Relationship Between Job Characteristics and Flow Experience of R&D Personnel: Case study of A High Technology Company in Taiwan

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ABSTRACT

This work is to study the relationship between the job characteristics and flow experience of R&D personnel in order to understand whether or not R&D personnel find it easier to obtain the flow experience due to certain job characteristics, and focuses on the influence of flow experience on R&D performance, in order to provide proper suggestions to the enterprise for reference. This study applies in-depth interviews to collect data. The interviewees are divided into two groups, one is R&D personnel, and the other is the supervisors. The relationship between the job characteristics and flow experience is investigated through the analysis of the contents of the interviews. This study discovered that due to the specific work contents, developers may find it easier to establish flow experience with increased degrees of attention. R&D personnel usually take the challenge and difficulty from the work positively and hence easily obtain satisfaction and achievement psychologically. They enjoy the pleasure obtained from a more constant flow experience. Within the constraints of work efficiency, the flow experience can help R&D personnel improve the work quality, which is beneficial to the R&D performance of the enterprise.

Keywords: Flow experience, job characteristics, in-depth interview

INTRODUCTION

To the enterprise or company, R&D competency may represent competitiveness. In recent years, high quality personnel are always considered as the important resource of the business. R&D personnel themselves play the key role in the competitiveness of their company. Porter (1990) pointed out that in the world of global competition, traditional natural resources and plentiful capital are no longer the main factors of economic advantage, while the formation and application of new knowledge are more important. With the development across time, technology and skill continue to evolve and the difficulty increases. If people want to stand out from the competitive environment, the outcome of R&D should be pioneering. Therefore, the developers will automatically fall into the weeding-out process if they are not enthusiastic. Therefore, the higher the challenge of the development job, the higher the pressure from it. However, why are R&D personnel still highly interested in their jobs? Huang (1988) believed that people who require high growth will accept skillful and highly challenging jobs. Furthermore, some researchers have studied how computer personnel can be stimulated. The research results show that under the self-motivation and requirement, people with the characteristic of high growth need will be easier to be engaged in a job, work towards goals and take challenges involving various kinds of risks and uncertainties (Couger & Zawacki, 1980; Farn, Couger & Sung, 1993).
According to the Job Characteristic Model proposed by Hackman and Oldham (1975), when facing individual or entire outcomes, core dimensions are different due to the effect of individual psychological states. However, the main factors are various due to the different strength of individual growth need. Explicitly, employees with high growth need strength will wish to have a more challenging job, apply self-independent thinking, and pursue self-esteem and self-actualization needs. Besides, via the observation using the Experience Sampling Method, ESM, the Psychologist, Csikszentmihalyi (1990) proposed the flow theory. He indicated that flow experience is a kind of temporary and subjective experience. Moreover, such experience can allow a person to become totally absorbed in an activity. When a person participates in the production activity, his/her focus is so complete that he or she just forgets all about the existence of other issues. The participant is willing to accept challenging jobs and the achievement from it will be much higher than that of the physical return. Such experience will only be appraised on the completion of the task and the participant will obtain great intrinsic pleasure afterwards.

Integrating the viewpoints form the former researchers, certain relationship between the job characteristics and flow experience can be established. This work will include the job characteristics into the study framework in order to investigate which kind of job characteristics will be easier to induce flow experience. From the comprehensive survey of current articles about the relationship of flow experience, in general, the researches basically focused on applying the quantitative method to study the flow experience for Internet browsing or playing online games (Chen, Wigand & Nilan, 1998; Novak, Hoffman & Yung, 1988; Pace, 2007). Very few studies used the method of qualitative interview to explore whether or not there is a relationship between the flow experience of the enterprise’s employees and the job characteristics. In this study, the interviewees were divided into two groups – one is R&D personnel (subordinates) and the other is the supervisors. From the interview contents, it is generalized that certain kind of job characteristics is easier to induce flow experience of R&D personnel, and from different viewpoints among the subordinates and supervisors, analysis is done for the subordinates and supervisors’ perspectives on whether or not the flow experience may influence work performance. The conclusion and recommendations drawn from this study will be provided to the human resources management of the enterprise for their reference.

