Full Length Research Paper

What is professional? An experiential learning theory perspective of sales engineer competencies in the semiconductor industry

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The position of sales engineer is an important and specialized job in the high-tech industry. Sales engineers are responsible for getting orders from clients, which is critical for a firm's survival. In order to complete his or her job targets, a sales engineer needs two abilities – technical knowledge and interpersonal skills. This study focuses on the semiconductor industry and examines by job analysis, the competency of sales engineers using the experiential learning theory. The study found fourteen abilities, including judgment, networking, relationship building and maintaining etc., are necessary for this kind of work. Three personality traits, namely goal orientation, initiation, and service orientation are also required. Comparatively, the required abilities and personality traits vary across streams in the industry, with "relationship building" being the most important ability. This exploratory study can provide new ideas for research and a useful practical direction for the selection and training of sales engineers.

Key words: Sales engineer, competency, experiential learning, semiconductor industry.

INTRODUCTION

The 21st century is a new digital economic age in which the internet, wireless communication, digital household appliances and information technology are all integrated. The semiconductor industry plays a crucial role in this tide. Oil used to be regarded as black gold, and today the study can say that semiconductors are the black gold of the high-tech industry because there would be no modern civilized technological society without them. The high-tech industry has become the main force of future development, and the actual strength of science and technology is a very important index to evaluate the competitive ability of a country. Indeed, engineering is the largest group in the industry, and sales engineers play a crucial role within this group. In the long run, well-made and uniquely-designed products need to be sold through sales engineers. Therefore, sales engineers are the lifeblood of the industry, allowing it to exist and to make a profit.

From the beginning of the study of psychology, intelligence quotient (IQ) has been the basic standard for choosing and recruiting talent. However, McClelland (1973) stated that the traditional intelligence test is not suitable for evaluating total working results because differences in culture, race, gender or socio-economic status will cause a decline in the results. In addition, not only the generally used aptitude tests and professional knowledge tests, but also academic records, and educational and professional background all fail to exactly forecast an individual's related performance in their work. Therefore, McClelland (1973) identified the real reason behind excellent results, competency, in his study "testing for competence rather than for intelligence" published in American Psychologist. This was the very beginning of the competency movement in Psychology. The follow-up research has gradually explored the relationship between IQ and competency, and opened up different areas of discussion and kinds of application in

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this field.

In order to be competitive, the semiconductor industry is a priority for a country's development and the role of sales engineers' key in making a profit. Therefore, for organizations, the important issue is how to recruit the most suitable talent for these positions; however, there has been no research on sales engineers' competency in the semiconductor field to date. Thus, this is the motivation for this research.

There are many extensive discussions on the research of competency. However, it is quite limited in relation to the competency of semiconductor sales engineers. This is therefore, an undeveloped field. Through this research the study can not only understand the competency of semiconductor sales engineers, but also provide a reference for industry and follow-up academic research. There are therefore, two purposes to this study on the bases stated:

I. To explore sales engineers' competency in the current semiconductor industry.
II. By understanding the competency of sales engineers, to provide recruitment direction for human resource management.

The results of this research are presented as a reference for decision-making by human resource recruiting management through greater knowledge of the competency of sales engineers.

LITERATURE REVIEW

Competency theory has gradually been credited with greater importance in recent years. The main reason is because industrial and commercial business has become increasingly prosperous and different types of organizations are looking for suitable talent. This search has become a very important activity inside organizations, in order to allow them to operate and make more significant profits. In Taiwan, the output value of the semiconductor industry is ranked first among all other industries. Thus, the sales engineers' role cannot be overlooked and competency research can provide a basis for the selection, recruitment, education, post retaining and reward of talent, in order to bring them into full play within the organization. Two aspects of the literature are explored in this section: sales engineers and competency research.

Sales engineers

The Oxford English Dictionary gives the definition of sales engineer as follows: Those who sell the company's products or promote sales business as their job.

Generally speaking, it refers to those field personnel who engage in common sales business (or are called salespersons.) Its synonyms are: sales person, sales representative, account executive, field representative, sales specialist, sales consultant, and external affairs man. No matter what the title, the main responsibility of this position is not only to help or develop customers' future purchase of products or services, but also to develop and maintain communication between the enterprise and its customers.

Armstrong and Kolter (2005) stated that, there are six duties for the sales person: prospecting, communication, selling, service, information gathering and allocating. As for the sales persons' functions, in the concept of marketing, they are more important than activities such as advertising, publicity and promotion. That is, because sales persons are generally more friendly, flexible and mobile (Taylor, 1978). Kolter (1986) also indicated that sales persons are not only the communicative bridge between the enterprise and the customers, but also re-present the reputation and credibility of the company. The sales engineers of the semiconductor industry should similarly perform the above six duties in line with other industries. In addition, they must also have a professional engineering background such as in electrical machinery, electronics, optoelectronics, materials, the chemical industry or automatic control, because of the specialty of the industry. Thus, they will be able to offer appropriate technical explanations and support to the customers. Specialization in engineering is helpful in opening up relationships with new customers and establishing good communication in order to maintain excellent cooperation. It is also beneficial to the carrying out of sales projects.

Generally speaking, if sales engineers want to carry out their duties and goals effectively, they should possess the following: expression and communication abilities, negotiation, consultation and discussion abilities, inter-personal relationship abilities, problem solving abilities, rich merchandise knowledge, and a good service attitude (Boyatzis, 1982; Brown, 1993; Saxe and Weitz, 1982; McGee and Spiro, 1988).

