Chapter 2

Literature Review

Information system displays its major role in the industry, organization and competitiveness. It is intended to support organizations or individuals to support communication of information within organizations and to be used proactively or strategically.

Especially, at the organizational level, the volume of information and its complexity is increased. It requires careful interpreting information, systematic processing and refined analyses. Increasing the severity of information basically involves development of systems that collect, retrieve and arrange information.

Krajewski and Ritzman (1996) addressed that one of approaches used in achieving cross-functional coordination within organization is improvement to information systems. They can aid coordination. There must be information be conformed to the needs of each functional manager. However, sharing information helps coincide the efforts of employees from different parts of the organization and enables them to make decisions. It also provides input in making decision throughout the organization with advances in information systems such as voice mail, internet, database management system so that people can interact with increasing facilitation.

Gordon (1996) addressed that information technology has enabled the revolution of information. It can reduce cost, increase value of collecting, storing, handling and disseminating information. Database management technology arranges and controls information storage retrieval efficiency. Data communication technology makes the information moves quickly. Therefore, managers who recognize

this technology can make decision wisely about how to use information technology so suit their own information needs and their organizations.

Productivity Enhancement: according to Lee and Larry [9]: "Mc Donnell Douglas spent 10 million to introduce CIM in Florida factory. The computer system automatically schedule manufacturing tasks, keep track of labor, and send instructions to computer screens at work stations along the assembly line. Eliminating paper work led to an increase of 30 percent in productivity. Less than 1 percent of U.S. manufacturing companies have approached full-scale use of CIM, but more than 40 percent are using one or more element of CIM technology."

Global Expand: according to Lee and Larry [9], Toys "R" Us, 1980's, a toy company, realized the communication technology can reduce the barrier of distance. It has expanded its branches in Canada, Singapore, Canada, Hong Kong and other locations since 1984. They all has exchanged information and rely on the same information processing systems. Their information was identical as if they all located in the same area.

Unique Information: according to Lee and Larry [9], Metropolitan Life Insurance Company of America uses the EIS system that updates information in database regularly such as sales information, financial information, corporate budgets and so on. This database has been accessed for business forecasting, to signal missed sales target and examine salespeople's progress report. Development of an EIS system, the information is spread to lower level employees so that they all aware and can access the unique information same as the organizational leaders.

The following section is to explain the background of recording head manufacturing that concerns the development of

the information system for recording head performance test. It also includes appropriate information may be used to improve the product quality and productivity.

2.1 Recording Head Components

According to Denis [3], the recording head component is the key component in magnetic hard disk drives (HDDs). Writing and reading signals are achieved with a gang array of recording heads, each provided with a spring suspension attached to an arm as shown in figure 2.1. The head elements are individually mounted on sliders, which contains elements respond to a change in magnetic field during performing read and write signal.

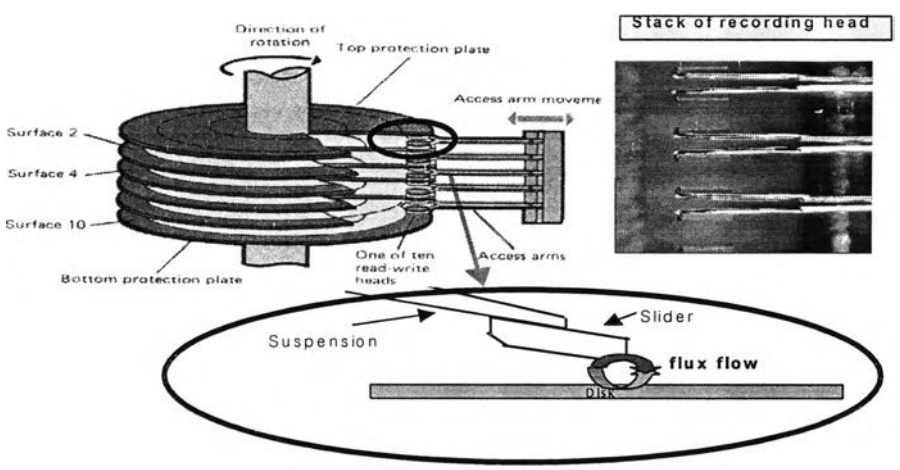


Figure 2.1 Recording head function in a stack of disk drive assembly (Denis [3])

According to the situation of an ever-increasing demand for storage equipment, it affects to high volume build of recording head accordingly. It is also coupled with low quality of recording head as the major problem that require to be tested 100% before assembly into a stack of hard disks. Even though it is considered as the non-value added operation

to screen recording head defects out, its tested signal is the meaningful information to improve productivity and its quality. However, the conventional information system, that manipulate information manually for analysis, solve problem and decision making, did not fully support the situation mentioned above. Therefore, development of an information system to recording head test operation is an advantage to improve organization and its quality.