LITERATURE REVIEW

The Concept and Definition of Flow

The concept of flow was introduced by the psychologist, Csikszentmihalyi, in 1975. In his early stage, the objects of Csikszentmihalyi’s study are artists, athletes, musicians, chess masters and surgeons. Those are the people who select their careers based on their personal pursuits. They usually spend a lot of time and energy becoming engrossed in their work for a long time, gaining great satisfaction from it. According to the flow experience they described, Csikszentmihalyi constructed the flow theory which denotes when people are immersed in the activity they engaged in, since they are completely absorbed in an activity, everything else of the reality surrounding is forgotten and distractions are excluded from consciousness. The sense of time becomes distorted, self-consciousness disappears, and people enjoy the experience of the fulfillment of self-actualization and a gush of inspiration. Csikszentmihalyi described this paramount experience as the “flow experience”. Such experience is the unique psychological experience for human beings and is also called the optimal experience. A scholar has paralleled the flow experience with the peak experience proposed by Maslow, i.e., the especially joyous
and exciting emotion of an individual who is under the status of self-actualization. People under such status may feel as if they are unable to refrain from continuing. After the flow experience, those elements incorporate into a profound pleasure that brings incomparable payback. Indeed, this is the reason why people are willing to continue such kind of activity (Webster & Martocchio, 1992; Webster, Trevino & Ryan, 1993; Csikszentmihalyi, 1990).

According to Csikszentmihalyi’s original definition, flow is that “participants undergo the same kind of experience model; the participants are all attracted into it. Their attention is so focused on the very confined area that some unrelated consciousness and thoughts are filtered out, and their self-consciousness is also lost. They only response to definite and clear target and explicit feedback, and gain the sense of control by manipulating the environment.” Flow consists of two main factors, which are skill and challenge. These two factors have to be balanced, and drive the individual towards a higher and more complicated level. Flow creates a kind of self-harmony and the enjoyment of “union of consciousness and activity”. Since the participants are completely immersed in the activity, they may be able to complete the tasks which would be beyond their ability in normal times. However, the participants are not aware that the challenge of the activity has already exceeded the past manageable level. Such experience will make the participants reconfirm their egos and encourage the individual to make more of an effort to learn the new skills (Csikszentmihalyi & Csikszentmihalyi, 1988; Csikszentmihalyi & Lefevre, 1989).

The Meaning of Job Characteristics

The so-called job characteristics are the job related factors or attributes. Seashore and Taber (1975) considered the scope of job characteristics to be very wide. Such as the job nature, working environment, salary and benefit, job safety, feedback from job, job autonomy, challenge of job, new knowledge learnt from job, opportunity of future development, interpersonal relationship at work, achievement, self-actualization, etc. are all included in job characteristics. Each of these characteristics has different extents of influence on satisfying personal needs.

After conducting many related researches about job characteristics, Hackman and Oldham (1975) proposed the Theory of Job Characteristic Model, JCM. The core of the model is the three critical psychological states: experienced meaningfulness of the work, experienced responsibility for outcomes of the work, and knowledge of the actual results of the work activities. These three psychological states are caused by five core job dimensions including skill variety, task identity, task significance, autonomy and feedback, which can predict the influence of the characteristics on the work performance, work motivation and work satisfaction. The model in Figure 1 shows that the five core dimensions can generate different psychological states, which will affect the individual or work outcome. In addition, Hackman and Oldham (1975) found that employees who work for the jobs with good quality job characteristics could support the continuous growth and development of the individual or the company. This will also improve the work motivation, job achievement, and job satisfaction. Under the stable and sustainable condition, the absenteeism and turnover rate will also be reduced.

Figure 1: Job Characteristic Model

Source: Hackman and Oldham (1975).