Competency research

In the previous research, the majority of scholars agree that competency is regarded as the related knowledge, skills and personal specialties required to carry out jobs and their duties (Wang and Niu, 2010; Lado et al., 1992). Knowles (1980) raised the point that competency means performing a specific function or job, which involves the necessary knowledge, personal values, skills and attitudes. McLangan (1980) suggested that competency is a series of knowledge, skills and abilities which combine well to complete the main work results. Bjoyatzis (1982) also indicated that competency is the difference displayed in jobs. In sum, competency can affect a person can affect a person in their work and in exhibiting highly effective or outstanding specialties.

Spencer and Spencer (1993) believed that competency is a potential personal specialty. There is a very deep causal relationship between these specialties and work performance. Potential specialty means that competency plays a deep and lasting role in personality, and can forecast a person's behavior and performance in a complicated working situation, as well as their ability to bear heavy responsibility. Causal relationship means that competency can be used to forecast achievements and performance. Reynold (1993) indicated that on the basis of personal specialty, competency is the employee's personal potential field, and it can help the employees successfully accomplish their jobs or reach the expected output standard. Furthermore, Ralelin and Cooledge (1995) emphasized that, competency refers to some personal specialties such as sensitivity, creativity and intuition, including the organic ability to "learn and learn", which are not so easily observed. If competency does not have lasting learning ability, it will gradually lose its effect. Therefore, it can be improved through training.

Parry (1998) had the same opinion on this issue, defining competency as the combination of the main related knowledge, attitude and skills which influence personal work, and which is related to work achievements. In addition, it can be measured by an accepted standard and be improved through training and development. Catano (1998) collected and arranged the different definitions of competency from the research and summed up the three common points: competency is the KSAOs (knowledge, skills, abilities, and other characteristics) hidden within effective and successful work performance. Not only can these qualities be observed, but they can also be used to distinguish between ordinary and outstanding achievements. The study can therefore, say that competency can be defined as (1) knowledge, skills and ability, (2) its range includes personal motivation, specialty, skills, self-image or social roles, (3) it can distinguish between ordinary and outstanding performance, and (4) it can be measured and improved through training and development.

Since competency is the main reason leading to workers' advantages in performance (Parry, 1998), and since it influences behavior so immensely, if a measurement standard can be developed, not only can competency forecast work achievements and be applied to analyze the conditions to recruit employees, but it can also decrease the damage to the organization of inadequate talent, later on.

The content of competency

In general, there are five aspects of competency: motivation, specialty, self-concept, knowledge and skills (Spencer and Spencer, 1993). Analyzing the types of competency has practical meaning in planning human resources within an organization. The most important concept in studying competency is to forecast behavior. People can make use of it to choose qualified competent employees to serve in specific positions, which will provide a great deal of direct and actual help to the enterprise.

Competency of knowledge, motivation, specialty and self-concept can be used to forecast behaviors and skills according to Spencer and Spencer's theory (1993), and these behaviors will bring out the best work results. Competency includes intention, and intention is the first cause of motivation or specialty. Such powers can produce plentiful action-driven performance and lead to positive results. This study segments competency into knowledge, abilities and specialties, according to the mentioned definition.

Framework of competency classification

Kolb (1971) argued that experiential learning is the individual particular cognition and way of dealing with messages. Through the interactive influence between the learner and learning environment, it can cultivate a very steady reaction. Usually it includes personal perception types, feelings, characteristics and specialties of physiological habits. Specialty is the message dealing structure developed through experiential learning. From this perspective there are four types of competency inclu-ding concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and active experimentation (AE) (Kolb, 1971). Furthermore, besides retaining these four dimensions and adding one more, "development learning", Yamazaki and Kayes (2004) evolved and inferred from this model, adding one concept of development and learning to include two skills of "adapting ability and flexibility" and "managing pressure."

Competency contradicts the traditional concept that it is intelligence which mainly influences work performance. It also consists of explicit action skills with tacit characteristics, values, feelings or attitudes and potentially developed abilities in the future. The knowledge, skills and characteristics which a person possesses are associated with their jobs. They are closely linked with the content of the job he/she undertakes and the situations of the organization and causal relationship of ability and work performance. These competencies can be developed and promoted through training and learning, and are the key factors which influence working performance. Competency comes mostly from learning and experience, therefore, this research adapts Yamazaki and Kaves' (2004) experiential learning model, after adjustment to the framework of analysis, to make competency classification more unequivocal. In addition, Standberg (2000) argued that, competence is hierarchical since the attributes within each conception of a task differ, based on a study of 50 engine engineers at the Volvo Car Corporation in Sweden. In this study, therefore, we

Table 1. The semi-conductor industry value chain.

Manufacturers	Upstream	---					Downstream		Six IC application market
Products framework and standards establishment	IC design tools	Core IP obtainment and development IC design and integration	System gradation integration	TMA production	Wafer production skills	Wafer packaging	Wafer testing	Production/assembly/management	-Information and electronics -Communication electronics -Consumer electronics Industrial electronics Car electronics -National defense
System manufacturer	EDA (electronic design automation)	IP supplier IC design service manufacturer	IC design manufacturer	TMA supplier	Wafer foundry	Packaging manufacturer	Test manufacturer	System manufacturer/OEM manufacturer	IC application market

Source of information: Directorate-General of Budget, Accounting and Statistics, Executive Yuan, R.O.C.(Taiwan), National Statistics Bulletin.

distinguish engineers according to three distinct groups: upstream, midstream and downstream.

METHODOLOGY

Objects of study and sampling

The scope of this study is the semiconductor industry, a whole outline of which is given in Table 1. The industry can be divided into upstream, midstream and downstream businesses, of which the upstream factory owners frame and establish standards for products such as IC design tools, and are IC providers and IC design manufacturers. The midstream includes TMA (Transparent Media Adapter) suppliers, wafer foundries, and related equipment, material and consumable suppliers. The downstream businesses are involved in packaging, test manufacturing and end-market applications. Also provided is information about the output value of the industry which is used to decide on the sampling ratio, as shown in Table 2.

