THE REGULAR AND PART-TIME MANPOWER PLANNING FOR A FIRM TO OFFER INFORMATION SERVICE

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ABSTRACT

The objectives of this paper are to explore the issues regarding applying regular workers and part-time workers on customer information services via a telecommunication network, to formulate relevant costs to analyze their relationships with the level of customer services under the time dependent demand pattern, and to construct a manpower requirement model. Moreover, a heuristics algorithm is developed to solve the problem and an example is performed to illustrate the application of the model. The result shows that the manpower requirement at peak hour and the total cost paid by the firm for customer information service can be cut down by using different combinations of regular workers and part-time telecommuters, though a small amount of service delays will occur.

INTRODUCTION

Today, the market condition faced by a firm is very complex and the level of information service requested by customers raise sharply. Many firms focus on their core business by changing organization structure so as to reduce unnecessary costs and put themselves in an advantageous position. Furthermore, people can communicate each other easily via a variety of mediums due to the advanced information technology. Accordingly, there are more service channels via which the firm can provide information services to its customers, such as telephone service, internet service, service by part-time workers or telecommuters, etc.

In practice, it is difficult for a firm to schedule the number of regular employees in different time period so as to satisfy its customers' information demand which are usually with a dynamic pattern. The personnel cost will increase rapidly and there will be many idle employees in the off-peak period if the firm uses the peak-hour demand as a base to determine its manpower requirement. On the other hand, the service quality during the peak period will deteriorate if the firm uses the off-peak demand as a base. Compared to large companies, small and medium firms hold less resources such as labor or capital, so that it is difficult for them to offer a sufficient number of employees to serve their customers. Because the internet technology nowadays has advanced up to support rapid interactions, using telecommuters who work at home to offer part-time services in peak period has provided an answer for the firm to solve this problem. The objectives of this paper are to explore the issues regarding applying regular workers and part-time workers on the customer information service, to formulate the relevant costs, to analyze their relationships with the level of customer information service in a dynamic demand pattern, and to construct a manpower requirement model.

Previous literature mostly focuses on the problem of establishing a work schedule that satisfies the given manpower and service requirements and complies with regulation and budget constraints. However, the scheduling problems considered in the literature were much more general, and none of them dealt with issues such as simultaneously determining the manpower and service demand leveling as concentrated in this paper. Here are some references that are deemed important as they describe methods or algorithms for the construction of efficient schedules in a particular area, such as airline crew scheduling in Etschmaier and Mathaisel (1985) and in Desaulniers et al. (1997), employee service scheduling in Bechtold and Showalter (1987), operator scheduling in Segal (1974), nurse scheduling in Arthur and Ravindran (1981), toll collectors in Byrne and Potts (1973), shift scheduling for banking operations in Davis and Reutzel (1981), and telephone sales manpower planning in Gaballa and Peace (1979). However, there were a few literature dealing with both the determination of manpower requirements and demand leveling, though none of them dealt with the issues regarding employing part-time telecommuters. Nobert and Jacques (1998) construct a freight handling personnel scheduling model at air cargo terminals for achieving cost reductions and determining the number of employees at different period while maintaining customer service levels.

The firms we focus here are those provide masses of information services or

those with a customer information service department. In this paper, the customer demand pattern is time dependent and with various service duration. Different degrees of urgency providing for the customer service are also considered. In this paper, we explore the relationship among the service level the firm offers for customer information inquiries and relevant costs paid for to achieve this service level. We use the difference in time between time expected by customers and time actually offered by firm to represent the time delay of customer information service and to represent the service level. Several types of time differences are analyzed by using different penalty costs to reflect their effects on the dissatisfaction or loss of customers. Moreover, the relevant costs for the firm using various combinations of regular workers and part-time telecommuters to offer customer information service at a certain service level are considered. The costs we analyze include the salaries of regular workers and part-time telecommuters, rent, commuting costs and other personnel costs for regular workers, and information transferring costs and other costs for part-time telecommuters, etc. From the viewpoint of economic efficiency, we formulate penalty costs for various time delays of offering customer service and other relevant costs by analytical approach, and then construct a manpower requirement model. Finally, a heuristic algorithm is developed to solve the problem and an example is performed to illustrate the application of the model.

MODEL FORMULATION

2.1 Basic Characteristics

The type of customer service we concern here is mainly information service. The customer request a service to the firm's service center through telecommunication network (such as telephone, fax, or internet), and the service center responses this request and provides the service via the same way. This is a common service type for many firms to setup their telephone service centers or internet consulting centers. Because the internet is available with lower and lower price today, more and more firms attempt to build their service centers in internet to satisfy more customers' inquiries. In addition, it is unnecessary for the firm's employees to commute between office and home due to no face-to-face service. Furthermore, the firm now may cut down total costs by using part-time telecommuters to offer a part of customer information services while maintaining the same service level.

The characteristics of the customers' information inquiries we consider here are with various time duration and different degrees of urgency. We explore the trade-offs between service levels and other relevant costs for firms using different combinations of regular workers and part-time telecommuters to provide their customers' information services, and then further analyze the manpower requirement at each time period. If the service request from the customer is urgent, the firm must make a response rapidly otherwise the firm may suffer the loss due to delay. On the other hand, if the request from the customer is not urgent, a bit of delay is acceptable.

We assumes that the firm pursues the goal of minimizing total costs including the penalty costs induced by the delays of offering services and other relevant costs paid by

the firm to offer customers' information service. The penalty cost is represented as reduced revenue owing to the dissatisfaction or loss of customers who are unsatisfied with the firm's information service response. Customer dissatisfaction comes from the discrepancy between the time customer expect to start or to finish the service and the time actually offered by a firm to start or to finish. Besides, the communication cost for customers waiting online for a service is also considered. Other relevant costs actually paid by firms include salaries for regular workers and part-time telecommuters, rent paid for the floor area of the information center, the commuting cost for regular workers, communication and transportation costs for part-time telecommuters, and the cost for equipment purchasing. The salaries of regular workers involve the health insurance premiums, retirement funds, and dismission funds. The rent paid for the floor area of the information center used by regular workers and part-time telecommuters is affected by the site of the center. The accessibility costs are defined as those paid by the firm's workers to contact with the information center or access to office. These costs are commuting costs for regular workers or transmission costs for telecommuters to transfer information or commuting costs for telecommuters to go back to office for meeting occasionally. The equipment for regular workers is different from that for part-time telecommuters, so the equipment purchasing cost will vary with the number of regular workers and the number of part-time telecommuters.

2.2 Cost Functions

In this section, we will analyze and formulate each of all costs paid by the firm for providing customer information services and explore interactions among them.

1. Penalty cost of service delays

We use the differences in time between the service starting time and the finishing time expected by customers and those actually offered by the firm to represent the level of service and define them as the delay of starting service and the delay of finishing service, respectively. The losses due to the delay of starting service or the delay of finishing service can be evaluated by giving various penalty costs for different types of delays. The concepts of delay are shown at figure 1. The two ends of white bar are the starting and finishing time expected by a customer to accept a service, respectively. And, the gray bar represents the length of service duration. There are three cases possible while the service is processed. If the firm immediately replys the service request of the customer, no delay will occur as shown by case 1 in figure 1. If the firm can not reply the request immediately due to the shortage of available employees to dispatch, the delay of starting service arises as shown by case 2 and case 3 in figure 1. In case 2, there is no delay of finishing service even though there is a delay of starting service. In case 3, there is a delay of finishing service since the starting time actually offered by firm is too late.

Let c_{ijk} be the number of customers who expect to start their services at i-th time interval and to finish at j-th time interval and the duration of processing the request is k time intervals. Assume that if the firm actually starts the service at the time expected

to start by the customer, it is certain that the time at which the firm actually finishes this service will be before the time expected to finish by the customer, i.e., $i + k \le j$.

Let x_{ijk}^{t} , $t \ge i$ be the number of customers who can be counted to c_{ijk} and actually start to be served by the firm at *t*-th time interval. Then the following equality is held.

$$\sum_{t} x_{ijk}^{t} = c_{ijk} \ , \quad \forall ijk \tag{1}$$

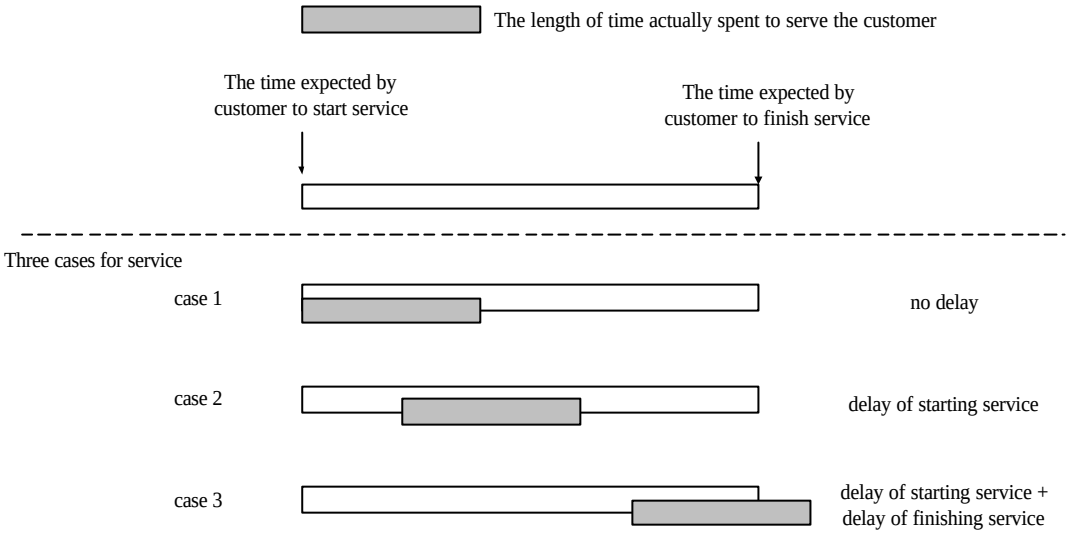

Figure 1. The concepts of delays of starting service and finishing service

There is no delay of starting or finishing service for the customer group x_{ijk}^{t} , $\forall t = i$; while there will be some delay of starting service for the customer group x_{ijk}^{t} , $\forall t > i$, and the delay time is $(t - i)$. Moreover, the total delay of starting service for customer group c_{ijk} can be represented as the sum of the product of the number of customers who start to be served at each of different time intervals and their respective delay time, that is

$$\sum_{t} (t - i) x_{ijk}^{t} \tag{2}$$

When the starting time at which the service is actually offered by the firm is so late as it affects on the finishing time of the service, the delay of finishing service may occur. In other words, if the actually finishing time $t + k$ for customer group x_{ijk}^{t} is later than the time expected to finish the service by customers, the delay of finishing the service occurs and the delay time is $(t + k - j)$. On the other hand, if the actually finishing time $t + k$ is ahead of *j*, then there is no delay.

When there exists a delay of starting service or a delay of finishing service, customers will be unsatisfied with the service provided by the firm due to waiting. Those who receive the service with delay may look at the service unreliable or even suffer a loss for this reason. And then, it is possible that customers may give up the

service or choose another firm's service as the next information request arises. Assume the customer give-up rate is a probability and affected by the amount of the delay of starting service and the delay of finishing service. Let $p_1(h)$ and $p_2(h)$ as the give-up rates for the delay of starting service and the delay of finishing service as the delay time is *h*. And assume these two give-up rates are independent of each other. Then, the give-up rate for customer group x_{ijk}^t is

$$P_{ijk}^t = p_1(t-i) + p_2(t+k-j) - p_1(t-i)p_2(t+k-j) \tag{3}$$

and if $t+k<j$, $p_2 = 0$.