Relationship Between Flow Experience and Job Characteristics

Csikszentmihalyi (1999) found that multiple flow experiences under the specific environment do not only increase the intrinsic task interest but also lead to both the positive and delightful feeling. In the 1970’s, Csikszentmihalyi applied the Experience Sampling Method, which originated with him, to collect...
and evaluate the data from 2,300 participants. The study found that the flow experience for adult life usually occurs during the working hours and not during leisure time. When people are in a high challenge, high skill situation, they will find that they are highly concentrated and with certain levels of satisfaction. Usually such a moment occurs during the time they work (Csikszentmihalyi, 1997). The research result of Csikszentmihalyi and LeFevre (1989) about the optimal leisure experience discovered that in general the flow experience induced from work rather than leisure. When the employee experiences flow during his/her work, he or she at that moment feels the significance and value of the task, and his/her performance will be very good.

On the other hand, Ghani and Deshpande (1994) studied the human computer interaction for 149 staff using the variables of concentration, perceived control, perceived challenge and exploratory use. The study shows that there is obvious relationship between sense of challenge together with exploratory behavior and flow experience. The research of Meltzer and Feder (1996) found that the pleasure experience from the perfect completion of a job is just the flow experience achieved form the job, which is one of the most important factors of work. If the job cannot generate any pleasure, it may induce pressure, withdrawal and dissatisfaction.

Consolidating the viewpoints of former studies, it can be concluded that the work progress is possible to drive the participant into a flow state. However, exactly what kind of job characteristics help people enter the flow state is a valuable study topic. This work applies the method of case study and conducts in-depth interviews to generalize the possible reasons, and refers to the other researchers’ study results as the basis of this study in order to introduce the relevant viewpoint for this study.

**METHODS**

**Case Enterprise and Interviewees**

The interviewees of this research are the employees of a high technology Company X in Taiwan. This high technology company was established in 1998; recently the development direction of Company X is mainly divided in three categories, which are R&D in Optical Media, R&D in Polarizer and Product Development in Bio-Medical Business respectively. With the rapid growth of the business, the number of staff has increased substantially. Nowadays, the total number of employees has been over 5,000 on a global scale. The standard of selecting people in Company X should be “honest but wise”. “Wise” means that a person behaves solid knowledge, good ability, good creativity, quick learning, and good efficiency at the workplace. “Honest” means that this person is endowed with a stable personality, a fact seeking nature, and an affirmative work attitude. Great ability should be affiliated to possessing the right attitude. Hence, Company X evaluates a talent under the criteria of their attitude more than professional considerations. The analysis of academic background shows that up to 35% of the employees are master degree holders, 51% of them are degree holders and the others completed the technical college education. Since the scale of its business is so large and there are many departments in the company, further under the constraint of the willingness of the employees to cooperate with the study and selecting the employees who are easy to initiate flow experience, this study mainly focuses on developers, R&D supervisor and human resources supervisor as the research objectives. Table 1 consolidates the basic information of the interviewees.

To conduct more in-depth analysis regarding flow experience, this study adopts the non-quantitative but qualitative method. Berg (1998) indicated that qualitative analysis is a way to explore the connotation of an individual when he or she experiences a specific incident. This method can also support in-depth analysis among the unperceived reasons and facts. The sample selected for qualitative analysis should
meet the criteria of providing “in-depth” and “scope of multi-social realities” information. The sample should follow the sampling principle so that it can represent the population and infer the results to the population (Hu, 2000). From the viewpoint of this study, in order to conduct in-depth analysis of the flow experience of the enterprise’s employees, the information collected from the qualitative analysis should be able to provide a deeper understanding of the consciousness and attitude of the individual (Yin, 1994).

Table 1: The interviewees’ background

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Education</th>
<th>Job Nature</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. A</td>
<td>30+</td>
<td>Degree</td>
<td>R&amp;D</td>
<td>Engineer</td>
</tr>
<tr>
<td>Miss B</td>
<td>30+</td>
<td>Degree</td>
<td>R&amp;D</td>
<td>Engineer</td>
</tr>
<tr>
<td>Mr. C</td>
<td>25+</td>
<td>Degree</td>
<td>R&amp;D</td>
<td>Engineer</td>
</tr>
<tr>
<td>Mr. D</td>
<td>30+</td>
<td>Degree</td>
<td>R&amp;D</td>
<td>Engineer</td>
</tr>
<tr>
<td>Mr. E</td>
<td>35+</td>
<td>Master</td>
<td>R&amp;D</td>
<td>Assistant Manager</td>
</tr>
<tr>
<td>Mrs. F</td>
<td>35+</td>
<td>Master</td>
<td>HR</td>
<td>Manager</td>
</tr>
</tbody>
</table>