The titles and the related business differ for the interviewees in different companies. Therefore, the study chose the interviewees according to the definition of sales engineer from the standard occupation classification in the US Labor Department website, that is to say, those respon-sible for selling products or services and who must have a technical background or engineering bachelor degree, to assure they are qualified and do actually perform the job of "sales engineer". During the interview procedure, the study avoided questions related to management jobs. The interviewees' basic information is shown in Table 3.

Design and method of interviews

The research used a content analysis approach. After selecting the interviewees, the study informed them of the purpose of the research, the interview questions and the interview methods in written form before the interview took place, in order for them to prepare and understand in advance. The interview procedure was carried out according to the sequence of the questions. In principle the study avoided interrupting the interviewees' thinking, allowing them to complete their answers. When the inter-viewees indicated that they were not clear about or did not understand a question, the researchers explained the inter-viewing purpose of the question to help them answer to the point. In addition, the researchers inquired interactively

iwith the interviewers to be sure to obtain complete answers to the questions. Each interview took between one and a half hours. The interview content and procedure were sound-recorded, and notes were made on the spot throughout the process. The interviews were then transcribed, and if there was any ambiguity or any data missing, the researchers contacted the interviewees again by phone to ensure the correctness of the content.

The written drafts were assigned serial numbers word by word, and line by line, on the basis of the interviewees' an-swers, and were then analyzed using the content analysis approach. At first, the content was assigned numbers sentence by sentence and then classified according to the research questions. Then the researchers generalized the results of each research question and analyzed the interview content through objective and organizational me-thods, to achieve the goal of equally emphasizing quality and quantity.

Design of the interview questions

In order to understand the research questions, Interviewing goals of this research were as follows: To understand the interviewees' industry and the sales engineers' work

Table 2. Industry upstream, midstream and downstream sampling ratio (Unit: 100 million U.S. dollars).

Corp. business type	Position	2006 Revenue	Percentage (%)	Sample size
Revenue		422	100	15
IC design	Upstream	95	23	4
IC manufacture	Midstream	233	55	7
IC packaging IC testing	Downstream	93	22	4

Table 3. Interviewee profiles.

No.	Position in Industrial chain	Corp. business type	Department	Title
A	Upstream	System operator	Sales and service	Manager
B	Upstream	IC design	Sales	Engineer
C	Upstream	IC design	Product sales	Product marketing assistant manager
D	Upstream	EDA	Sales	Sales manager
E	Midstream	Mask manufacturer	Sales	Technical services project manager
F	Midstream	Foundry	Sales/ engineering services	Assistant manager
G	Midstream	Foundry	Sales/ manufacturing services	Project assistant manager
H	Midstream	Foundry	Sales	Sales project assistant manager
I	Midstream	Equipment manufacturer	Sales	Senior sales engineer
J	Midstream	Equipment manufacturer	Sales	Senior sales engineer
K	Midstream	Equipment manufacturer	Sales	Deputy general manager
L	Downstream	Wafer testing	Sales	Project assistant manager
M	Downstream	Wafer packaging	Sales	Sales engineer
N	Downstream	Wafer packaging testing	Testing/ sales	Senior engineer
O	Downstream	Application	Sales	Assistant manager

content, quality, factors of success, and some practical working behavior examples. The interview outline was developed according to the interview purposes: (1) Explain the interview purposes and forms, (2) Ask the interviewees to describe their most important jobs and their duties, (3) Ask the interviewees to describe in detail their most crucial personal experience (either success or failure), (4) Describe the qualities and related situations and conditions the sales engineers need, (5) Thank the interviewees and digest the important events, then reflect on and generalize the data to make conclusions (Table 4). Before forming the formal interview questions, the researchers carried out three interviews in advance and then revised the questions according to the interview results and the interviewees' suggestions. Eventually, 11 interview items were settled on.

CONTENT ANALYSES AND RESULTS

Job analysis

This research generalizes sales engineers' work content into 15 main tasks through content analysis. These tasks are: product research and development, looking for new clients, selection of new clients, visiting clients, standards clarification, quotation and price negotiation, preparation before production, taking clients' formal orders, production

coordination, delivery, collection of related information, maintenance of client relationships, business sales prediction, handling problems, and other tasks. Details of each of these tasks are given subsequently and a summary is provided in Table 5.

Product research and development

A total of 25% of the interviewees must execute product research and development work, which includes: (1) product planning, (2) preparation before stepping into the market (competitors, price, frame of the product cost and price making), (3) production completion (first-class clients' sales), and (4) understanding the development project of the products.

Looking for new clients

In all, 73% of the interviewees have to execute this assignment, and the sources of ordinary clients include: (1) commercial agents' personal connections and clients, (2) if the original clients have demand and recommend products

Table 4. Interview outline, purposes and items.

