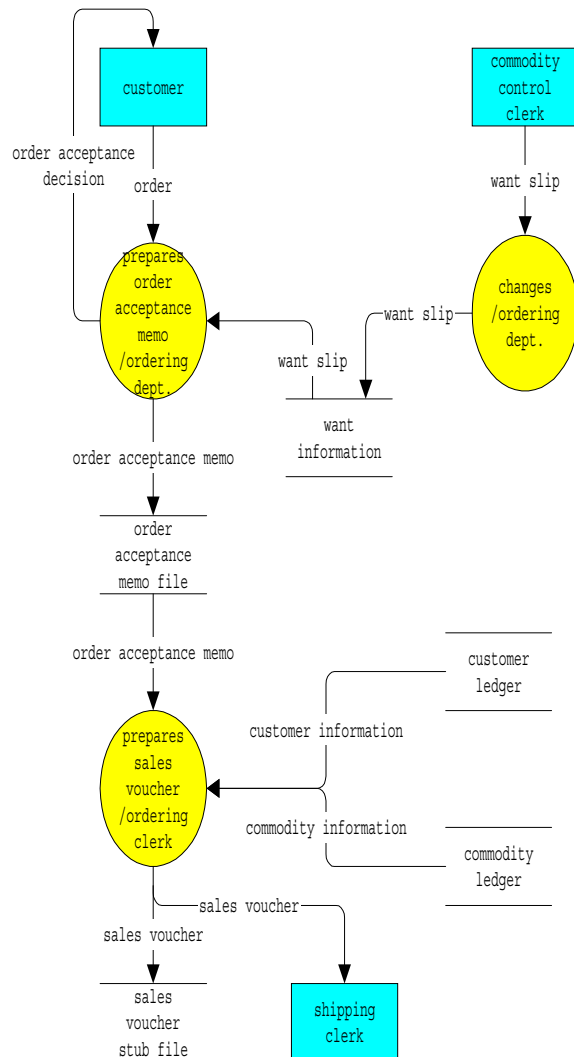
(Sample 2) Structured inter-language in Japanese

- 1-0. : [tokuisaki] • chumon • (juchu memo-wo sakuseisuru juchujimugakari)•juchu memo•[juchu memo fairu]
- 1-1. : [tokuisaki]•chumon•(kaitousuru•juchu jimugakari)• juchu kahi•[tokuisaki]
- 1-2. : [shinagire shinausu joho]•shinagire shinausu memo• (kaitousuru•juchu jimugakari)•juchu kahi•[tokuisaki]
- 1-3. : [shohinkanrigakari] • shinagire shinausu memo • (irekaesuru•juchu jimugakari)•shinagire shinausu memo• [shinagire shinausu joho]
- 1-4. : [tokuisakidaicho]•tokuisaki joho•(uriagedenpyo-wo sakuseisuru juchugakari)•uriagedenpyo•[shukkagakari]
- 1-5. : [shohindaicho] • shohin joho •(uriagedenpyo-wo sakuseisuru•juchugakari)•uriagedenpyo•[shukkagakari]
- 1-6. : [juchumemo fairu]•juchumemo•(uriagedenpyo-wo sakuseisuru•juchugakari)•uriagedenpyo•[shukkagakari]
- 1-7. : [juchumemo fairu] • juchumemo •(hozonsuru • juchugakari)•urigaedenpyo•[uriagedenpyo hikae fairu]

(Sample 3) Structured inter-language in English

- 1_0. : [customer]-order-(prepares order acceptance memo|ordering dept.)-order acceptance memo-[order acceptance memo file]
 - 1_1. : [customer]-order-(replies|ordering dept.)-order acceptance decision-[customer]
 - 1_2. : [want information*]-want slip**-(replies|ordering dept.)-order acceptance decision-[customer]
 - 1_3. : [commodity control clerk] -want slip-(changes| ordering dept.) -want slip-[want information]
 - 1_4. : [customer ledger]-customer information- (prepares sales voucher| ordering clerk) -sales voucher-[shipping clerk]
 - 1_5. : [commodity ledger] -commodity information- (prepares sales voucher| ordering clerk) -sales voucher -[shipping clerk]
 - 1_6. : [order acceptance memo file]-order acceptance memo-(prepares sales voucher| ordering clerk)-sales voucher-[shipping clerk]
 - 1_7. : [order acceptance memo file]-order acceptance memo-(preserves| ordering clerk)-sales voucher-[sales voucher stub file]
- * want information: shortage information
 **want slip: notice of shortage

(Sample 4) DFD generated by Structured inter-language



(Sample 5) Sentences generated by Structured inter-language

- 1_0. Customer sends order to ordering dept., which prepares order acceptance memo to order acceptance memo file.
- 1_1. Customer sends order to ordering dept., which replies concerning order acceptance decision to customer.
- 1_2. Want information provides want slip for ordering dept., which replies concerning order acceptance decision to customer.
- 1_3. Commodity control clerk sends want slip to ordering dept., which changes want slip for want information.
- 1_4. Customer ledger provides customer information for ordering clerk, who prepares sales voucher for shipping clerk.
- 1_5. Commodity ledger provides commodity information for ordering clerk, who prepares sales voucher for shipping clerk.
- 1_6. Order acceptance memo file provides order acceptance memo for ordering clerk, who prepares sales voucher for shipping clerk.
- 1_7. Order acceptance memo file provides order

acceptance memo for ordering clerk, who preserves sales voucher for sales voucher stub file.

Since the modified Case Theory and SMAD are mainly invented for the Japanese language, it is difficult to apply to the English language without artificial clumsiness in terms of sentences generated by the algorithm. The artificial clumsiness should be smoothed by utilizing case grammar or other grammatical and mechanical translation theories (Halliday & Hasan 1976 etc.) more effectively.

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