Data Collection and Interview Procedure

Besides the principle of “conceptualization”, qualitative research also adopts a sampling method which is different from quantitative analysis. Patton (1990) has discussed that the sample size of qualitative research usually is quite small, or even there is only one case in the sample. Therefore, it requires the “conceptualized” in-depth sampling. Moreover, since the number of samples decreases, only the experienced participants, that is, the comprehensive samples should be selected in order to obtain the most comprehensive response information (Miller & Crabtree, 1992). To collect the required information, there are three major methods of the data collection for qualitative research, which are “observation”, “record” and “interview” (Miller & Crabtree, 1992). Based on the above principles, this study had prepared two versions of questionnaire for subordinates and supervisors. With the consent of the company, the interviews were arranged at the conference room of the company in order to avoid any disturbance from the outside environment. In addition, agreement was sought from the interviewees for recording the conversation of the interview and then the records were interpreted and analyzed. The interview was conducted in semi-structural mode and started with the everyday conversation in order to establish a good interaction and let the interviewees understand the objective of interview under a relaxed and pleasant atmosphere. Explanation and illustration of professional terms were provided to the interviewees in advance in order to avoid the loss of focus of the interviewees due to misunderstanding. Then the interviewees were prompted to provide more in-depth description for each question.

Method of Analysis

The focus of this study is to figure out the similarity and divergence of the answers to the same question from different interviewees. The work content of the participant and his/her social experience are also taken into account for conducting the analysis. Two versions of questionnaire are designed according to the different interviewee groups of R&D subordinates and supervisors. The subordinates and supervisors expressed their opinions in the interviews separately. Via the consolidation and comparison, the important interview contents are selected for further generalization and analysis and being the basis of the conclusion for this study.

RESULTS
The objective of this study is to examine thoroughly the existence of the relationship between flow experience and job characteristics. Through the interview process, the interviewees explained their working conditions and experience. Then after the follow up consolidation, analysis and generalization, the issue of which job characteristic can drive the participant in flow state more easily and the effects of flow experience on work performance are further analyzed.

**Which Types of Jobs do You Think to be Easier to Stimulate Flow Experience?**

During the interview, besides encouraging the interviewees to express their true feeling, the simple answers such as “agreed”, “yes” are also avoided. The interviewees are invited to think thoroughly and recall factual incidents that happened while working, and if they have any special feeling when achieving the flow state. All the R&D personnel in the interview indicated that if the job nature is independent and static, and there is no other disturbance, then the participant is easier to be concentrated and not easy to be distracted. In this case, the chance of achieving the flow state is higher. The supervisor shared the same view that except for the static job nature, the work of R&D staff is mostly independent. When performing the precise operation, the developers always need to be very concentrated, otherwise it may very likely fail.

**Do You Feel That it is Very Easy For You to Ignore Your Surroundings and the Time When You Are Absorbed in Your Task?**

Under the circumstance with clear objective, immediate feedback and balanced challenge and ability, participant’ attention is easy to be focused and devoted. When engrossed in ones job, the irrelevant thoughts and emotional response seem to be ignored easily; experience of time distortion and time seems to fly by swiftly. Therefore, the interviewees indicated that if they received a job in which they are interested, they are very concentrated on it. However, if the assigned job does not contain points of interest, then focusing on the task will prove harder.

The flow state can be accessed if full effort is made to undertake the challenge and move towards the designated goal. However, if the “ability and challenge” are out of balance, and the participant cannot achieve the goal despite exerting a lot of effort, then the individual would experience strong frustration.

If the difficulty of the challenge is too high and not balanced with the personal skill, then the participant will perceive excess frustration and hence anxiety and depression (Novak, Hoffman & Yung, 1998; Csikszentmihalyi, 1990). If the participant’s skill is greater than the challenge, he or she will be aware of his/her excess capacity and hence perceive boredom. If both the participant’s skill and challenge are low, then the participant’s attitude will turn into indifference. Only a balance between the challenge of the task and the skill of the participant, together with the complete engrossment into the job, can achieve the flow state and generate the supernormal experience. (Massimini & Carli, 1988; Csikszentmihalyi, 1990; Csikszentmihalyi, 1998). Concerning the viewpoint of the balance between challenge and skill, the interviewees said that due to the job nature, the developers have to obtain related professional experience. Though they do not need advanced technical skills, since their operating process is very complicated, they also need to be highly concentrated on their jobs.