Item	Question	Purpose
The position in the organization, the relationship with the members in the organization, division of labor	What is your professional title? Who is your supervisor? Do you have subordinates?	The inside relationship between sales engineers in the semiconductor industry and the organization to understand the influence of the environment on sales engineers' competency.
	What is the relationship between your position and that of the staff mentioned? What do the other staff members do? How do you divide your work?	
Understand the main working content, quality and importance of the sales engineers	What is your main working content? How do you arrange the time and importance of the work?	Find out the qualities needed from work analysis.
Relationship with clients.	What companies are your main clients? How do you get in touch with them?	To understand the competencies needed from the relationship with clients.
Causes of success and failure.	Give some examples of success and explain the content and the reasons for the success.	Match the sales engineers' knowledge, skills, characteristics, motivation, attitudes, values and self-concepts through the information.
	Give examples of cases that failed and explain the content and the reasons for the failure.	
The important characteristics of high achieving sales engineers.	How do you judge the pros and cons of your job performance?	There is a causal relationship between competency and achievements on the basis of documents.
	What is the difference between good and ordinary sales engineers?	
To understand the characteristics and competency needed based on past experience.	What is the professional background needed? Do you have other qualifications or special professional talents?	To understand competency (knowledge, skills and characteristics) from the interviewees' experience.
	What are the abilities needed by new recruits?	
To understand the supporting systems.	What kind of personal skills and supporting systems do you need?	To understand the characteristics and competencies needed through inquiring about the support system demands.

products to others, (3) personal connections, (4) directly ordered by supervisors, (4) from newspapers and magazines related to the industry (for example, new companies producing new products), (6) unknown telephone contacts (the operators' target company connects the staff or supervisors to the appropriate department), (7) asking users to introduce their supervisors, and (8) connected actively by clients.

Selection of new clients

Not permitted to grant favors to any company that asks, 27% of the interviewees must select new clients according to the regulations of their company; these

regulations include: (1) if they are a potential company, (2) if they can afford the capacity, (3) the clients' payment ability is confirmed through credit checks with the Department of Financial Affairs, and (4) a final decision made by the supervisors once they have further understanding and have considered the case.

Visiting clients

A total of 93% of the interviewees must perform this aspect of the job, which has three stages: first visit, formal visit, and follow-up after visiting the clients. There are 33% of the interviewees who execute first visits, while the others go directly into formal visits.

Table 5. Sales Engineers' major projects and content.

Major projects and content	Upstream		Midstream		Downstream		Sum	%
	No.	%	No.	%	No.	%		
Product R&D	3	25	-	-	-	-	3	25
Looking for new clients	3	75	6	86	2	50	11	75
Selection of new clients	1	25	1	14	2	50	4	27
Visiting clients	4	100	7	100	3	75	14	93
Standards clarification	4	100	7	100	4	100	15	100
Quotation and price negotiation	4	100	7	100	4	100	15	100
Preparation before production	2	50	4	57	3	75	9	100
Taking clients formal orders	4	100	7	100	4	100	15	100
Production coordination	1	25	6	86	3	75	10	67
Delivery	2	50	2	29	1	25	5	33
Collection of related information	3	75	6	86	2	50	11	73
Maintenance of client relationships	3	75	5	71	4	100	12	80
Sales forecasting	-	-	2	29	2	50	4	27
Handling problems	4	100	7	100	3	75	14	93
Others	3	75	5	71	3	75	11	73

Standards clarification

Sales engineers are the connection between the clients and the company. They are also the order producers. Therefore, standards clarification is a must when performing their job. Among the interviewees, 40% are non-manufacturers, or they have already developed mature products. Thus in the work of this stage, they put stress on the assurance of the standards needed.

Quotation and price negotiation

Some of the interviewees must execute the duties of quotation and price negotiation as part of their job. Price making is a special task for those interviewees who have the ability to develop products, so it only applies to 7% of the sample. The regulation for establishing price is production cost plus gross profit, which is usually around 30%, mainly for research and development costs. As for the clients' quotation, generally speaking, it cannot be below the established price. However, there is some room for price negotiation in situations such as the following: large quantity, market price variation, the cost of raw materials, the market share rate and the clients' goal price. In the end, price negotiation is used to decide the final price.

Preparation before production

For 60% of the interviewees, their clients need to develop new products. The executive steps are as follows: (1) pre-production preparation and testing before mass production, (2) discussion between the engineering departments of both sides, (3) product testing, (4) the clients' testing and verification of the products, (5) problem correction, and (6) sending the samples to the clients for testing and verification.

Taking clients' formal orders

These are the steps related to clients' formal orders that the sales engineers should execute: (1) sign a contract and formal order to purchase, (2) negotiate contract and payment conditions, (3) make a judgment on whether to accept the order or not, and (4) communicate with the factories to start producing. Usually the main emphasis of their job is signing the contracts, deciding the orders and negotiating payment conditions.

Production coordination

In this stage, the main jobs executed are communicating and coordinating the production situations with the clients and the manufacturers, clarification to the internal units, and sending messages to clients.

Delivery

For this aspect of their job, sales engineers are responsible for the explanation, coordination and investigation when something goes wrong with the delivery. In addition, they should demonstrate the functions of the products on delivery to prove that they meet the clients' demands.

Collection of related information

In all, 73% of the interviewees must carry out the task of collecting information about the industry, clients and

Table 6. Sales engineers' required abilities, characteristics and knowledge.