Let the average potential revenue is *c* dollars per service, then the penalty cost due to delay for customer group x_{ijk}^t will be

$$P_{ijk}^t \cdot x_{ijk}^t \cdot c \tag{4}$$

Though some of customers may still choose the services with delay, the firm's cash flow may be slightly postponed. However, since it is usually negligible and therefor could be neglected. Then, the total penalty cost for service delay is

$$c\sum_{ijk}\sum_{t} P_{ijk}^t \cdot x_{ijk}^t \tag{5}$$

2. Communication Cost for Customers Waiting Online for Service

As the firm serves its customers through internet, the cost for information transferring must be paid and it equals to the product of the online time and the telecommunication fee per unit time. The customer online time for service includes the actually service duration *k* and the time waiting online which equals the delay time of starting service. Let *u* be the telecommunication fee per unit time, which is affected by the site of the firm, the condition of national information infrastructure and the distances from the site of the firm to those of customers. Then, the total communication cost for customers waiting online for service can be obtained as

$$\left[\sum_{ijkt} kx_{ijk}^t + \sum_{ijk}\sum_{t}(t-i)x_{ijk}^t\right]u \tag{6}$$

3. Salaries

The salaries offered by the firm for their regular workers and part-time telecommuters are usually different. The salaries for regular workers are mostly constant with fixed work hours, such as pay per month or per week, and there are extra benefits offered by the firm due to regulations, such as health insurance premiums, retirement funds, and dismission funds, etc. On the other hand, the salaries for part-time workers are related to their working hours and a little extra allowance is also included. Assume each service requested by a customer is served by one worker and only one. Then, it ought to be satisfied that the total number of workers at each time

interval is bigger or at least equals to the number of customers in service at the same time interval. The number of customers in service at time interval t, is equal to the sum of the number of customers who enter the service system at time interval t and the number of all customers who enter the service system before t but their requests have not yet been finished by t. Therefore, the total number of customers in service at interval t is

$$x^t + \sum_{n=1}^{t-1} \sum_{k>n} x_k^{t-n}, \quad \forall t \tag{7}$$

where

$$x^t = \sum_{ijk} x_{ijk}^t, \quad \forall t$$

$$x_k^t = \sum_{ij} x_{ijk}^t, \quad \forall tk$$

Denote P_{s1} and P_{s2} as the periods of the time covered respectively by a regular-working shift $s1$ and by a part-time working shift $s2$. Let e_r^{s1} be the number of regular workers working at the regular-working shift $s1$, and e_p^{s2} be the number of part-time workers working at the part-time-working shift $s2$. Then, the total number of regular workers and part-time telecommuters at interval t should be greater than or equal to the total number of customer in service at interval t, for all time intervals, as shown by constrains below:

$$\sum_{s1:t \in P_{s1}} e_r^{s1} + \sum_{s2:t \in P_{s2}} e_p^{s2} \geq x^t + \sum_{n=1}^{t-1} \sum_{k>n} x_k^{t-n}, \quad \forall t \tag{8}$$

In general, the salaries paid by the firm for regular workers are related to the number of regular workers employed by firm. Thus, it is important for the firm to know the required number of regular workers to serve and fulfill the customers' information requests at each time interval. The total person-shifts for the total planning time T can be determined by the definition of e_r^{s1} as $\sum_{s1=1} e_r^{s1}$. Let S be the average number of shifts served by a regular worker, then we can obtain the number of regular workers needed by firm is

$$\frac{\sum_{s1} e_r^{s1}}{S} \tag{9}$$

However, if the number of customers' information requests in different time interval varies and appears in a peaking pattern, then the required number of workers needed by firm to serve customers in different shifts will also vary and exhibit the same peaking phenomenon. The maximal number of regular workers the firm can use at any time intervals is $\frac{\sum_{s1} e_r^{s1}}{S}$ as shown in equation (9). If the required number of regular workers needed by firm at each of all time intervals is smaller than the maximal number, then the firm can hire merely $\frac{\sum_{s1} e_r^{s1}}{S}$ regular workers to serve their customers. If the number of regular workers needed at some time intervals exceeds this maximal number,

the firm may hire the number of workers based on the maximal required number of workers among for all shifts. Briefly, the total required number of regular workers needed by firm for customer information service is

$$E_r = \max\left[\max_{s1}\left(e_r^{s1}\right), \frac{\sum_{s1} e_r^{s1}}{S}\right] \tag{10}$$

Let the average wage per regular worker be *w*, and the health insurance premiums, retirement funds and dismission funds which are extra benefits offered by the firm is a fraction of *w*. Denote this fraction by *r*, then the total salaries for all regular workers are

$$E_r(1+r)w \tag{11}$$

The salaries for part-time telecommuters are usually related to their actual working hours. In general, the firm must promise in the contract that part-time workers at least have a certain lower bound of working hours with a wage rate larger than the minimum wage.. Part-time telecommuters who bear less workload still get a certain amount of the minimal pay. On the other hand, the lower bound of working hours is an obligation of part-time telecommuters that ensures the firm can obtain reasonable labor hours. Assume both the lower bound of working hours and the minimal wage are satisfied, i.e., the working hours per part-time telecommuter are all greater than the lower bound of working hours and the wages are all greater than the minimal wage. Then, we can determine the total salaries for all part-time telecommuters by multiplying the total working hours served by telecommuters by the average wage rate. Let the average wage rate for *s*2 is w_p^{s2}, then the total salaries for part-time telecommuters are

$$\sum_{s2} e_p^{s2} w_p^{s2} \tag{12}$$

4. Rent for the information service center

The regular workers we discuss here are those who commute to office to work, and the part-time telecommuters are those who work at home. In general, the firm will not subsidy the rent of floor area used at home by part-time telecommuters. Therefore, the rent for the information service center will be mainly affected by the number of regular workers. Denote the average size of floor area per regular worker by a_1, and the rent for the service center sited at *j* by p_j. Assume that the shifts of regular workers do not overlap each other, and the same office equipment and floor area allows to be used alternately by different regular workers working in different shifts. So, we can set the maximal number of regular workers among all shifts as the planning capacity, and the rent for the service center used by regular workers will be

$$a_1 p_j \max\left(e_r^{s1}\right) \tag{13}$$

Though the part-time workers work at home, but they need to go back to office for training, re-training, meeting, or other activities occasionally. The frequency for these

activities is low, but the firm still needs to prepare some space for them. Assume each part-time telecommuter must return to office every n shifts, and all part-time telecommuters return to office by b batches. Then, the number of part-time telecommuters return to office per batch is

$$\frac{\sum_{s2} e_p^{s2}}{nb} \tag{14}$$

Let the average floor area used by each returned telecommuter is a_2, then the rent for the service center used by part-time telecommuters is

$$a_2 p_j \frac{\sum_{s2} e_p^{s2}}{nb} \tag{15}$$

5. Accessibility cost

We define the accessibility cost as the time cost and monetary cost paid by workers for commuting or telecommuting to office. For regular workers, the costs are commuting costs between office and home. For part-time workers, the costs are telecommunication expense used for communicating with the information center and the transportation cost for returning to office periodically. The accessibility cost includes both the monetary cost and time cost for regular workers and part-time telecommuters. The time cost reflects the opportunity cost of the time spent on commuting or telecommuting and is measured by the value of time which is assumed to be equal to the wage per hour. The wage rate is different between regular workers and part-time telecommuters due to the different ways used to determine their salaries. For each regular worker, the average wage rate can be represented as the total salary at planning period divided by the total working hours, that is

$$\frac{w}{\sum_{s1 \in \mathbf{S}} t(P_{s1})} \tag{16}$$

where $t(P_{s1})$: the length of time covered by one regular shift $s1$;

S: the set of all shits offered per regular worker.

The average wage rate for part-time telecommuters can be represented as the average salary for each shift divided by the average length of time in one part-time shift, that is

$$\frac{\sum_{s2} w_p^{s2} \Big/ s2}{\sum_{s2} t(P_{s2}) \Big/ s2} = \sum_{s2} \frac{w_p^{s2}}{t(P_{s2})} \tag{17}$$

where $t(P_{s2})$: the length of time covered by one part-time shift $s2$.

Assume the length of time in one regular shift is long enough so that it is impossible for a regular worker to work on two continuous shift, i.e. the regular worker ought to commute one round trip per shift. Let the average commuting distance of a round trip per regular worker is d_1, and the travel speed is v. As each regular worker works on S shifts, the total time cost for all regular workers used for commuting to office will be

$$E_r S\left(\frac{d_1}{v}\frac{w}{\sum_{s1\in s} t(p_{s1})}\right) \tag{18}$$

where d_1/v is the time spent for one round trip. Let the unit-distance transportation fee is f. Then, the monetary cost paid by all regular workers commuting to office will be

$$E_r S(fd_1) \tag{19}$$

where fd_1 is the monetary cost spent for one round trip. Then, the total accessibility cost for regular workers is the sum of the time cost and the monetary cost used for commuting to office, that is

$$E_r S\left(\frac{d_1}{v}\frac{w}{\sum_{s1\in s} t(p_{s1})} + fd_1\right) \tag{20}$$

Because the part-time telecommuters do the job at home via telecommunication, the access time equals to the total time spent for communicating with office on line, i.e., it equals to the length of time covered by the total number of part-time shifts, so the total time for all part-time telecommuters access to office via telecommunication will be

$$\sum_{s2} e_p^{s2} t(P_{s2}) \tag{21}$$

Denote u as the unit-time fee for telecommunication, then the total monetary cost for part-time telecommuters used for information transferring is

$$u\sum_{s2} e_p^{s2} t(P_{s2}) \tag{22}$$

It must be noted, the accessibility cost for part-time telecommuter via telecommunication only includes monetary cost but not includes time cost. The part of time cost is paid as the salary for part-time telecommuters, therefore it cannot be computed for avoiding double counting.

As described above, part-time telecommuters must return to office for specified activities periodically, so the transportation cost for them should be counted. Let the average round-trip distance for a part-time telecommuter traveling to office once is d_2,

and the value of time is measured by the wage rate. Because each part-time telecommuter must return to office every n shifts, there are $\frac{\sum_{s2} e_p^{s2}}{n}$ round trips made by all part-time workers for returning to office. Similar to equation (20), the total transportation cost for part-time telecommuters can be represented as

$$\frac{\sum_{s2} e_p^{s2}}{n} \cdot \left(\frac{d_2}{v} \cdot \sum_{s2} \frac{w_p^{s2}}{t(P_{s2})} + d_2 f \right) \tag{23}$$

6. The cost for equipment purchasing

Some communicating equipment is needed for the firm to serve their customers, such as central process system, servers or personal computers, etc. The equipment cost can be divided into two parts: one is the fixed cost, the other is variable cost which is related to the number of workers. Because the regular workers are formal long-term employees in the organization, the firm usually provides them equipment. On the other hand, the firm generally does not provide part-time telecommuters the equipment, but instead give a small amount of subsidy relating to their actual working hours. Let the fixed cost for equipment is A, and the variable cost of equipment purchased for each regular worker is m^r. Then, the total equipment cost excluding the part for part-time telecommuters will be

$$A + m^r E_r \tag{24}$$

where E_r is the total required number of regular workers needed by firm for customer service as defined by equation (10).