**Would You Mind the Disturbance From Other People or Issues at Your Thought When You Are in the Flow State?**
Csikszentmihalyi (1975) used skiing as an example to elaborate that when you are skiing down the hill, you will totally focus on every movement of your body. From the direction of the skis, the airflow across your face, to the snowed trees passing aside, all of these would not allow you to interfere or stand out against it. If you do make any mistake, you would have to bear serious consequences. How can you be cursory under such a situation? With total concentration on the situation, the skiing activity will be very smooth and the participant will be immersed in it and enjoy it heartily. If such argument is inferred to the work content of the participants, would the similar results occur? The consolidated data from the interviews shows that all the interviewees indicated that they become annoyed if the original engrossing condition is interrupted. The main reason is that it takes time in order to return to the original engrossing condition from the interrupted train of thought. On the other hand, the individual task may not be able to be completed on time, which will affect the original schedule. Furthermore, the outside disturbance may even cause defect or imperfection to the product design, which may induce serious damage to the profit of the company. In other words, if R&D personnel are completely immersed in the job, it can help to control the schedule of each project and hence improve the quality of product design and promote the work performance.

Do You Think the Flow Experience of Developers Can Essentially Improve the Work Performance?

Will the Flow Experience of R&D Personnel Generate Negative Effects on Work Performance?

From the viewpoints of supervisors observation of the flow experience and work performance can be used to indicate the effect, whether it is positive of negative. The R&D supervisor in the interview mentioned that flow experience can improve the work performance of R&D personnel, especially when the developers are totally engrossed in the task; such diligence is highly appreciated by the supervisor. However, the HR manager expressed a different point of view. She mentioned that the work performance of R&D personnel should not only cover the development process, but it should also include the practical outcome of the research. The developers should also understand the expectation of the organization or the supervisors and hence apply their knowledge and skill to transform and create valuable products.

Do You Think That the Extra Cost caused by Flow Experience Can be Accepted by the Supervisors or the Enterprise?

If R&D personnel achieve the flow state frequently, it may increase the tangible or intangible cost of the enterprise. How will the supervisors view and handle this issue? The R&D supervisor in the interview mentioned that when the developers completely engross and immerse in their development jobs, though the cost of each input factor will increase, the supervisor will still support his/her subordinates if the direction is correct and the research outcome is valuable. Further, the supervisor believed that in this case the enterprise would also be willing to put in more resources for the completion of the project. However, the HR manager indicated that the time effectiveness of the developer who always immerses in their work is ineffective. Though he is very focused on his task, the use of resources has already been in excess of the original budget. Even if the staff can finally produce the required outcome, it is not that valuable to the company. Not even that, the efficiency of the staff should also be assessed again. It should be pointed out that since the positions of the two supervisors are different, their viewpoints also differ. Basically, the R&D supervisor emphasized that the supervisors should support their subordinates if the direction is correct and the research outcome is valuable, that is, the supervisors should support the developers to concentrate on their tasks completely, no matter how much it will cost. While the HR manager focused on the investment return of the enterprise – if the flow experience of R&D personnel is
overwhelming thereby causing the enterprise to spend excess resources and hence the return is lower than the cost, it then becomes unacceptable to the enterprise.

Overall, do You Think Whether the Effect of Developers’ Flow Experience on Company Operation Performance is Positive or Negative?

If the performance issue is extended to influence of developers’ flow experience on company operation performance, then the opinion of both supervisors are consistent. Both of them found that influence of flow experience on company operation performance should be assessed by the final outcome. If the outcome matches the company’s expectation, then influence of flow experience on the company is positive, and vice versa. Even due to the different positions of the two supervisors, the attitudes of them towards the use of excess resources due to the overwhelming flow experience of R&D personnel are different; they tend to have the same views toward the issue of company operation performance.