Abilities, characteristics, knowledge	Upstream		Midstream		Downstream		Sum	%
	No.	%	No.	%	No.	%		
Abilities								
Sense	4	100	6	86	4	100	14	93
Establishing connections	2	50	7	100	4	100	13	87
Technical expertise	4	100	7	100	-	-	11	73
The capacity to convert messages to information	3	75	5	71	3	75	11	73
Maintenance of interpersonal relationships	4	100	4	57	3	75	11	73
Organization and coordination	2	50	5	71	3	75	10	67
Customer information collection, transfer, exchange	4	100	4	57	2	50	10	67
Market information collection, transfer, exchange	2	50	5	71	3	75	10	67
Logical analysis	3	75	4	57	2	50	9	60
Bargaining power and negotiation skills	1	25	4	57	3	75	8	53
Sales techniques	-	-	6	86	2	50	8	53
Problem solving ability	-	-	5	71	3	75	8	53
Ability to communicate and convince	2	50	4	57	2	50	8	53
Capacity for teamwork	2	50	3	43	3	75	8	53
Internal information collection, transmission, exchange	2	50	2	29	3	75	7	47
Planning and implementation capacity	4	100	-	-	3	75	7	47
Mood control ability	3	75	1	14	3	75	7	47
Ability to interpret messages	-	-	4	57	3	75	7	47
Learning ability	2	50	2	29	2	50	6	40
Ability to bear pressure	3	75	2	29	1	25	6	40
Frustration bearing and self-encouragement	2	50	-	-	4	100	6	40
Ability to be flexible	-	-	3	43	2	50	5	33
Ability to cope with social communication	4	100	-	-	1	25	5	33
Ability to integrate information	-	-	3	43	-	-	3	20
Ability to influence others	3	75	-	-	-	-	3	20
Ability to provide personal advisory services	-	-	-	-	3	75	3	20
Forging language	1	25	1	14	-	-	2	13
Ability to manage the expectations of others	2	50	-	-	-	-	2	13
Ability to put up with uncertainty	2	50	-	-	-	-	2	13
Information verification skills	-	-	2	29	-	-	2	13
Ability to grasp the situation of sales cases	-	-	2	29	-	-	2	13
Ability to look for resources and third-parties	-	-	2	29	-	-	2	13
Consideration of actions from the company's point of view	-	-	2	29	-	-	2	13
Business determining based on corp. long-term perspectives	-	-	-	-	2	50	2	13
Ability to face conflict	-	-	-	-	2	50	2	13
Market planning capacity	-	-	1	14	-	-	1	7
Response capacity	-	-	1	14	-	-	1	7
Paperwork capacity	-	-	1	14	-	-	1	7
Ability to standardize concepts	-	-	-	-	1	25	1	7
Observation	1	25	-	-	-	-	1	7
Sensitivity	1	25	-	-	-	-	1	7
Associative thinking		25	-	-	-	-	1	7
Characteristics								
Goal-oriented	3	75	4	57	4	100	11	73
Energetic	4	100	4	57	2	50	10	67
Focus on customer service	-	-	4	57	4	100	8	53
Honest	2	50	3	43	2	50	7	47
Enthusiastic	1	25	4	57	-	-	5	33

Table 6. Contd.

Friendly	2	50	2	29	-	-	4	27
Can place oneself in others' positions	3	75	-	-	-	-	3	20
Obliging and sharing	3	75	-	-	-	-	3	20
Interpersonal orientation	-	-	-	-	3	75	3	20
Sense of accomplishment	-	-	2	29	1	25	3	20
Sense of responsibility	-	-	2	29	-	-	2	13
A high degree of completion of tasks	2	50	-	-	-	-	2	13
Respectful	1	25	-	-	-	-	1	7
Creative and flexible	1	25	-	-	-	-	1	7
Self-confident	1	25	-	-	-	-	1	7
Sense of humor	1	25	-	-	-	-	1	7
Serious	-	-	1	14	-	-	1	7
Agile thinking	-	-	-	-	1	25	1	7
Confident	-	-	-	-	1	25	1	7
Responsible	-	-	-	-	1	25	1	7
Loyal	-	-	-	-	1	25	1	7
Knowledge								
Industry knowledge	-	-	4	57	-	-	4	27
Commercial	1	25	-	-	-	-	1	7
Knowledge in unidentified fields	1	25	-	-	-	-	1	7

competitors. The information sources are: (1) clients, (2) research reports, investment reports, financial and economic news, (3) the dealing manufacturers, and (4) people other than their clients. Moreover, they have to protect the information from being pirated by illegal competitors.

Maintenance of client relationships

A total of 80% of the interviewees are responsible for maintaining client relationships. The methods they use are mostly regular visits and communication with the clients. Besides, they have to receive and take care of clients from abroad, including being responsible for flight arrangements, meals and social activities, hotel and restaurant arrangements, etc. They maintain better relationships with the clients in these ways in order to exchange information with them.

Sales forecasting

In the sample, 27% of the interviewees put much stress on the task of business sales prediction. They mostly lay particular stress on this in the midstream and downstream businesses. Such businesses refer to original materials purchase and capacity arrangement considerations, and are greatly influenced by the economic environment.

Handling problems

Handling problems is one of the most important jobs (93%) for the interviewees, and mainly involves communication with the clients about their demands, clients' complaint handling and the resolution and coordination of major problems.

Other tasks

In all, 73% of the interviewees also have to carry out other tasks as part of their job, including late payment collection and retrieval, as well as sales and promotion jobs.

Competencies needed by sales engineers

Sales engineers' abilities, characteristics and knowledge

After analysis and integration of the data, it was found that there are 42 abilities (Table 6) that sales engineers should have. Of these abilities, more than half of the interviewees share a common view that the 14 most important are: judgment, establishment of personal connections, technological professional ability, ability to transform messages into information, maintenance of interpersonal relationships, organizational coordination ability, clients/market message collection/communication/exchange, logical analysis

Table 7. Semiconductor industry upstream, midstream and downstream sales engineers' competencies.