To compare the equipment cost with other costs at the same time base, let the life of service in years for all equipment is b and the interest rate is g. Then, the capital-recovery-factor is $a = \frac{g(1+g)^b}{(1+g)^b - 1}$. Consequently, the equivalent equipment cost spent over the planning period T in days is

$$a\left[A + m^r E_r\right]\frac{T}{365} \tag{25}$$

As discussed above, the part-time telecommuter is not formal employee of the firm, and generally the firm will not provide them the equipment, but give a small amount of subsidy relating to their actual working hours. Let m^p denote the subsidy per part-time shift, then the total amount of subsidy for part-time telecommuters' equipment is

$$m^p \sum_{s2} e_p^{s2} \tag{26}$$

2.3 Manpower Requirement Model

We can formulate here the manpower requirement model by combining each of all cost functions and relevant constraints discussed in section 2.1. The mathematical programming problem for the model is formulated as

Min.

$$c\sum_{ijk}\sum_{t}P_{ijk}^{t}\cdot x_{ijk}^{t}+\sum_{ijk}\sum_{t}\left[kx_{ijk}^{t}+(t-i)x_{ijk}^{t}\right]u$$
$$+E_r(1+r)w+\sum_{s2}e_p^{s2}w_p^{s2}$$
$$+a_1p_j\max\left(e_r^{s1}\right)+a_2p_j\frac{\sum e_p^{s2}}{nb} \qquad (27)$$
$$+E_rS\left(\frac{d_1}{v}\frac{w}{\sum_{s1\in S}t(p_{s1})}+fd_1\right)+u\sum_{s2}e_p^{s2}t(P_{s2})+\frac{\sum e_p^{s2}}{n}\cdot\left(\frac{d_2}{v}\cdot\sum_{s2}\frac{w_p^{s2}}{t(P_{s2})}+d_2f\right)$$
$$+a\left[A+m^rE_r\right]\frac{T}{365}+m^p\sum_{s2}e_p^{s2}$$

S.t. $\sum_{t}x_{ijk}^{t}=c_{ijk},\ \forall ijk$ (28)

$$\sum_{s1:t\in P_{s1}}e_r^{s1}+\sum_{s2:t\in P_{s2}}e_p^{s2}\geq x^t+\sum_{n=1}^{t-1}\sum_{k>n}x_k^{t-n},\ \forall t \qquad (29)$$

$$x^t=\sum_{ijk}x_{ijk}^{t},\ \forall t \qquad (30)$$

$$x_k^t=\sum_{ij}x_{ijk}^{t},\ \forall tk \qquad (31)$$

$$P_{ijk}^{t}=p_1(t-i)+p_2(t+k-j)-p_1(t-i)p_2(t+k-j),\ \forall ijkt \qquad (32)$$

$$E_r=\max\left[\max_{s1}\left(e_r^{s1}\right),\frac{\sum e_r^{s1}}{S}\right] \qquad (33)$$

$x_{ijk}^{t},\ e_r^{s1},\ e_p^{s2},\ E_r$ are integers

The objective function in equation (l7) is to minimize the total costs including the penalty costs for service delay, the communication costs for customers waiting online for service, rent for the information service center, salaries, and accessibility costs for regular workers and for part-time telecommuters, and the costs for equipment purchasing. Constraint (28) specifies that customers in each of all customer groups will be served while the time intervals at which customers are actually served may be different. Constraints (29), (30), and (31) ensure that the number of workers working at each time interval is at least equal to the number of customers in service at the same interval. Constraint (32) defines the probabilities of the give-up rates for the delays of starting services and finishing services which are independent of each other. Constraint (33) states the number of regular workers hired by the firm is large enough at each of all shifts. The objective function (27) can be rewritten as

Min.

$$+ E_r \left\{ (1+r)w + S\left(\frac{d_1}{v} \frac{w}{\sum_{s1 \in \mathbf{S}} t(p_{s1})} + f d_1 \right) + \frac{am^r T}{365} \right\} \quad , \qquad (34)$$

and further, equation (34) can be simplified as equation (35)

$$+ \sum_{s2} e_p^{s2} \left\{ w_p^{s2} + \frac{a_2 p_j}{nb} + ut(P_{s2}) + \frac{1}{n} \cdot \left(\frac{d_2}{v} \cdot \sum_{s2} \frac{w_p^{s2}}{t(P_{s2})} + d_2 f \right) + m^p \right\}$$

$$\text{Min.} \quad \sum_{ijk} \sum_{t} c_{ijk}^{t} x_{ijk}^{t} + c_2 E_r + \sum_{s2} c_{3p}^{s2} e_p^{s2} + a_1 p_j \max\left(e_r^{s1}\right) + \frac{aAT}{365} \qquad (35)$$

where

$$c_{1ijk}^{t} = cP_{ijk}^{t} + [k + (t-i)]u$$

$$c_2 = (1+r)w + S\left(\frac{d_1}{v} \frac{w}{\sum_{s1 \in \mathbf{S}} t(p_{s1})} + f d_1 \right) \frac{am^r T}{365}$$

$$c_{3p}^{s2} = w_p^{s2} + \frac{a_2 p_j}{nb} + ut(P_{s2}) + \frac{1}{n} \cdot \left(\frac{d_2}{v} \cdot \sum_{s2} \frac{w_p^{s2}}{t(P_{s2})} + d_2 f \right) + m^p$$

The last term of equation (35) is a constant, so it can be omitted. Consequently, the manpower model will be

$$\text{Min.} \quad \sum_{ijk} \sum_{t} c_{1ijk}^{t} x_{ijk}^{t} + c_2 E_r + \sum_{s2} c_{3p}^{s2} e_p^{s2} + a_1 p_j \max\left(e_r^{s1}\right)$$

$$\text{S.t.} \quad \sum_{t} x_{ijk}^{t} = c_{ijk}, \quad \forall ijk$$

$$\sum_{s1: t \in P_{s1}} e_r^{s1} + \sum_{s2: t \in P_{s2}} e_p^{s2} \geq x^t + \sum_{n=1}^{t-1} \sum_{k>n} x_k^{t-n}$$

$$x^t = \sum_{ijk} x_{ijk}^{t}$$

$$x_k^t = \sum_{ij} x_{ijk}^{t}$$

$$P_{ijk}^{t} = p_1(t-i) + p_2(t+k-j) - p_1(t-i)p_2(t+k-j)$$

$$E_r = \max\left[\max_{s1}\left(e_r^{s1}\right), \frac{\sum_{s1} e_r^{s1}}{S} \right]$$

x_{ijk}^{t}, e_r^{s1}, e_p^{s2}, E_r are integers

ALGORITHM

The manpower requirement model we formulate here is a NP-hard problem and the integral condition in the model makes it a difficult problem to solve exactly in polynomial time. Therefore, we develop a heuristic algorithm for this problem via shift-by-shift basis. The Algorithm is described as follows:

Step 1. Count the number of customers being served at each interval under the condition

of no delay.

Assume all customers of the firm can be served at the time they expect, i.e., the equation below is true.

$$x_{ijk}^{t} = c_{ijk}, \text{ for all } \quad t = i$$

$$x_{ijk}^{t} = 0, \text{ for all } \quad t \neq i$$

Because the duration of processing some service requests is longer than one interval, the number of customers in service at each interval is the sum of the numbers of those who enter in system at this interval and those who enter before but not complete their service at t. That is

$$x^{t} + \sum_{n=1}^{t-1} \sum_{k>n} x_{k}^{t-n}, \quad \forall t$$

Step 2. Count the number of regular workers e_r^{s1} for each of all shifts in case that there is no delay and no part-time telecommuter. That is

$$e_r^{s1} = \max\left[x^{t} + \sum_{\substack{n=1 \\ t \in P_{s1}}}^{t-1} \sum_{k>n} x_{k}^{t-n} \right], \quad \forall s1$$

Determine the minimal number of regular workers E_r which should be hired by firm by:

$$E_r = \max\left[\max_{s1}\left(e_r^{s1}\right), \frac{\sum_{s1} e_r^{s1}}{S} \right]$$

Solve an initial solution via Step 1 and Step 2 and compute the total cost under the condition of no delay and no part-time telecommuter.

Step 3. Construct a manpower requirement submodel based on the length of time of one regular shift.

Step 3.1. Construct a submodel of $s1$-th regular shift, and set the number of regular workers at the $s1$-th shift, the number of part-time telecommuters at the corresponding simultaneous shifts, and the number of customers actually served at the $s1$-th shifts as decision variables, and set other variables as given.

Then, relax the integral condition in this model and solve the corresponding LP problem. The form of submodel for the $s1$-th regular shift is

$$\text{Min.} \quad \sum_{ijk} \sum_{t \in P_{s1}} c_{1ijk}^{t} x_{ijk}^{t} + c_2 E_r + \sum_{s2 \in P_{s1}} c_{3p}^{s2} e_p^{s2} + a_1 p_j \max\left(e_r^{s1}\right)$$

$$\text{S.t.} \quad \sum_{t \in P_{s1}} x_{ijk}^{t} = c_{ijk}, \quad \forall ijk$$

$$e_r^{s1} + \sum_{s2: t \in P_{s2}} e_p^{s2} \geq x^t + \sum_{n=1}^{t-1} \sum_{k>n} x_k^{t-n}, \quad \forall t \in P_{s1}$$

$$E_r = \max \left[\max_{s1} \left(e_r^{s1} \right), \frac{\sum_{s1} e_r^{s1}}{S} \right]$$

x_{ijk}^{t}, e_r^{s1}, e_p^{s2}, E_r are non-negatives

Step 3.2. Update the initial solution obtained in Step 2 by the result of the submodel of $s1$-th regular shift. Then, return to Step 3.1 to construct and solve the submodel of the $(s1+1)$-th regular shift.

Step 3.3 Repeat Steps 3.1 and 3.2, until submodels for all regular shifts in the planning period T are solved.

Step 4. Round up the number of regular workers and the number of part-time telecommuters at each of all shifts and round up or down of the numbers of customers in service at each of all time intervals to obtain the solution. Compute the total cost for this solution at the end.

EXPERIMENTAL RESULTS

We use an example to illustrate the application of the manpower requirement model formulated in this paper. The study planing period is a week. The length of time per regular shift is 8 consecutive hours and that per part-time shift is 4 consecutive hours. Therefore, there are 3 regular shifts and 6 part-time shifts in a day. The beginning times of regular shifts are 0H, 8H, and 16H, and the average salary per regular worker is 10000 NT dollars per week. The beginning time of the part-time shifts are 0H, 4H, 8H, 12H, 16H, and 20H. The average salary for the part-time telecommuter with shift beginning at 0H or 4H is 1000 NT dollars per shift, that for the part-time telecommuter with the shift beginning at 8H or 12H is 600 NT dollars, and that for part-time telecommuter with the shift beginning at 16H or 20H is 800 NT dollars. In this example, we set 10 minutes as a time interval, so there are 1008 time intervals during the planning period. All customers are categorized according to the degrees of urgency and the duration of processing their information requests. Regarding the duration of processing the request, all customers are divided into two groups. One is those whose requests can be finished at the duration of single time interval ($k=1$), and the other is those whose requests are finished at the duration of two time intervals ($k=2$). There are also two customer groups with regarding to the degrees of urgency. One is those whose requests are urgent and the firm must provide their requests immediately, and the other is those whose requests are not urgent and a bit of delay is acceptable. The give-up rates for the customer group whose information requests are urgent are

$$p_1(t-i)=\begin{cases}0 & ,t-i=0\\ 0.04 & ,t-i=1\\ 0.16 & ,t-i=2\\ 0.36 & ,t-i=3\\ 0.64 & ,t-i=4\end{cases},\quad p_2(t+k-i)=\begin{cases}0 & ,t+k-i=0\\ 0.04 & ,t+k-i=1\\ 0.16 & ,t+k-i=2\\ 0.36 & ,t+k-i=3\\ 0.64 & ,t+k-i=4\end{cases}$$

And the give-up rates for the customer group whose information requests are not urgent are

$$p_1(t-i)=\begin{cases}0 & ,t-i=0\\ 0 & ,t-i=1\\ 0.04 & ,t-i=2\\ 0.16 & ,t-i=3\\ 0.36 & ,t-i=4\end{cases},\quad p_2(t+k-i)=\begin{cases}0 & ,t+k-i=0\\ 0 & ,t+k-i=1\\ 0.04 & ,t+k-i=2\\ 0.16 & ,t+k-i=3\\ 0.36 & ,t+k-i=4\end{cases}$$

Assume the numbers of customers who is inquiring information in each time interval are distributed in a poisson distributions, then we can simulation the demand data by assuming the appropriate values for parameters. For customers whose requests can be finished by a single time interval, we assume the parameters of arrival rates for those whose requests are urgent and not urgent as 5 and 6 person/interval, respectively. For customers whose requests can be finished by two time intervals, we set the parameters of arrival rates for those whose requests are urgent and not urgent as 5 and 6 person/interval, respectively. Other parameters for the model are assumed by inferring and referring from the data in the reality and shown in Table 1.

Figure 2 shows the number of customers in service at each time interval with no delay and no part-time telecommuter hired. The total person-shifts of required regular shifts is shown to be 969 person-shifts, and the number of regular workers must be hired by firm is 162 workers when the average number of shifts served by a regular worker is 6 shifts during the study period. And, the corresponding total cost paid by the firm to provide the customer information services during the study period is 2,270,290 NT dollars.