2.2 Raw Material of Recording Head

FA Engineering STTH-T writes the explanation about recording head components that it is composed of 3 component parts: slider, suspension and FOS as shown in figure 2.2 and called head gimbal bond assembly (HGA).

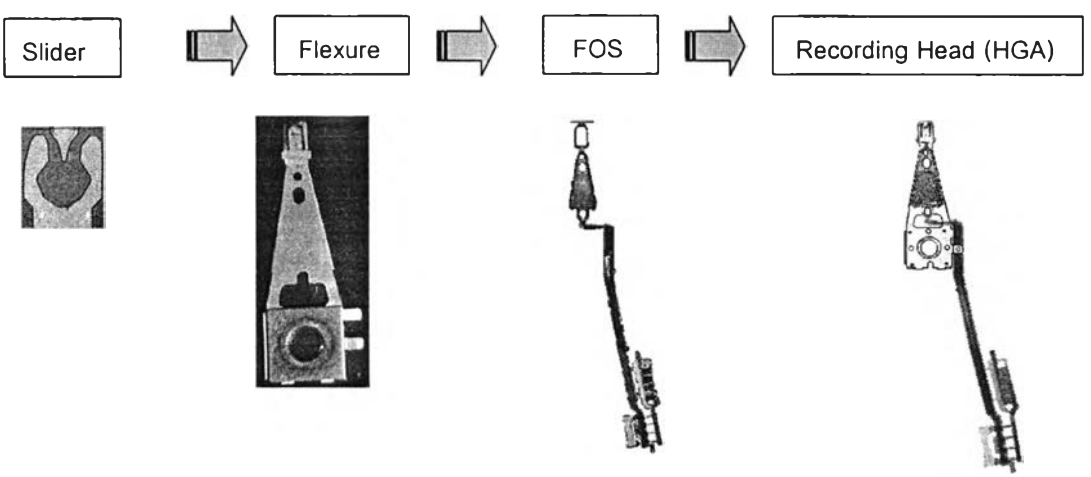


Figure 2.2 Component parts of recording head assembly (HGA) (FA Engineering STTH-T [5])

Slider is the most key component that contains transducer to perform reading and writing signal as described in item 2.1. It is deposited magnetic film, which is fabricated in wafer process. One large wafer holds up to 21,600 sliders, which is cut into bars with as many as 126 bars. Then each bar is cut into sliders. See figure 2.3.