Adjusted experience learning model	Concrete experience aspect			Reflective observation			Abstract conceptualization			Active experimentation			Development and learning	
	Leading	Relationships	Assistance	Reception	Collection	Analysis	Theory	Quantity	Technical	Goal-setting	Action	Initiative to create	Adaptability and flexibility	Manage stress
Upstream sales engineers' competency	**Abilities** 1. Maintenance of interpersonal Relationships (f =4; 100%) 2. Establishing connections (f=2; 50%) 3. Teamwork capacity (f=2; 50%) **Characteristics** 4. Placing oneself in others' positions (f=3; 75%) 5. Honesty (f=2; 50%)			**Abilities** 1. Customer information collection, transfer, exchange (f=4; 100%) 2. Market information collection, transfer, exchange (f=2; 50%) 3. Internal information collection, transmission, exchange (f=2; 50%)			**Abilities** 1. Technical expertise (f=4; 100%) 2. Sense (f=4; 100%) 3. Logical analysis capability (f=3; 75%) 4. Capacity to convert messages to information (f=3; 75%) 5. Learning ability (f=2; 50%)			**Abilities** 1. Planning and implementation Capacity (f=4; 100%) 2. Ability to influence others (f=3; 75%) 3. Ability to manage the expectations of others (f=2; 50%) 4. Ability to communicate and convince (f=2; 50%) 5. Energetic (f=4; 100%) 6. Goal-oriented (f=3; 75%) 7. High degree of completion of input tasks (f=2; 50%)			**Abilities** 1. Ability to bear pressure (f=3; 75%) 2. Mood control ability (f=3; 75%) 3. Ability to put up with uncertainty (f=2; 50%) 4. Frustration bearing and self-encouragement (f=2; 50%)	
Midstream sales engineers' competency	**Abilities** 1. Establishing connections (f=7; 100%) 2. Maintenance of interpersonal relationships (f=4; 57%) 3. Ability to cope with social communication (f=4; 57%) 4. Teamwork capacity (f=3; 43%) 5. Looking for resources and third-parties (f=2; 29%) **Characteristics** 6. Enthusiasm (f=4; 57%) 7. Obliging and sharing (f=3; 43%) 8. Honesty (f=3; 43%) 9. Friendliness (f=2; 29%)			**Abilities** 1. Market information collection, transfer, exchange (f=5; 71%) 2. Customer information collection, transfer, exchange (f=4; 57%) 3. Ability to interpret messages (f=4; 57%) 4. Ability to integrate information (f=3; 43%) 5. The skill to verify messages (f=2; 29%) 6. Ability to grasp the sales cases (f=2; 29%) 7. Internal information collection, transmission, exchange (=2; 29%)			**Abilities** 1. Technical expertise (f=7; 100%) 2. Sense (f=6; 86%) 3. Capacity to convert messages to information (f=5; 71%) 4. Logical analysis capability (f=4; 57%) 5. Learning ability (f=2; 29%) **Knowledge** 1. Industry knowledge (f=4; 57%)			**Abilities** 1. Sales techniques (f=6; 86%) 2. Organization and coordination capacity (f=5; 71%) 3. Problem solving ability (f=5; 71%) 4. Ability to communicate and convince (=4; 57%) 5. Bargaining power and negotiating capacity (f=4; 57%) 6. Consideration of the company's point of view (f=2; 29%) **Characteristics** 7. Energetic (f=4; 57%) 8. Goal-oriented (f=4; 57%) 9. Focus on customer service (f=4; 57%) 10. Sense of Accomplishment (f=2; 29%) 11. Sense of responsibility (f=2; 29%)			**Abilities** 1. Ability to be flexible (f=3; 43%) 2. Frustration bearing and self-encouragement (f=3; 43%) 3. Ability to bear pressure (f=2; 29%)	

Table 7. Contd.

Downstream sales engineers' competency	Abilities	Abilities	Abilities	Abilities	Abilities
	1. Establishing connections (f=4; 100%) 2. Maintenance of interpersonal relationships (f=3; 75%) 3. Teamwork capacity (f=3; 43%) 4. Provision of personal advisory services (f=3; 75%) **Characteristics** 5. Interpersonal orientation (f=3; 75%) 6. Honesty (f=2; 50%)	1. Market information collection, transfer, exchange (f=3; 75%) 2. Internal information collection, transmission, exchange (f=3; 75%) 3. Ability to interpret messages (f=3; 75%) 4. Customer information collection, transfer, exchange (f=2; 50%)	1. Sense (f=4;100%) 2. Capacity to convert messages to information (f=3; 75%) 3. Learning ability (f=2; 50%) 4. Logical analysis capability (f=2; 50%) 5. Business determining based on corp. long-term perspective (f=2; 50%)	1. Problem solving ability (f=3; 75%) 2. Organization and coordination (f=3; 75%) 3. Bargaining power and negotiating capacity (f=3; 75%) 4. Planning and negotiating capacity (f=3; 75%) 5. Sales technique (f=2; 50%) 6. Ability to communicate and convince (f=2; 50%) **Characteristics** 7. Goal-oriented (=4; 100%) 8. Customer service tendency (f=4; 100%) 9. Energetic (f=2; 50%)	1. Frustration bearing and self-encouragement (f=4; 100%) 2. Mood control ability (f=3; 75%) 3. Ability to face conflict (f=2; 50%) 4. Ability to be flexible (f=2; 50%)

ability, price negotiation ability, sales skills, problem solving, communication, persuasion and team work.

There are 21 personality characteristics, of which three were mentioned by over half of the interviewees, namely being goal oriented, being active and constructive and focusing on client service. Among them, the upstream interviewees commonly believe that being active and constructive is a "must have" characteristic, while the midstream interviewees differ widely in their opinions, with no common characteristics identified. The items that were mentioned by the most midstream interviewees were goal orientation, being active and constructive, focusing on client service and enthusiasm. The downstream interviewees believe in common that goal orientation and focusing on client service are indispensable characteristics.

In terms of knowledge, the interviewees believe that sales engineers should have industry knowledge, as well as commercial and industrial knowledge and knowledge in other undefined fields. Among these, more midstream interviewees consider industry knowledge as a must. The study omits the other two items because of insufficient sample (Table 7).