Figure 3 shows the number of customers in service at each time interval by applying the manpower requirement model we develop in the paper. The differences

Table 1. The values of parameters used for the model

Variable	Description	Value
c	The average potential revenue per service (NT dollar)	100
u	The telecommunication fee per unit time (NT dollar)	0.16
r	The fraction of wage for extra benefits offered by firm (%)	10%
a_1	The average size of floor area per regular worker (m^2/worker)	15
p_j	The rent for the service center sited at j (NT dollar/ m^2)	11.635
a_2	The average size of floor area used by each returned telecommuter (m^2/worker)	5
n	The average number of shifts during which each part-time telecommuter returning to office once	10
b	The number of batches all part-time telecommuter return to office	2
S	The average number of shifts a regular worker works on	6
d_1	The average round-trip commuting distance per regular worker (km)	20
d_2	The average round-trip distance for a part-time telecommuter traveling to office once (km)	25
v	The average travel speed (km/hr)	38
f	The unit-distance transportation fee (NT dollar/km)	1.56
a	The capital-recovery-factor with the life of service in b=5 years and the interest rate g=0.06.	0.2374
A	The fixed cost for equipment (NT dollar)	500,000
m^r	The variable cost of equipment purchased for each regular worker (NT dollar)	20,000
m^p	The subsidy per part-time shift (NT dollar/shift)	50

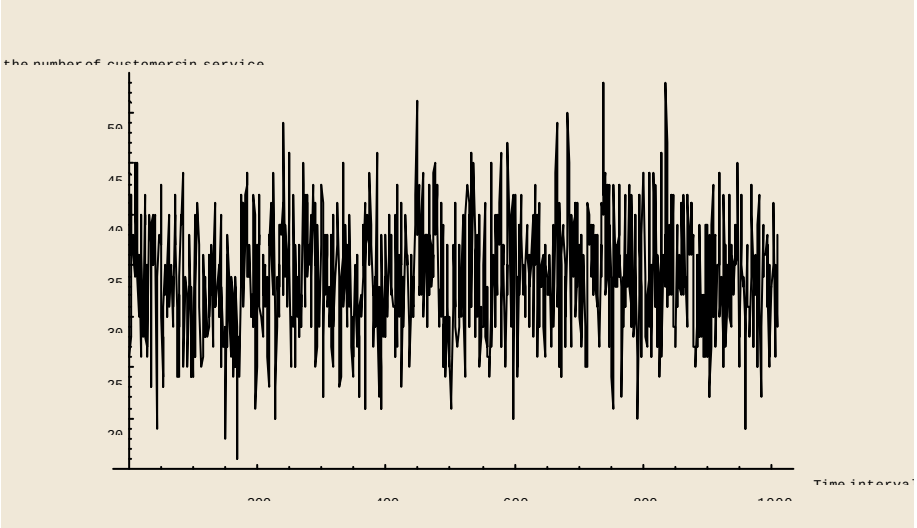

Figure 2. The number of customers in service at each time interval with no delay and no part-time telecommuters hired.

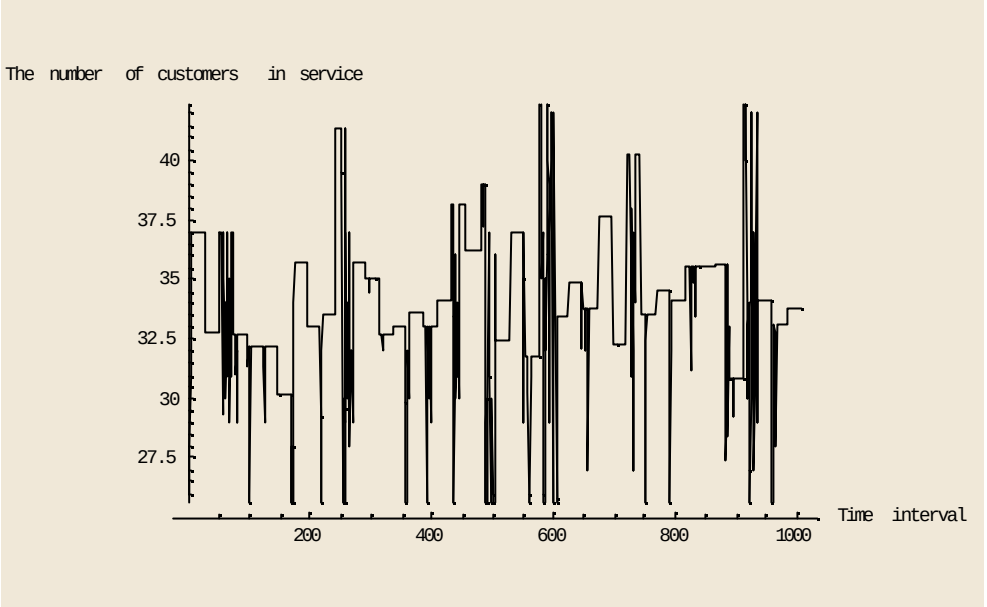

Figure 3. The number of customers in service at each time interval with allowing delays of services and hiring part-time telecommuters.

between the number of customers at peak interval and those in off-peak interval are shown to be markedly reduced as compared with those shown in Figure 2. The total person-shifts of regular shifts obtained by our model is 708 person-shifts and the number of regular workers must be hired by firm is 118 workers as the average number of shifts served by a regular worker is still 6 shifts during the study period. The total person-shifts of part-time shifts is 100 person-shifts and equivalent to about 50 person-shifts of regular shifts. The manpower requirement by allowing delays and hiring part-time telecommuters is shown to be cut down substantially. Consequently, the total cost paid by the firm for providing customer information services via employing both regular workers and part-time telecommuters as determined by the model is 2,270,290 NT dollars. The saving is shown up to 661,400 NT dollars.

Regarding the delays of providing service, there are 6,674 customers served with delay, and the average delay is 1.024 intervals per delayed customer, while the average delay is only 0.311 intervals for all 21,976 customers. For those who are served with delay, 28.5% of them are with urgent requests, and 71.5% are with non-urgent requests. The result also shows that the manpower requirement at peak hour and the total cost paid by the firm can be cut down effectively by allowing delays of services and using different combinations of regular workers and part-time telecommuters, though a small amount of delays will occur to about one-third of total customers.

CONCLUSION

This paper develops a model on the manpower requirement of customers' information services which are provided by firm via the telecommunication network. The demand pattern for information requests with various duration and different degrees of urgency is considered. The paper explores the relationships between the level of service the firm offering and the costs paid by firm to achieve this service level and then

formulate relevant cost functions and construct a manpower requirement model for the firm providing customers information services by employing different combinations of regular workers and part-time telecommuters. Furthermore, a heuristic algorithm is developed to solve the problem and an example is implemented to illustrate the applications of the model. The results show that using part-time telecommuters to offer a part of customer services will reduce both the problem of the worker shortage at peak hour and the problem of workers idle at off peak. Moreover, allowing a small amount of service delays will decrease the difference between the number of customers who requests a service at peak hour and those at off peak. These strategies provide an answer for the firms that are burdened with heavy expense on customer information services.

We suggest that several situations might be tested in the future via this model, such as the situation where the number of customers' requests is at each interval with a large variation, or the situations for the different sites of the information center. The effects of the changes in the values of the key variables in the model such as the level of service and relevant costs also can be examined by performing the sensitive analysis. Finally, the length of time interval for describing customers' arrivals and service duration also should be adjusted based on the characteristics of various services on different types of industries.

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THE CHALLENGES AND THE OPPORTUNITIES OF E-COMMERCE AND INTERNATIONAL SMEs: IMPLICATIONS FOR HRM IN APEC

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THE CHALLENGES AND THE OPPORTUNITIES OF E-COMMERCE AND INTERNATIONAL SMEs; IMPLICATIONS FOR HRM IN APEC

ABSTRACT

Not all SMEs are the same when it comes to contributing to growth. OECD research suggests that over 60% to 70% of economic growth and growth of employment seems to come from about 10% of SMEs; the "entrepreneurial engine". These SMEs are characterised by fast growth. Growth rates of 50% pa or more are not uncommon amongst such firms, and such rapid growth poses special HRM challenges. The emergence of the Internet economy (or E-commerce) is now opening up significant growth opportunities for some SMEs. To take advantage of these opportunities, SME managers face another set of challenges - they need to be "born global" and to be able to grow globally, they need to understand the new E-economy and to be able to access the technology of the internet, and they need to be able to access the finance necessary to grow quickly. The biggest HRM challenge is at managerial level.

APEC is not homogenous; - of the 40 million or so SMEs in APEC, those best positioned to take advantage of the window of opportunity offered by E-commerce tend to be located in the more developed economies. The western, or Asian, half of APEC is still struggling with the financial market problems and recession, while USA and Australia are growing strongly. The USA in particular seems to have established something of a virtuous circle of growth, much of it based on the "entrepreneurial engine", while most the Asian economies are struggling to swim away from a whirlpool of debt and recession. It is important to the longer term success of APEC, and to continued political support of APEC objectives, that Asia restart its entrepreneurial engine, and is not left behind in taking advantage of the window of opportunity offered by E-commerce. The potential for internationalised SMEs to add to the APEC economy should not be underestimated. Estimates by the author suggest that greater structural integration of APEC economies (offered by E-commerce and reduction of tariff and non tariff barriers) will allow SMEs to increase their contribution to the APEC economy *relative* to larger firms, and bring it more in line with that typically found in integrated economies. Available evidence suggests that there is the potential for SMEs to add about $1 trillion in trade and about $150 billion in FDI per annum to the APEC economy if structural changes allow a simpler, more business friendly, more integrated APEC economy to emerge.

What can APEC do to help SMEs, especially those in Asia, take advantage of the opportunities offered by E-commerce? This paper seeks to address this question by:

1. briefly revisiting work on the entrepreneurial engine;
2. outlining estimates of the potential economic benefits offered by SMEs via greater economic integration and E-commerce in APEC;
3. reviewing what APEC is doing with respect to E-commerce and SMEs;

4. outlining the HRM challenges associated with fast growth internationalised, E-commerce SMEs;

5. examining some suggested options for initiatives to meet these challenges and realise the potential gains.

1. THE ENTREPRENEURIAL ENGINE IN APEC

At a micro level, much of the debate on the contribution of SMEs to growth has focussed on large versus small. This misses the point. Not all SMEs are equal when it comes to contributing to growth. At a macro level it has been known for a long time that most economic growth is attributable to TFP (total factor productivity) improvement, not increased inputs.

Box 1 Schematic summary of the contribution of SMEs to development

Source of contribution	overall contribution	SME and SME FDI contribution
Conventional Engine		
Supply side – production		
Increased factor input		
capital investment	about 25%	SMEs contribute about 40% - 60% of this. SME FDI contribution is usually small but probably can be increased by several orders of magnitude.
labour	about 10%	SMEs have no major impact, but may increase effective use of labour force
intangible investment	about 40%	SMEs employ around 40% to 60% of the workforce, so they have a major potential impact on training. SME FDI is a major source of technical training and productivity improvement.
Productivity	about 25%	SMEs probably contribute about half of this. SME FDI is an important source of technology transfer and catch up.
Supply side - savings	necessary for investment	SMEs employ over 50% of the workforce and are an important source of funds. SME FDI is a small but useful source of investment funds.
Demand side		
Domestic		SME wage payments make up over half of GDP, so SME growth is important in domestic demand expansion.
Export		SMEs contribute about 35% or so of exports in the Asian region, so they make a major contribution to this growth engine. SME FDI is usually export oriented, so it increases the potential for exports.
Entrepreneurial Engine		Most SME contribution to growth is focussed in a relatively small proportion of fast growing firms which start up and expand.
Fast growth firms		SMEs receiving FDI generally have higher growth rates...
Adaptability and technology		...a higher propensity to apply technology and training
Flexible exports		..and a greater willingness to increase exports and to internationalise

Source UNCTAD 1998

Although there are few attempts to decompose this TFP improvement by size of firm, SMEs are generally assumed to contribute little because their average productivity is only one third to one quarter of large firm productivity. Again, this misses the point. Box 1 summarises the contributions to growth from a conventional engine point of view, where growth depends on demand pull and supply push. As illustrated in box 1, SMEs have the potential to play an important role in growth. SME FDI (foreign direct investment) is important because E commerce makes it easier for small firms to form cross border alliances and share technology.