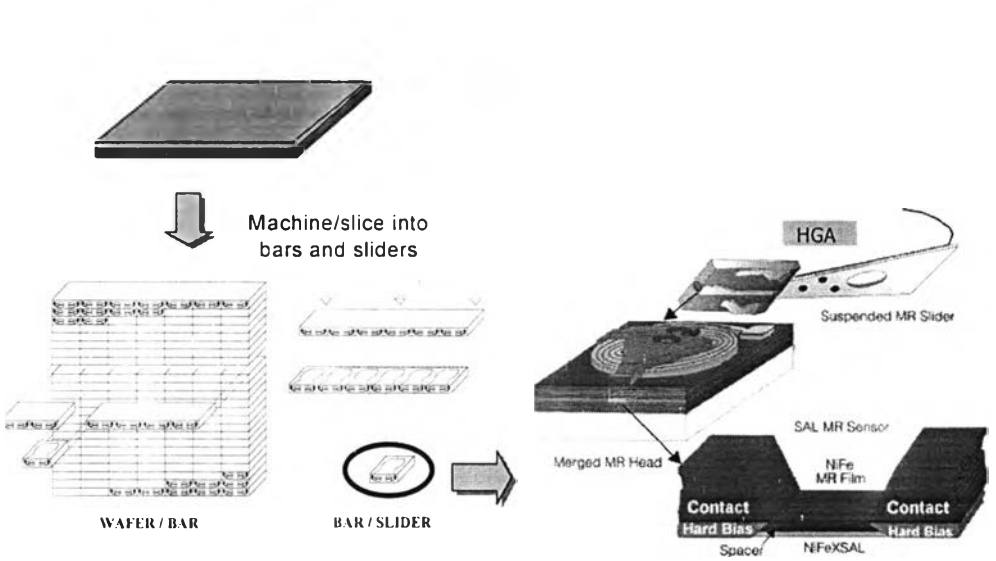


Figure 2.3 Slider and its component as fabricated from wafer process (FA Engineering STTH-T [5])

The wafer manufacturing technique is associated with the process and clean room environment with dust particle control which affect to properties of transducer significantly. However, the process are sequential and the final quality can rarely be tested until HGA is tested.

2.3 Known Fix Variable Concept

According to FA Engineering STTH-T's assert, the known fixed variable concept is called same quad analysis concept in recording head manufacturing. It is relevant to recording heads processed from the same quad of a wafer that is assumed that it has homogeneous performance. So, It can be used to indicate variations that affect to test performance of recording heads.

Typically, the large wafer is defined into 4 quads as shown in figure 2.4a. Each quad will contain 5400 sliders, which is assumed that the performance of the entire quad is identical since they are fabricated at the same time. Therefore, this assumption is used in analysis to determine the root cause by

recall the product type and sequence number as illustrated in figure 2.4b. So, individual slider is identified from wafer built such as lot and batch by serial number marked at its bottom end, will be recorded at the test operation.

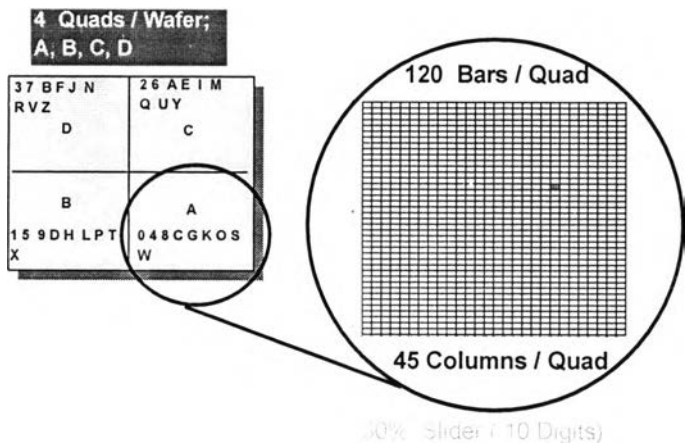


Figure 2.4a Wafer layout (FA Engineering STTH-T [5])

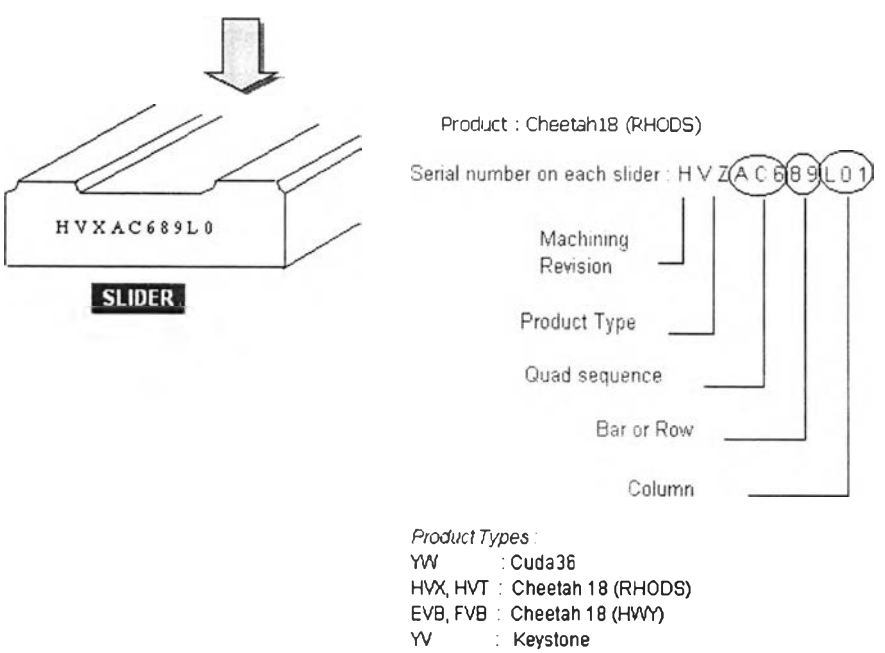


Figure 2.4b Serial number identified on individual slider (FA Engineering STTH-T [5])