Sales engineers' competencies

The research used descriptive statistical analysis to encode and analyze the data from the transcripts. Based on this analysis, the study have developed upstream, midstream and downstream sales engineers' competency charts (Tables 8) for the semiconductor industry according to the competency content through the adjusted experiential learning models (concrete experience, reflective observation, abstract conceptualization, active experimentation, and development and learning) presented by Yamazaki and Kaves (2004). The study decided to omit only one interviewee from the statistical analysis. After integrating all the information, the study eventually obtained a model of sales engineers' competency within the semiconductor industry.

Concrete experience concept

There are six abilities in this concept: maintenance of interpersonal relationships, establishment of personal connections, team work ability,

Table 8. Semiconductor industry sales engineers' competencies.

Adjusted experiential learning model	Concrete experience	Reflective observation	Abstract conceptualization	Active experimentation		Development and learning aspect	
	LeadingRelationshipsAssistance	ReceptionCollectionAnalysis	TheoryQuantityTechnical	Goal settingAction	Initiative to create	Adaptability and flexibility	Manage stress
Sales engineers' competencies	**Abilities:** 1. Maintenance of interpersonal relationships 2. Establishing connections 3. Teamwork capacity 4. Provision of personal advisory services 5. Ability to cope with social communication 6. Looking for resources and third-parties **Characteristics:** 1. Placing oneself in others' positions 2. Honesty 3. Interpersonal orientation 4. Enthusiasm 5. Obliging and sharing 6. Friendliness	**Abilities:** 1. Market information collection, transfer, exchange 2. Customer information collection, transfer, exchange 3. Internal information collection, transmission, exchange 4. Ability to interpret messages 5. Ability to integrate 6. The skill to verify messages 7. Ability to grasp sales case situations	**Abilities:** 1. Technical expertise 2. Sense 3. Logical analysis capability 4. Capacity to convert messages to information 5. Learning ability 6. Business determining based on corp. long-term perspective **Knowledge:** 1. Industry knowledge	**Abilities:** 1. Planning and implementation capacity 2. Ability to influence others 3. Ability to manage the expectations of others 4. Ability to communicate and convince 5. Consideration of the company's point of view 6. Problem solving ability 7. Organization and coordination 8. Bargaining power and negotiating capacity 9. Sales techniques **Characteristics:** 1. Energetic 2. Goal-oriented 3. High degree of completion of input tasks 4. Customer service tendency 5. Sense of accomplishment 6. Sense of responsibility		**Abilities:** 1. Ability to bear pressure 2. Mood control ability 3. Putting up with uncertainty 4. Frustration bearing and self-encouragement 5. Ability to face conflict 6. Ability to be flexible	

offering of individual consultancy service, social ability, and the ability to find sources and assistance. Additionally, there are six characteristics: placing oneself in others' positions, honesty, interpersonal orientation, enthusiasm, being accommodating, sharing and friendliness.

Reflective observation concept

There are seven abilities in this concept, including observation of the market, observation of clients, inside information collection/ communication/ exchange abilities, information explanation ability, information integration ability, information verification skills, and management of sales cases.

Abstract conceptualization concept

There are six abilities related to this concept: professional technical ability, judgment, logical analysis, the ability to transform messages into information, learning ability, and basing judgments on the long-term perspective of the enterprise. Knowledge refers to industry knowledge.

Active experimentation concept

There are nine abilities in this concept: scale and operation ability, the ability to influence others, the ability to manage others' expectations, communication and negotiation ability, sales ability, considering operations from the perspective of the company, the ability to solve problems, organizational coordination ability, price negotiation and negotiation ability, and sales skills.

Additionally, there are six characteristics: being active and energetic, being goal-oriented, enthusiasm for completing missions, focus on client

service, being achievement-oriented and being responsible.

Development and learning concept

There are six abilities in this item: the ability to bear pressure, mood control ability, the ability to deal with uncertainty, the ability to bear frustration and self-encouragement, the ability to face conflict, and the ability of flexible management. Following is a further comparison of the similarities and differences among the competen-cies of sales engineers of upstream, midstream and downstream manufacturers. Only one item in the five development concepts is the same for all three levels, but there are three or four similar items in the other concepts. Moreover, no matter what position the sales engineers hold in the industry, they must have the following ten abilities: interpersonal relationship maintenance, personal connections establishment, teamwork, client/market/ inside message obtainment/communication/collection, judgment, logical analysis ability, ability to transform messages into information, learning ability, ability to plan and execute, communication and persuading ability, and the ability to bear frustration. In addition, there are three shared characteristics, namely honesty, being active and energetic, and being goal-oriented.

The major difference between the levels is that the upstream sales engineers' competency is comparatively simpler than that of the midstream and downstream sales engineers for the aspect of concrete experience. This is because the upstream industry puts more stress on professional technique, and comparatively less stress on relationship maintenance. In the aspect of abstract conceptualization, they put more stress on professional technical ability. Apparently, they are different from the midstream and downstream sales engineers in terms of the aspect of active experimentation. They emphasize the ability to influence others, to manage others' expectations and to be enthusiastic about completing missions. The study can assume that because the types of products tend to be developed from scratch in the upstream Industry, uncertainty bearing is their concrete competency in terms of the aspect of development and learning.

For the concrete experience concept, the midstream sales engineers put more stress than those in the upstream industry on the competency to set up relation-ships, including social intercourse and dealing ability, finding resources and assistance ability, enthusiasm, friendliness, and obliging and sharing. For the reflective observation concept, they emphasize information integration ability, the skill of verifying messages and the ability to handle sales cases. These abilities and skills become more and more important as you move from downstream to midstream to upstream. As for the aspect of abstract conceptualization, midstream sales engineers demand the same professional technical ability as those

in upstream companies. In terms of the active experimentation concept, they emphasize the ability of commercial behavior, which is quite different from the upstream sales engineers in terms of operation, achievements and being responsible for the company's viewpoint, but it is almost the same as for the downstream sales engineers. Therefore, the study can presume that the midstream sales engineers must have some of the same professional abilities as the upstream sales engineers, and meanwhile, they should also have the ability to complete the sales more constructively.