Not all SMEs are equal when it comes to contributing to growth. OECD research suggests that over 60% to 70% of economic growth and growth of employment seems to come from about 10% of SMEs; the "entrepreneurial engine". These SMEs are characterised by fast growth. Growth rates of 50% pa or more are not uncommon amongst such firms, and such rapid growth poses special HRM challenges.

Growth seems to be best explained by an interplay of three parts of the economy.

1. Small firms and start ups.

There are many SMEs, - typically firms with less than 100 employees make up over 95% of all firms, and most of these have less than 5 employees. Most of these firms do not grow much, - they are best envisaged as small stores and "lifestyle " businesses - and although they often grow quickly (eg from one to two or four employees) this is not sustained. There is considerable "churning" of the population, so many only survive for 5 to 8 years or so. This means that the net contribution to growth is mostly a balance between exits and start ups. This balance changes for cyclical and structural reasons, but usually the addition of new SMEs contributes about 30% of net growth at the most.

2. Fast growth Firms

Some firms are growth oriented - and successful in growing. As a proportion this is only small; perhaps 20% to 25% of all SMEs are serious about seeking growth, but only 5% are successful in actually achieving sustained growth. These firms seem to contribute around 70% of all net job growth, though their contribution to value added growth may be less. These firms are not necessarily SMEs, and may be a part of a larger company (or may be taken over to become a subsidiary of a larger company). Their growth path does not necessarily follow a consistent trajectory, and the set of high growth firms changes continuously. Many of these firms emerge from the pool of small firms as successful start ups. Their success is often enhanced by entrepreneurs stepping out of larger firms to "do their own thing", and their success is dependent upon management skill and finance that can sustain continued growth. Many of these fast growth firms are now able to operate internationally.

3. Large firms

Large firms typically have more than 500 employees and contribute at most about 30% of job growth, although they often contribute to job reductions, depending on the

point in the business cycle, and depending on structural changes in the economy. A significant proportion of these large firms are MNCs. Large firms employ half the workforce and provide an important industrial infrastructure for start up and growth of smaller firms. Larger firms are important at increasing the efficiency of smaller firms by rationalising and providing efficient distribution channels, R & D sources and funds for development.

The entrepreneurial engine

Figure 1 schematically summarises the interaction of these three main elements of the entrepreneurial engine. All three elements are essential to entrepreneurial growth.

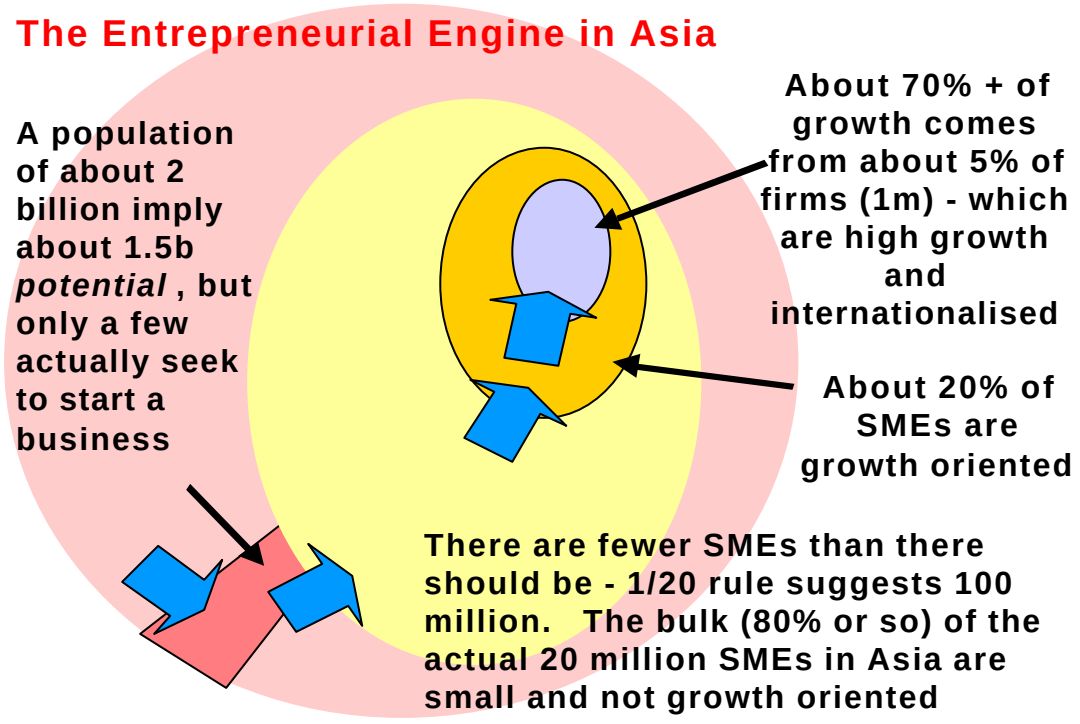
A second way of looking at the entrepreneurial engine is illustrated in figure 2, which focuses on the entrepreneurial engine in Asia. What this shows is that all entrepreneurs are drawn from the general population; there is a seedbed of potential entrepreneurs of about 2 billion people in Asia. Of these, about 1 billion to about 1.5 billion would be of the age that we might expect them to be able to start a business.

Figure 1 The entrepreneurial engine

Size and numbers	dynamics	growth contribution
Large - only about 1% of firms are large and they	..survive for longer by starting up new ventures or absorbing promising smaller firms, but ...	...they usually make a negative contribution to job *growth* as large firms rationalise
Fast growth - only about 5% to 10% of firms succeed in achieving sustained...	...growth, surviving 8 years or more, and expanding to a point where ..	...they make a large contribution to job growth - probably 70%+ of all growth
Small - 90+% of firms are small with less than 100 employees	Start up rates vary from 5% to 20% pa. Most firms do not grow much above 5 employees, and most exit within about 7 years	Some contribution to job growth in conditions where start ups exceed exits - typically this occurs when cyclical and structural conditions are favourable

source: Hall (1998)

Figure 2 The entrepre neurial engine in Asia



The seedbed of the population creates a garden of SMEs. In developed economies we can expect there to be about one SME for every 20 people in the population, or about 1 million SMEs for every 20 million people. In Asia the start up rates and numbers of SMEs are less than occur in developed economies. Estimates of the number or start ups and the number of SMEs are difficult to obtain for Asia. An approximate estimate is that there are about 20 million SMEs in Asia, though many of these would be small TVEs in China. This suggests that there are probably about 100 people per SME, and that ideally there should be somewhere around four and five times as many SMEs as there are now. For historical and structural reasons the number of SMEs is much less than it should be in China, Indonesia and Vietnam.

If the garden has less plants growing in it than it should have, then we would expect less trees to grow forth. This is the case, but some parts of Asia seems somewhat further disadvantaged; there is a "missing middle". Of the SMEs that do start, only about 20% will really be growth oriented. The rest are important politically and as lifestyle businesses, but they do not contribute much to net growth. That said, the sheer start up of SMEs in China, Vietnam, Indonesia and some other economies could be a very major source of job creation and growth in the future in those economies. Identifying which businesses are growth oriented is difficult, but a proxy is those that have succeeded in expanding from small or micro size (usually about 5 to 10 people) to a size where they are about medium sized (say 20 - 100 people), and thus have usually adopted some sort of formal management structure. In some Asian economies there is evidence of a "missing middle". This is particularly the case for Indonesia, as illustrated by Table 1. Medium sized firms (with between 20 and 99 employees) tend to be unrepresented - they make up only 8% of output in Indonesia. This can be contrasted with similar firms contributing about 32% of output in Japan, and 41% in Chinese Taipei.

Table 1. The missing middle - Percentage contribution to output, employment and structure, by size class in selected Asian countries - manufacturing

	small and cottage <20	medium 20 - 100	large 101 - 500	very large >501	n=
Japan					415,109
% establishments	74	21	3	1	
% output		32	19	48	
% employment		53	18	28	
Singapore					4,013
% establishments	41	42	14	3	
% output	3	12	26	59	
% employment	5	26	27	44	
Chinese Taipei					738,914
% establishments	96	3	1	0.1	
% output	25	16	20	39	
% employment	46	18	16	20	
Indonesia					1,600,000
% establishments	99	.8	.2	.06	
% output	17	6	22	55	
% employment	67	*	*	33	
				*	

Japan: - 1992 Small Business in Japan. Manufacturing only. medium is up to 300, large is 300 +.

Singapore: -1994 Manufacturing only . Census of Industrial Production.

Chinese Taipei (Taiwan): - 1991 Census of Industry and Commerce, figures are for non agricultural sector. Micro sector is for firms less than 30 employees, small is 30 - 99 employees.

Indonesia: - estimated - Manufacturing only, 1990. Applies to formal (ie registered firms only). Estimated from BPS data and from Thee (1994) and Hill (1995) and Basri (1994). * included in large category.

In developed economies, the evidence suggests that the bulk of job growth, and probably most value added growth, comes from only about 5% to 10% of firms that are growth oriented and successful. These firms are not all SMEs, but many are small and many are part of a larger network or grouping rather than being stand alone. They grow quickly, so growth rates of 50% pa are not unusual, and they are increasingly internationalised. Identifying these firms after they have succeeded is relatively simple, but identifying them before they succeed is much more difficult; this is the essence of the "picking winners" problem facing many policy makers.

2. ESTIMATES OF THE POTENTIAL ECONOMIC BENEFITS OFFERED BY SMEs VIA GREATER ECONOMIC INTEGRATION AND E-COMMERCE IN APEC

The potential for fast growing internationalised SMEs to add to the APEC economy should not be underestimated. Estimates below that greater structural integration of APEC economies (offered by E-commerce and reduction of tariff and non tariff barriers) will allow SMEs to increase their contribution to the APEC economy *relative* to larger firms, and bring it more in line with that typically found in integrated economies. Available evidence suggests that there is the potential for SMEs to add about $1 trillion in trade and about $150 billion in FDI per annum to the APEC economy if structural changes allow a simpler, more business friendly, more integrated APEC economy to emerge.

We really do not know how much trade and investment is carried out by SMEs in APEC. The best available information (and that usually quoted in APEC documents) suggests that:

SMEs contribute about 30% to 35% of APEC trade, and

SME FDI probably makes up less than 10% of FDI, but higher proportion of cases.

The figures for trade are from work done by the author for the OECD, set out below. They date from nearly a decade ago now, and are based on a jigsaw of information. No more recent estimates have been made. The figure usually quoted as being an APEC figure is in fact an Asian figure - not an APEC figure, so the 35% figure for SME trade is probably an overstatement when USA and other more advanced economies in APEC are taken into account.

Table 2 Structural contribution of SMEs to exports 1991-2

	GDP $ US millions	Exports as per cent of GDP	Share of SMEs in total Exports %
OECD			
Denmark	121 695	27	M ~46
Finland	121 982	19	M 23
France	1 167 749	18	M 26
Greece	65 504	12	19
Italy	1 072 198	15	53
Japan	3 337 191	12	13.5
Netherlands	278 839	47	26
Sweden	280 000	25	30
weighted contribution	4.3		26.1
Non OECD			
PRC	435 000	21	40 - 60
Korea	285 000	27	40
Indonesia	128 000	23	10.6
Chinese Taipei	210 000	44	56
Thailand	108 000	29	10
Malaysia	60 000	72	15
Singapore	46 000	138	16
Vietnam	14 000	7	20
weighted contribution	11.7		35.2

Source: OECD 1997

Note: ~ indicate estimate only. M = manufacturing only. Exports are direct exports by SMEs. This understates the true contribution of SMEs to exports.

Weighted contribution. For exports is the sum of GDP multiplied by the percentage of exports multiplied by the percentage of direct SME exports expressed as a percentage of total exports. For GDP is the same figure expressed as a percentage of total GDP.