2.4 Run Chart

Refer to 6 Sigma Seagate [1], run chart is a tool that shows what occurs over time. It can be used to illustrate the change of recording head that is testing at the test operation. The certain trend or patterns observed on run chart may indicate that special causes are occurring over time. So, it is intended to monitor the stability. If out-of-control or pattern is found, there is strong statistical evidence that the process is changed. However, the process may still be producing good parts.

Basically, there are 8 tests as summarized in figure 2.5, applied to the control charts to detect changes in the process that may occur over time, they uncover the changes differently as follows:

According to 6 Sigma Seagate [1]:

"Typically, only a subset of the 8 tests is applied to control chart interpretation;

>> Test 1 and 5 should be generally applied.

>> Sensitivity to smaller process shifts may benefit from applying Test 2 and 6.

>> Consistent mean shifts may be best detected by Test 4 and 8.

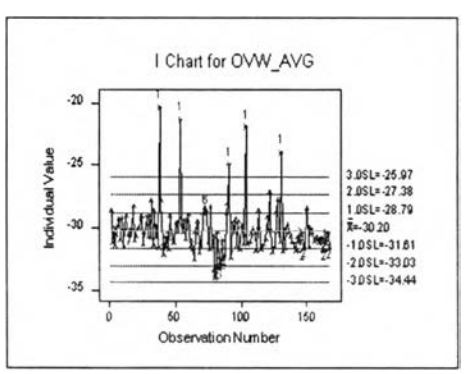
>> Test 2 will uncover an improvement of the process σ.

>> Test 3 should be used if the process inherently drifts."

TEST	Definition
1	One point more than 3 sigma from center linne
2	9 points in a row on same side of center line
3	6 points in a row , all increasing or all decreasing
4	14 points in a row, alternating up and down
5	2 out of 3 points more than 2 sigmas from center line (same side)
6	4 out of 5 points more than 1 sigma from center line (same side)
7	15 points in a row within 1 sigma of center line (either side)
8	8 points in a row more than 1 sigma from center line (either side)

Figure 2.5 Test for special causes (Minitab [11])

Figure 2.6 is an example of the use of run chart with all 8 test applied on a test parameter of a recording head product. It monitors the HGA test process stability over time that is recorded and considered to be unstable. The spike is due to a special cause affecting the process.



TEST 1 One point more than 3.00 sigmas from center line.

Test Failed at points: 38 54 91 104 131

TEST 2 9 points in a row on same side of center line

Test Failed at points: 86 87 88 145 146 147 148 149 163 164 165 166 167 168

TEST 5 2 out of 3 points more than 2 sigmas from center line (on one side of CL).

Test Failed at points: 81

TEST 6 4 out of 5 points more than 1 sigma from center line (on one side of CL).

Test Failed at points: 74 84 85 87 88

TEST 7 15 points within 1 sigma of center line (above and below CL)

Test Failed at points: 16 17

Figure 2.6 HGA parameter test is plotted on control chart in a timely manner and showed the instability performance

2.5 Moving Average

Refer to Warwick [15], the moving average is another tool that can be used to help evaluate the process stability in real time manner at recording head parametric test operation. Number of passed recording head after performing test is considered by plotting the range of the past "n" individual values as described below.

Yield (%) = (quantity of output / quantity of input) x 100

Yield t = $(P_t + P_{t-1} + P_{t-2} + ... + P_{t-n-1}) / (D_t + D_{t-1} + D_{t-2} + ... + D_{t-n-1}) * 100$

WHERE ;

P_t = Passed HGA at time t ; not count for failure

D_t = HGA test in at time t

(Warwick [15])