With respect to the concrete experience concept, the biggest difference between the downstream engineers' competency and that of the upstream and midstream sales engineers is placing importance on personal consultancy service and interpersonal orientation ability. This is not merely related to the inside relationship between the clients and the company, but it even relates to relationships with competitors. The midstream sales engineers' method of setting up relationships is from "formal" to "personalized". In terms of the reflective observation concept, it is obviously less important for midstream sales engineers, as their main goal is to collect and explain the information. The biggest difference in abstract conceptualization is the emphasis on basing judgments on the enterprise's long-term perspective, and there are no professional technical items. The downstream sales engineers also perform the role of staff assistants. They help with capacity prediction and judgment from the perspective of the enterprise, owing to the high maturity of the products being greatly influenced by the market. Thus their job is different from those of upstream and midstream sales engineers. They are however, similar in terms of the active experimentation concept. Its purpose is to complete the sales. Because this technique is fully developed, it can almost be regarded as perfectly competitive conditions. The clients also have several suppliers and they lay particular stress on price competition.

Therefore, they put stress on personal service and relationship establishment, in order to differentiate themselves from their competitors, especially for those decision makers who have simultaneous purchasing and outsourcing authority. It is just because of this difference in their jobs, in terms of the development and learning concept, that the need for sales engineers to have "the ability to face conflict" is apparently different in upstream and midstream companies.

DISCUSSION AND IMPLICATIONS

Competency can be used to effectively discover and affirm an employee's skills, knowledge, personality characteristics and behavior. Due to their understanding of the importance of competency, enterprises include it in their educational training courses, in order to effectively

reach the goals of the organization, and it has become an inevitable tendency recently. Since "competency" has a certain degree of importance in human resource management, it can be used in recruitment decisions, training, development and rewards, but generally it is used more in training and development and it is less discussed in terms of setting up recruitment decision conditions. Hopefully, this primary research can identify some important aspects and effectively present suitable directions for the recruitment of sales engineers in the semiconductor industry.

The results of the comprehensive survey of this research indicate that, there are 42 abilities within the competency of sales engineers in the semiconductor industry. Adjusted according to Kolb's experience learning category, there are in fact 34 abilities, 12 characteristics and 1 kind of knowledge. After including upstream, midstream and downstream differences in the analysis in order to make a complete comparison, the study can find that the sales engineers' core abilities and characteristics in the semiconductor industry are: the maintenance of interpersonal relationships, the establishment of connections, team work, the obtainment, communication and collection of messages from clients, the market and within the organization, judgment, and the ability to bear frustration. There are three main characteristics, namely honesty, being active and constructive, and being goal-oriented.

In addition, judging from the results, the study can see that the sales engineers of the upstream, midstream and downstream businesses have their specific competency demands. The upstream sales engineers require three major abilities, that is influence on others, managing others' expectations, and bearing uncertainty, and they require two characteristics, namely putting themselves in others' positions and enthusiasm to complete missions, while the midstream sales engineers' six abilities are social intercourse and engaging in social activities, integrating messages, confirming messages, controlling sales cases, searching for information and co-workers, and considering operations from the viewpoint of the company. Besides, they have five characteristics, namely enthusiasm, being obliging and sharing, friendliness, achievement and being responsible. Downstream sales engineers' three abilities are providing personal advisory services, having a long-term business perspective, and the ability to face conflict, while the one characteristic is interpersonal orientation. Therefore, interpersonal relationship management is more important in the downstream part of the industry.

In sum, the semiconductor sales engineers' main task is sales; however, in practice, they still follow the traditional concept of needing an educational background in engineering and science, not in sales related skills. In contrast, the general perception of the characteristics of most sales engineers is that they do things by the book, they are not eloquent, and they tend to have poor interpersonal relationships. However, the study has

discovered in this research that these characteristics are contradictory to the semiconductor sales engineers' important qualification that is, "interpersonal relationship management". Therefore, in terms of recruitment, after actually understanding the practical qualities of the work content, recruiters should adjust the requirement for industrial specialization, and instead, establish a more accurate direction for the recruitment of talent and thus hopefully find the most suitable talent for the enterprise.

With the view of competency in semiconductor sales engineers' positions in this research, the study have re-analyzed the specialty and situation of the jobs through observation and interviews, and offer a new direction for the reworking of job descriptions. As for human resource management, the job content of the position should be re-examined and adjusted. The most important issue is the handling of interpersonal relationships and problem solution, followed by the qualification of knowledge and ability in fields related to the semiconductor industry. Semiconductor sales engineers' job descriptions (recruitment, selection, education, training and performance appraisal) should be re-examined and adjusted for the organization to find and retain suitable talent, and to maximize the effectiveness of the organization.

In the previous research, most studies have defined competency in terms of tasks. This research however, generalizes competency through job analysis. The past studies have used different ways to classify competency categories. However, this research adopts a more creative method with the attitude to solve problems based on the concept of experiential learning theory. Therefore the study can analyze sales engineers' competency more clearly.

This research adopts the approach of content analysis. The main principle is to look for new discoveries and correlations. In the situation of a sampling deficiency, this research mainly puts stress on description and comparison with the current situation, but does not discuss causal relationships and development concepts. However, it would be helpful for follow-up researchers to explore these issues in their studies. In addition, the scope of this research is limited to the semiconductor industry, so the results can not necessarily be applied to other industries. The study suggests that follow-up research can be expanded to other industries in order to attain a more complete understanding.

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