SME FDI is much more difficult to estimate - though some work has been done by UNCTAD (1998). Only two APEC economies, Republic of Korea and Japan, keep any form of statistics on FDI by size of firm. None of the other APEC members keep data on the size of the firm investing or being invested in. The only figures which might approximate SME FDI are based on approvals, not actual investment, and are based only on approvals of a given amount, say, less than $1 million US. These can only be obtained from economies which require registration of foreign investments, and which then allow access to the data so as to allow a breakdown by size of investment. This approach does not of course guarantee that the investment is by an SME. An investment of $1 million may be being made by quite a large firm as part of a bigger project (for example the installation of computer equipment in a refinery). Similarly many SMEs may make significantly larger commitments. What figures are then

available on "small package" inward FDI - this is based on FDI approvals of less than $US 1 million. The key points which emerge from this are that:

- in terms of *cases*, small package FDI makes up a significant proportion, ranging from about 15% - 20% in Vietnam to over 60% in Philippines.

- however, in terms of *value*, small package FDI does not loom very large in the overall picture. It makes up as little as half a percent in Vietnam, and only about 2% to 10% by value in the Philippines. SME FDI flows from Korea make up about 20% of all outward FDI flows.

How much SME trade and investment *should* there be in APEC? This question is impossible to answer except in some very broad brush terms. Two aspects need to be distinguished:

- The first is growth of international activity by SMEs as a result of economic growth. UNCTAD evidence generally suggests that, as a rough proxy, trade grows at about double the rate of GDP growth, and FDI grows at about double the rate of trade. Other things equal, and even if SMEs remain relatively under-represented in international activity, we can expect the growth of SME trade and investment to outstrip GDP growth.

- The second is a structural change in the relative importance of SMEs versus larger firms in international activity. The potential for gains here is much larger. SMEs make up only about 30% of trade and about 10% of FDI, whereas they have the potential to contribute nearly 50% of each.

Table 3 suggests that trade in APEC is likely to be about $3 trillion per year in 2000. If GDP in APEC grows at about 4% per annum, then growth in trade can be expected to be about 8% pa, and SMEs should add about 30% of this, or about $80 billion per year.

How much *could* SMEs contribute to trade under ideal conditions? In a fully integrated economy SMEs typically make up about 50% of economic activity; that is SMEs contribute about 50% of GDP and about 50% of investment. At present SMEs seem to make up only about 30% or so of trade. If APEC exports are expected to be about $3 trillion in 2000 (see table 2 below), then SMEs would make up only $1 trillion of the total (or about 30%). If SMEs were to realise their full potential, then they should contribute roughly the same as larger firms (that is about 50%, or about what they contribute in a fully integrated economy), or about $2 trillion. This implies that if SMEs reach their full economic potential, SME exports would double, from $1 trillion to $2 trillion, and total export trade in APEC would expand by 30%, from $3 trillion to $4 trillion. To put this in perspective, an extra $1 trillion in trade each year is more than the combined economies of Canada and Australia, and about double the equivalent of all of Asean. It would be a significant addition to the APEC economy.

Table 3 Imports and Exports 1990 - 1997 - APEC and the World

year	world imports $ Trillion	APEC Imports $ trillion	% APEC	world exports $ trillion	APEC exports $trillion	% APEC
1997	5.4	2.4	44	5.3	2.3	42
1996	5.3	2.3	43	5.2	2.1	40
1995	5.1	2.1	43	4.9	2.1	41
1994	4.2	1.9	44	4.1	1.8	42
1993	3.7	1.6	43	3.6	1.5	42
1992	3.8	1.5	39	3.7	1.4	39
1991	3.5	1.4	38	3.4	1.3	38
1990	3.6	1.3	37	3.4	1.2	35

Source: APEC, drawn from UN Monthly Bulletin of Statistics July 1998

Table 4 shows FDI flows in APEC. SMEs probably make up only about 10% of these (or about $20 billion). If GDP in APEC grows at 4% then FDI is likely to grow at about 16%, so the growth of SME contributions to FDI is likely to be about $3.2 billion.

How much *could* SMEs contribute to increased FDI in APEC under ideal conditions? SMEs typically make up about half of all investment in an economy, but across borders it is much less; SME FDI usually only makes up about 10% of FDI. Table 4 shows that in 1996, FDI flows in APEC amounted to about $189 billion in inflows and $166 billion in inflows. (Seen in perspective, FDI flows are less than one tenth of trade flows in APEC, but typically trade flows are growing at about double GDP growth, and FDI is typically growing at about double the growth in trade flows). About 90% of this FDI (or about $168 billion in outflows) is probably attributable to large firms, and only 10%, or about $20 billion in outflows, is attributable to SMEs. In an ideal world, SMEs would be contributing as much as the large firms. This would suggest that the potential is there for SMEs to increase FDI in APEC by about $150 billion per year. To put this in rough perspective, $150 billion is about the same as the GDP of Hong Kong China or Indonesia. In itself it would be a significant addition to the APEC economy, but FDI has strong multiplier and technology transfer benefits as well.

Table 4 FDI flows in APEC 1996

	FDI inflows 1996 $m	FDI outflows 1996 $m
Australia	6403	1343
Brunei Darussalem	9	0
Canada	6681	7543
Chile	3140	956
China	42300	2200
Hong Kong China	2500	27000
Indonesia	7960	512
Japan	220	23440
Korea	2308	4188
Malaysia	5300	1906
Mexico	7535	553
New Zealand	2928	-157
PNG	230	0
Philippines	1408	182
Singapore	9440	4800
Chinese Taipei	1402	3096
Thailand	2426	1740
USA	84629	84902
Vietnam	2156	1740
	188975	165944

source: UNCTAD World Investment Report 1997 table B

In summary, we should expect that if commitments to reduced trade and investment barriers are maintained then we can expect SMEs to add:

about $80 billion a year to trade in APEC; and

about $3.2 billion in FDI.

Similarly, were the APEC economies to achieve a level of integration where SMEs can move as easily across borders as large firms (in effect achieving an almost borderless economy) it would be possible for SMEs to add as much as about:

$1 trillion each year in additional economic trade; and

$150 billion each year in additional investment.

Clearly the main gains will come from a structural shift which would enable SMEs to operate in a more integrated APEC economy. How realistic is this?

On the one hand, it is unlikely that APEC will become a fully integrated economy in the next 20 years, at least in the sense of the moves of the European Union to full monetary union. The target might thus be discounted to reflect the political reality that even with the best will in the world, and even by 2020, economic union in APEC will be a long way off. Even so, even if the figures above are halved, they still reflect a very large potential gain which at present is being almost ignored.

On the other hand, the rapid changes brought forth by E commerce and globalisation mean that the potential for SMEs to contribute to the growth of the global or regional economy is greater than ever before. It would be particularly shortsighted to ignore this potential, and to not address any impediments that can be identified.

3. WHAT IS APEC DOING WITH RESPECT TO E-COMMERCE AND SMEs

APEC has two main streams of activity:

1. TILF - Trade and investment liberalisation. This is implemented by individual action plans (IAPs) put forward by individual member economies in line with broader targets negotiated by a consensual process. The main elements of these broader targets are to achieve free and open trade and investment in the region by 2010 for industrialised economies and by 2020 for the developing economies.

2. ECOTECH - Economic and technical cooperation. This is mostly implemented by means of a series of projects, undertaken by individual economies or by groups of members working together. The main goals of the ECOTECH program are to:
   - develop human capital;
   - foster safe efficient capital markets;
   - strengthen economic infrastructure;
   - harness technologies for the future;
   - promote environmentally sustainable growth; and
   - encourage the development and growth of SMEs.

There are three broad areas where APEC can contribute to SMEs:

1. *Reduce barriers to trade and investment.* Most of this TILF activity to date has focussed on tariffs and investment guidelines.

2. *Support SMEs in their efforts to become more internationally competitive.* The APEC Ecotech Agenda has a number of initiatives focussing on SMEs.

3. *Build a better business environment.* Within APEC, improving the business environment (for example, by seeking to harmonise regulations) has been largely the responsibility of working groups such as Infrastructure, Fisheries, Tourism, Trade Policy etc. SMEs are a cross cutting issue in this context.

APEC has no specific targets or objectives for SME activities, and the IAPs do not set any specific targets. The SPAN document (Integrated Plan of Action for SME Development), launched at the 1998 SME Ministerial, seeks to provide a focus for other APEC groups to refer to when reviewing their activities. The intention is to encourage a common framework for the development of SMEs though this is so broad as to be of very little use in setting priorities at economy level or at APEC level.

The APEC 1999 Blueprint for Action on Electronic Commerce sets out the role for government as being to:

- Provide a favourable environment, including the legal and regulatory environment, which is predictable transparent and consistent;
- Provide an environment which promotes trust and confidence;
- Promotes the efficient use of electronic commerce;
- Become leading edge in the use of electronic commerce.

The first meeting of the Electronic Commerce Steering Group was held in New Zealand in June 1999. The main work program focuses on:

- "Paperless trading" (actually electronic customs clearance and export documentation and payment for goods). This is left ultimately to individual action plans.
- Measurement of electronic commerce. At this stage this is limited to encouraging meetings of experts, and sharing available information.
- Researching the legal foundations for electronic commerce. This area follows work by OECD and UNICTRAL, and mostly involves holding of workshops.
- Establishing readiness indicators, so that members can evaluate their preparedness and position themselves for electronic commerce.

The APEC work complements and tracks the broader OECD work plans which cover:

- consumer protection;
- privacy protection;
- authentication and certification;
- defining and measuring electronic commerce;
- analytical work examining the economic and social impacts on SMEs;
- taxation issues;

- delivery of government services;
- trade and market access, and electronic commerce in the next WTO round;
- development cooperation.

What is APEC doing with respect to SMEs and E commerce? The short answer is nothing very specific.

4.THE HRM CHALLENGES ASSOCIATED WITH E-COMMERCE AND SMEs

The emergence of the Internet economy (or E-commerce) is now opening up significant growth opportunities for some SMEs. Much of the growth of China, Korea, Chinese Taipei and Japan is directly associated with the success of their SMEs. The challenge is to ensure that the next generation of SMEs can contribute to their full potential. From an APEC perspective, E commerce offers opportunities for firms, especially smaller firms, to move across borders, and to create a much more integrated and seamless business environment. To take advantage of these opportunities, SME managers face challenges - they need to be "born global" and to be able to grow globally, they need to understand the new E-economy and to be able to access the technology of the internet, and they need to be able to access the finance necessary to grow quickly. The biggest HRM challenge is likely to be at a managerial level.

No one really knows how the E commerce economy will evolve, especially in Asia where fixed line access and internet access is less common than in more anglophone economies. In some scenarios, E commerce will radically alter the way firms do business with each other, and with their customers. It will open up access to global market places, and it is already providing a flood of information and intelligence to managers and customers. In other scenarios, E commerce will essentially just replace the existing communication and transactions methods that firms use already, albeit making them cheaper and more efficient. People and firms will adapt, much as they have already to the telephone, and to TV. There is some truth to both scenarios. Most electronic commerce is business to business, and in most countries about 80% of money has been electronic for 20 years or so. In economies such as France, where Minitel has been in place for more than 15 years, E commerce has been the norm for many people, and it has not radically altered the way people do business. On the other hand it is clear that some internet based firms are growing quickly, and they are altering the ways in which we can do and do business.

We can broadly hypothesise then that E commerce will offer opportunities to firms on three main dimensions:

1. Cost reducing - eg E commerce will create opportunities to reduce costs or improve efficiencies.

2. Market enhancing - eg E commerce will allow direct access to customers beyond a local market catchment, or will allow tailoring of products and prices to specific customers.

3. Information, competitive intelligence and management enhancing - eg E commerce will allow managers to identify opportunities, to track competitors, and to build and manage alliances and global network arrangements much more effectively than hitherto possible.