CONCLUSIONS AND RECOMMENDATIONS

This work is to study the relationship between the job characteristics and flow experience of R&D personnel in order to understand the effect of flow experience on work performance. The interviewees of this study are R&D personnel, R&D supervisor and HR manager of the high technology company X in Taiwan. Through the developers’ self-observation on flow experience and the observation of supervisors on the effect of the subordinates’ flow experience on the enterprise performance, the interview contents are consolidated and analyzed, and the conclusion and related suggestions are drawn.

Conclusions

Two major characteristics of flow experience are clear goals and immediate feedback. These are also the main characteristics of the nature of R&D. Therefore, R&D personnel may very easily achieve the flow state. The developers with sufficient professional and technical background are able to take the challenge from their tasks. With the balance of skill and challenge, they are encouraged to move towards their goals continuously.

As there are usually time constraints on the job, and time is required to restore the original state if their work is interrupted, the developers need to maintain a high degree of attention and hence are easier to achieve the flow state. In addition, developers in general are more enthusiastic in completing difficult and challenging tasks whereby they may gain high satisfaction and achievement psychologically. They may find it not only easier to achieve the flow state, but also may be willing to enjoy the continuous pleasure from the flow experience.

If simply assessing the individual’s development performance by flow experience, the result is not very objective. Since there are still other objective and subjective factors which can affect the work performance. However, once a developer achieves the flow state, it indicates that the employee really presents the attention to detail that is required by his/her position. This will definitely make the corresponding contribution to his or her job. In other words, the R&D outcome presented by developers who are totally engrossed in their work should be better than those who are not totally engrossed.

If the members of R&D team achieve the flow state too early, or even experience flow from the very beginning, then the team will be unable to grow and it may cause the project to stagnate.
drafting the proposal, through to the operation process to the completion of the project, the team members need to cooperate and communicate with each other and continue to take various difficulties and challenges. If there is a team member who achieves flow state at the very beginning, he or she may lose the opportunity to discuss and brainstorm with each other, which is harmful to the growth of the entire team.

The issue of excess cost caused by employee’s flow experience can be discussed in different aspects: if the flow state of the employee is so overwhelming that causes a serious time lag of the work progress and affecting the original time schedule, then the supervisor should try to stop it. If it does not affect the work progress and it is expected to generate very high value to the enterprise, increase in cost is acceptable under a controllable budget.

**Recommendations**

The flow experience of R&D personnel can improve the work quality, but time effectiveness is a critical factor that affects R&D performance. Therefore, if the flow experience is too frequent and delaying the work progress, the supervisor should try to stop it. In other words, within the acceptable work efficiency, employee’s flow experience can help promote the work quality and improve the R&D achievement of the enterprise.

Influence of flow experience on company operation efficiency should be assessed by the final outcome. If the outcome matches the expectation of the company, the influence is positive, and vice versa. Certain milestones of work progress should be set at the early stage of the project. The supervisor can handle and control the process of the project, review and revise it at an appropriate time, in order to ensure the project to be completed on schedule. Flow experience can cause R&D personnel to obtain greater enjoyment from their tasks, to be more willing to contribute their knowledge and skills, and to be more willing to stay in the company. To the company, the enterprise will waste large amounts of their budget on human resources development if the turnover rate of employees is too high. Only if the employees are willing to stay in the company, the resources of human resources development can be spent on development projects and enhance performance of the enterprise’s practical operation.

In an excellent organization, staff should make efforts toward the common goal with coherence and consensus, and create a good workplace climate in order to generate the positive influence from the employee’s flow experience. An unstable working environment may emotionally affect staff, and even reduce the loyalty of staff to the company. Therefore, the two main factors stability and respect should be put into the enterprise to stabilize the emotion of the staff and develop mutual respect between staff in the company. Sufficient time and space should be provided to the staff for them to work independently. The supervisors should supervise and coach the subordinates adequately. This will not only improve the workplace climate, but also promote the harmony among the company staff and create a work environment for each employee to be able to be engrossed in his/her job and to enjoy the flow experience.

**REFERENCES**