The firms that can and do take advantage of all three will be the ones that contribute most to growth. APEC is not homogenous - of the 40 million or so SMEs in APEC, the firms best positioned to take advantage of the window of opportunity offered by E-commerce tend to be located in the more developed economies. It is important to the longer term success of APEC, and to continued political support of APEC objectives, that Asia restart its entrepreneurial engine, and is not left behind in taking advantage of the window of opportunity offered by E-commerce. E commerce will not benefit, or impact on, all SMEs equally. It makes sense to identify priorities, and to target scarce resources in APEC at where they will have most effect. This is the main challenge.

In terms of the entrepreneurial engine framework developed in section 1, there are about 1.5 billion potential entrepreneurs and about 20 million SME managers in Asia who need to be better informed about E commerce. This poses an almost impossible HRM challenge. However, the great bulk of about 80% of SMEs are mostly lifestyle businesses which do not grow much or contribute much to growth. E commerce will be likely have a marginal impact on most of them, and the impact will be limited mostly to the benefits passed on by larger firms and governments, for example by means of lower transaction costs and better support services.

On the other hand, the biggest opportunities, and the biggest potential impact is likely to be from those 20% or so of SMEs seeking growth, and more particularly the 5% of firms who really have the potential to succeed and make a significant net contribution to job and value added growth. As argued in section 2, the potential gains here are quite large, but they are contingent upon firms being able to take advantage of the opportunities to achieve growth by moving across borders. The challenge here is still large, - in Asia we are probably talking about 1 to 4 million or more SMEs and their managers. The challenge is not just an HRM one; there are many tariff and non tariff barriers to be addressed, and the need to develop more efficient financial markets. Asian financial markets are not yet developed to a point where they can support fast growth firms effectively.

Figure 3 summarises the HRM challenges as along a scale, defined by the entrepreneurial engine. Although all three main targets need to be addressed, it makes more sense to attach a higher priority to targeting the fast growth SME managers; it is a relatively smaller, more manageable target, and likely to lead to more immediate results.

Figure 3 HRM challenges and E commerce in APEC - Asia

about 1 - 2 billion	About 20 million increasing to about 80 - 100 million	about 1 million increasing to about 5 million
General population	***SME managers***	***Fast growth SME managers***
Access to internet, training on entrepreneurship, and how to use electronic communications in business and as customers	Access to internet, access to training on how to use specific aspects of E commerce relevant to their business, and on how to identify business opportunities, and manage growth should they wish to take advantage of those opportunities	Access to training on how to manage fast growth, international firms, and access to updated knowledge of opportunities associated with E commerce as it evolves

5. SUGGESTED OPTIONS FOR INITIATIVES TO MEET THESE CHALLENGES AND REALISE THE POTENTIAL GAINS.

It is tempting to suggest that APEC should actively engage in appropriate HRM training to encourage more E commerce in SMEs. However, figure 3 above, clearly shows that the task is simply too large for APEC to have much impact. What can APEC realistically do?

In section 2 it was argued that the potential gains from a more integrated, more business friendly APEC are large. From an APEC perspective there are two prongs of activity which are relevant to meeting the challenges associated with E commerce and SMEs.

1. The first is breaking down barriers to a more integrated economy. This TILF activity broadly breaks into tariff and non tariff initiatives.
2. The second is in providing or creating an appropriate supporting environment. This is mostly ecotech activity.

5.1 Tariff and non tariff barriers

APEC's main activity to date has been in addressing tariff barriers. For the most part, tariff and investment barriers do not discriminate against SMEs, and SMEs will benefit in the same way as large firms with the reduction in such barriers. Where SMEs are suppliers to larger international firms they will benefit in line with the expansion of trade and investment. Where SMEs internationalise in their own right, they will also gain from the reductions in complexity and administrative burdens associated with reductions in tariffs and investment controls.

However the real gain to SMEs (and to APEC) will now come with attention to NTBs, especially reductions in non border regulatory and administrative burdens, because these pose special problems to small firms moving across borders and growing quickly. Attention to these areas will allow SMEs to expand their international activity *relative to* larger firms. This in turn means that the entrepreneurial engine will operate more effectively at an international level, and it is this that generates most of the jobs and wealth.

Box 2 - The benefits of reducing impediments to SME trade and investment

As part of the APEC technoforum feasibility study, a survey was made of advanced technology SMEs to see what initiatives would be most likely to benefit their firms. The results do not pretend to be statistically reliable (they only represent about 50 firms), but they are interesting nevertheless, if only because of the quality of the responses. Respondents were asked to indicate how helpful they would find a list of initiatives (box below). There is some commonality about the helpfulness of some issues, but on others there is wide variation. They were also asked if the package of initiatives they regarded as "very helpful" were to be implemented, then how much would that help them in expanding their international activities.

List of initiatives APEC is a multilateral organisation which seeks to encourage more trade, investment and economic activity across borders. Please indicate how helpful each of the following initiatives is likely to be in creating a better international business environment in which to expand your business.....
*a. Faster reduction of specific tariff barriers
*b. Faster reduction of non tariff barriers (eg unnecessary regulations)
*c. Better access to government and large firm procurement for smaller international companies
d. Increased efforts to reduce inconsistencies and differences in industry and product regulations
e. Better access for small firms to large firm EDI systems
f. Better access for small firms to processes for developing industry standards for specific products
g. Better protection of intellectual property rights
h. Dispute settlement procedures more suited to the needs of smaller companies (eg faster, less legalistic)
i. Reduced restrictions on mobility of skilled staff
j. Development of regional international capital markets suited to needs of smaller international companies
*k. More direct access to APEC officials to alert them to the needs of firms in emerging industries
*l. More opportunities for display of technology and products
m. More technology exchange and cooperation programs
n. Other (please specify)

* denotes regarded as being regarded as very helpful by a clear majority of respondents.

- The initiatives regarded by almost all respondents as *very helpful* were "faster reduction of specific tariff barriers and/or non tariff barriers" (though not necessarily both together), "better access to government and large firm procurement for smaller international companies", "more access for display of technology and products", and "more direct access to APEC officials to alert them to the needs of firms in emerging industries".

- For most of the other initiatives, the variation in helpfulness was quite wide - for example, for some, access to international venture capital, or standardised EDI, is likely to be very helpful, while for others these issues are of little or no importance.

- The *package* of initiatives that the respondents nominated as "very helpful" would, in their opinion, if implemented, be effective in increasing their rate of growth by somewhere between 20% and above 50%. Although some were start up business, and thus had no track record of sales yet, growth rate of turnover was between 10% and 30% pa.

It is extremely difficult to make any quantitative assessment of the relative importance of different barriers to SMEs, or of the likely effect of their removal on SME activity, simply because of the lack of any reliable empirical information in APEC. This is especially the case for NTBs, and for improvements in business infrastructure. Part of the problem is that "*administrative costs tend to be hidden. They do not usually involve actual money flows, but time lost in meeting administrative requirements.*" Netherlands Ministry of Economic Affairs (1995, p5). The OECD is currently undertaking work on the impact of NTBs and their effect on market dynamism, entrepreneurship and business activities. Work to date clearly shows that such NTBs do have a significant impact. Anecdotally, such NTBs may be responsible for 20% or so of SME costs. To the extent that these are unnecessary, and to the extent that they fall disproportionately on SMEs, they pose a significant barrier and impediment. Box 2 sets out some limited empirical evidence from APEC on the likely effect of addressing specific impediments. This suggests that the benefits may be quite large for SMEs ready to take advantage of the initiatives, and may allow them to increase their international activity by between 20% and 50%.

The problem is that we do not know what these impediments are when it comes to E commerce and SMEs, and APEC has no ongoing process for identifying them. An ad hoc project has been recommended at the Christchurch Ministerial, which requires member governments to identify impediments and report back to the next meeting in Brunei. However, because this is being done at a member economy level, and not an APEC level, and because it is a one off exercise, it is hard to see how it will really help much.

5.2 Supporting environment

The APEC SME PLG has tended to concentrate on this ecotech area. For example the SPAN document seeks to build the capacity of SMEs, and to assist in their adjustment, particularly through the key focus areas of financing, HRD, technology, market access, and access to information. "Helping your Business Grow" summarises the initiatives taken by APEC each year to assist SMEs. However most of these initiatives are ad hoc and there is no monitoring of the effectiveness or impact of them on SMEs in APEC (there is the usual process of administrative review of projects within APEC, but that is more procedural).

5.3 What can APEC do?

It is perhaps useful to first look at what APEC cannot do:

- APEC cannot engage in massive training programs, at least not on the scale required to bring the required skills and knowledge about E commerce to millions of people and managers;

- APEC is a consensus organisation, and it cannot impose conditions on member governments. It is thus not possible to adopt and enforce a comprehensive plan for implementing E commerce encryption standards for

example, nor is it possible to enforce a code of practice for E commerce consumer protection.

Given budget and political constraints, what can APEC do to increase E commerce usage in SMEs and amongst Asian SMEs in particular? From an HRD point of view, APEC is rather limited in what it can do. However it can take steps to

- facilitate private sector initiatives on enhancing E commerce:
- reduce impediments to fast growing international SMEs;
- provide indicators, benchmarks, and best practice information for members to better evaluate the rate of acceptance and penetration of E commerce.

5.3.1 Cooperate with private sector to increase access to advice on E commerce

Although APEC does not have the resources needed to make a significant contribution to E commerce HRD training, APEC can still play a useful role in cooperating with the private sector to improve access to information and training on E commerce. Two examples of initiatives which are already on the table are:

- PECC is already working in conjunction with IBM to develop and implement training programs in Vietnam and Philippines (PECC 1999);
- At the Christchurch SME Ministerial, Ministers directed the PLG to examine the feasibility of linking electronic information services for SMEs in APEC so that there is a single SME friendly entry point, and to similarly provide a single entry point for SMEs to data bases on tariff, non tariff and other requirements.

Further to these, it makes some sense to develop programs in conjunction with the private sector organisations who are active in working with fast growing SMEs in the region; venture capitalists, telecoms, ISPs and internet companies, consulting and accounting companies, etc. One of the benefits of such programs is that it gives more direct interaction between government officials and private sector executives which helps to give both sides a better understanding of the problems associated with rapid change and rapid growth.

5.3.2 Identifying and acting on impediments to E commerce

APEC *can* act as a point of focus for international business to express its concerns about unnecessary impediments to economic and social development. Business is no longer constrained by national borders. E commerce means that even small companies can operate across borders, but when they do so they are faced with impediments. Some of these impediments can be overcome if the firms have ready access to advice. Some are more intractable and unnecessary. APEC can be a focus point for identifying impediments, which in turn will help member states provide useful advice, and to respond by addressing unnecessary impediments to E commerce. ABAC is nominally

the business contact point, but it has been less than successful in being representative of business, and especially of small business.

Preliminary studies suggest that it is feasible to establish a self funded notification system, in conjunction with existing business or industry organisations, such as chambers of commerce and the like. An APEC Notification System or ANS, could be:

- A mechanism to identify areas in APEC where there are unnecessary regulations or impediments (especially non tariff barriers) to the development of business;
- A mechanism to help identify practical suggestions for ways that APEC and member economy governments can develop a better business environment;
- Business initiated, sponsored and run;
- Equally accessible to large and small businesses, but providing a cost effective means for SMEs to have their voice heard in international areas;
- Non confrontationist and non legalistic - ANS need not act as a lobbyist, but might simply seek to identify problems and raise general issues.

How might it work? Individual firms could lodge a notification, which might be a specific complaint or a more general suggestion. This would be lodged with an ANS agent. A notification lodgement would cost a nominal amount, which might go partly to ANS and partly to the ANS agent. An ANS agent would usually be an industry association such as a Chamber of Commerce. Once lodged the notification would be sent on to the ANS central point. The notification could be in two parts; a part which identifies the lodging firm and agent, and a part which sets out the issues. Only the latter part need be sighted by the ANS central point; the document will be identified only by a reference code, so anonymity is provided to the lodging firm. The ANS central point could then carry out an initial brief review, and then depending on the nature of the issue it may do any or all of the following.

1. request more information and clarification, or make suggestions as to other approaches that might be adopted in dealing with the problem;
2. pass the notification on immediately to appropriate authorities in the relevant economy for their information (ANS will not act as a lobbyist);
3. refer the information to a panel of exerts to review and to make general recommendations to APEC (ANS will not recommend on specific disputes or act as a lobbyist);
4. suggest to APEC that a more general review be initiated to address major issues or emerging issues.

ANS would request a response from APEC or from the relevant government. ANS could report back to the relevant ANS agent, who would then report to the lodging

firm. Each year ANS would provide a summary of the nature of lodgements and actions taken. This report would be likely to attract considerable media attention. Most of this could be done electronically and at relatively low cost. The administrative processes of the ANS could build on and complement existing facilities; it would not require any substantial new infrastructure. Preliminary feasibility studies show that its operations could be self funding, although start up would require some additional funding.

5.3.3 Better indicators on SMEs and E Commerce

Improved indicators are part of the APEC E commerce group's target activities. The APEC SME Indicators Project (Hall 1998) has shown that it is feasible to improve the quality and accuracy of information available to decision makers and policy makers, and that this can be done cost effectively. Being able to track the level of penetration and use of E commerce, and the level of E commerce training and access is important for member economies to decide on priorities for support services. At present it is almost impossible to benchmark these indicators against other economies.

Further E commerce itself might offer ways of better tracking SME activity in APEC. The emergence of electronic commerce, especially in conjunction with web based sales supported by post and courier, will have far reaching consequences for SMEs and their ability to penetrate international markets. At present it is not at all clear how the regulatory and reporting regime for Electronic Commerce will evolve. However, it seems likely that for tax purposes, all E-commerce transactions will need to be reported in some way, and in a way that links them to an identifiable entity. This offers the potential to track the participation of SMEs in E-commerce, and their role in international E-commerce.

CONCLUSION

APEC is limited in what it can do to foster E commerce, and is especially limited when it comes to HRD. However, there is a relatively narrow window of opportunity to develop a base of fast growing E commerce firms in Asia. The growth of E commerce in Asia has been impeded by the Asian slowdown, and by the lack of fixed line access to the internet. The potential gains in of a more integrated, business friendly APEC economy are large. Most of these gains will come from structural changes which increase the relative importance of SMEs in the international economy. E commerce will help achieve these gains more quickly than they would otherwise be able to be achieved, but only if APEC makes continuing efforts to

- identify and address impediments, especially at non border non tariff impediments.
- work with the business sector and private sector to make it easier for fast growth SMEs to grow quickly and internationally.

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TEMPORARY EMPLOYMENT IN US SMALL AND MEDIUM ENTERPRISES: PATTERNS AND DETERMINANTS

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TEMPORARY EMPLOYMENT IN US SMALL AND MEDIUM ENTERPRISES: PATTERNS AND DETERMINANTS

ABSTRACT

This paper examines the factors that influence US small and medium enterprises' (SMEs) use of temporary workers. The objective of this paper is to explain how the use of temporary workers allows SMEs to achieve staffing flexibility, lower labor costs, obtain specialized services, and deal with union pressure. To test these hypotheses, I identify features of jobs, organizations, and environments which are likely to predict the use of temporary workers.

Data for this research come from the 1991 National Organizations Study. These data on employers yielded information on around 1700 jobs. Most analysis was conducted using logit and tobit models that included extensive controls for occupation, industry, and region.

The results pertaining to the use of temporaries are mixed with respect to the main hypotheses. Evidence shows that temporaries are used to achieve staffing flexibility that is provided by part-time workers and that is facilitated by decentralizing the decision making on using contingent workers; and they are used more by firms that face union pressure. On the other hand, temporaries are less likely to be employed in jobs where labor costs such as pay and training cost are high; and they appear not to be used to obtain specialized services, because in general temporaries lacked such specialized skills.

The above findings provide some practical implications for SMEs' human resources management practices, particularly for contingent labor deployment.

INTRODUCTION

Recently public attention has been drawn to the "temping" phenomenon, the growing contingent work arrangements including part-time, temporary, and subcontracting work in American workplaces. Conspicuous headlines such as "the temping of America", "disposable workers", and "just-in-time employees" have been ubiquitous in the press. The growing contingent workforce has also become a pressing topic and a main concern of corporate America (Callaghan and Hartmann 1991; Nollen and Axel 1996).

Generally speaking, contingent workers are people with little or no attachment to the organization for which they work. When and how much they work depends on the organization's need. Their work schedule is irregular and usually they have no job security and no implicit contract for continued employment. Furthermore, contingent workers usually earn less and are less likely to receive fringe benefits than workers in comparable full-time jobs (Polivka and Nardone 1989). In practice, contingent workers can be hourly part-time employees, temporaries from staffing companies, direct-hire temporaries, workers from leasing companies, or independent short-term contractors (Nollen and Axel 1996). Due to space consideration, this paper focuses on temporary workers only.

Temporary employment has grown rapidly in recent years. Data from the Bureau of Labor Statistics (BLS) for the help supply services (temporary help) industry constitutes a basis for what is known about temporary workers. This industry, which supplies temporary workers to client firms, has been growing very fast. The employment share of the help supply services industry among nonfarm employments rose from below 0.3 to 1.8 percent between 1972 and 1994. The number of workers employed in this industry grew 8.4 times larger between 1972 and 1994 (from less than 214,000 to 2,002,000) (U.S. Department of Labor 1995: 32-33).

Following the rapid growth of temporary employment, there have been some studies about temporary workers, but thus far there are only few studies examine factors that facilitate or impede employers' use of temporary workers and, moreover, there is no research investigates different patterns of temporary employment for various sizes of enterprises. This research thus focuses on the pattern of temporary employment and explores factors that influence temporary employment in US small and medium enterprises (SMEs)[1].

The reasons for using contingent employment have been considered from several perspectives: staffing flexibility (Abraham 1990; Abraham and Taylor 1996; Callaghan and Hartmann 1991; Nollen and Axel 1996), employment costs (Abraham 1990; Callaghan and Hartmann 1991; Davis-Blake and Uzzi 1993; Pfeffer and Baron 1988), specialized services (Abraham 1990; Abraham and Taylor 1996; Harrison and Kelley 1993), and union avoidance (Davis-Blake and Uzzi 1993; Pfeffer and Baron 1988). An illuminating way to learn why employers use contingent workers is to study the job,

[1] SMEs refer to the enterprises whose number of employees are less than 500.

organizational and environmental correlates of reasons that have been proposed by major researchers (Abraham and Taylor 1996). Through such analysis, we can obtain a better understanding of what sort of job is more likely to be externalized, what type of organization tends to use contingent workers and what kind of environment paves the way for contingent workers.

The paper is organized as follows. The next section reviews the literature and discusses the theoretical and empirical expectations surrounding the reasons employers give for using contingent workers. The third section describes data, measures, and the empirical design. The fourth section gives the empirical findings and analysis about the determinants of employers' use of contingent workers. The last section provides a summary and discussion.

REASONS WHY SME EMPLOYERS USE TEMPORARY WORKERS

There are four main reasons SME employers give for their use of temporary employment arrangements: to increase staffing flexibility, to reduce labor costs, to acquire specialized services, and to avoid unionization.[2] In the next several sections, the corresponding job-related, organizational and environmental indicators of each reason are specified and then testable hypotheses are formulated.

Increasing Staffing Flexibility

Since the 1980s, new economic conditions have increased the variability and uncertainty in demand for products and services. In order to respond to cyclical or unpredictable variations in demand, employers need freedom to vary the number of work hours and the size of workforce; this type of flexibility is known as the numerical flexibility (Rosenberg 1989; Rubery, Tarling and Wilkinson 1987). In this light, contingent workers are the best choice for employers to achieve numerical flexibility. Employers can add or subtract the number of workers as needed, and thus avoid the added cost of idle people during slack times and the extra cost of overtime during peak periods (Nollen and Axel 1996). Therefore, if an important reason for firms to employ contingent workers is to rapidly adjust the number of workers because of fluctuation in demand, then the number of contingent workers an employer needs would be determined by the size of the workload fluctuations.

Previous research has provided some evidence that higher variation in production and employment levels increase the use of contingent workers. Mangum, Mayall, and Nelson (1985) found that the use of temporary workers was positively associated with the instability of product demand as measured by employment change. Abraham (1990) reported that both the seasonal and cyclical variation in an organization's demand affect the use of temporary workers. Based on the preceding discussion, I predict:

[2]Besides these five main reasons, there are some other reasons reported by various sources: filling in for absent employees, screening a candidate for future employment, inability to find regular workers and easing management tasks. Due to data limitations, I cannot construct variables for these reasons.

Hypothesis 1: There is a positive relationship between the extent of variation in industrial and organizational employment levels and the use of temporary workers.

Researchers have argued that transformed organizations often build participation and enpowerment into their organizational structure, both by pushing decisions to the lower levels of the organization and by breaking down boundaries across departments through the use of teams (Appelbaum and Batt 1994; Osterman 1994). The use of contingent work arrangements is related to the transformed organizations because contingent labor force is used to buffer core employees from job loss in such transformed work systems (Abraham 1990; Abraham and Taylor 1996). Through this link, I connect the degree of decentralization of decision-making on using contingent work arrangements to the actual use of contingent workers, and predict:

Hypothesis 2: The more decentralized the organizational decision-making structure is, the more likely the organization will employ temporary workers.

Reducing Labor Costs

Since the 1980s, new economic conditions have increased the variability and uncertainty in product demand, expanded and internationalized the domain of markets, and influenced firm market shares. These new features of competition in combination with the experience of severe and recurring recession have caused employers to become very sensitive to all types of costs, especially labor-related costs. These factors have pressured organizations to cut labor costs, to achieve greater flexibility in the employment of their workforce, and to change organization boundaries by shifting some costs of production to contingent workers. In this respect, contingent employment arrangements seem to fit employers' broader strategy of cutting labor costs and boosting organizations' competitiveness: contingent workers are less expensive than regular workers because their pay and benefits can be lower (Carre 1992, Parker 1994).

Using contingent workers can save on labor costs in two ways. First, the use of contingent workers can reduce employment costs, such as payroll, fringe benefits expenditure, and training costs. Second, many employers believe that dismissing regular employees and using contingent workers as replacements is the most effective way of reducing costs. Therefore, labor costs related to the use of contingent workers can be studied from these two perspectives: employment costs, and downsizing action.

Employment Costs

Contingent workers normally receive lower pay than regular full-time employees and are usually excluded from the available fringe benefits. In addition, through contingent employment arrangements, employers can reduce or eliminate overtime and save on expenditures associated with various aspects of employment such as recruiting, training, and even firing workers (Abraham 1990; Appelbaum 1987; Callaghan and Hartmann 1991; Parker 1994). Since data on the cost of other aspects of employment practices were not available, I limit my discussion to training costs only. Therefore, my discussion of employment costs focuses on pay, fringe benefits and training costs.

Pay. A major reason employers hire contingent workers is to minimize expenses associated with regular workers. Since contingent workers generally receive lower pay than regular employees, employers are tempted to use contingent work arrangements to reduce employment costs if the high pay level of certain jobs has been a main concern.

Research on the earnings of contingent workers has found that contingent workers earn less than regular workers. Using data from the Bureau of Labor Statistics, Callaghan and Hartmann (1991) found that temporary workers earned about 75 to 80 percent of what wage and salary workers earned during the 1980s.

Other researchers also have found a connection between the pay level and use of contingent work arrangements. Studying contracting arrangements in manufacturing industries, Harrison and Kelley (1993) reported that a higher wage level in the work force they studied increased the likelihood of subcontracting. Abraham and Taylor (1996) found that wage saving is a key factor in contracting out tasks in three out of five types of services they studied. Thus, I predict:

Hypothesis 3: The higher the level of pay for a job, the more likely the organization will use temporary employment arrangements.

Fringe benefits. Fringe benefit costs for regular employees are a substantial part of employment costs; thus employers are motivated to avoid fringe benefit costs by using contingent workers. The U.S. Chamber of Commerce's annual employer survey shows that non-wage payroll costs have increased from 28 to 38 percent of total payroll between 1969 and 1989 (cited in Callaghan and Hartmann 1991, p. 26). From BLS data on benefit, wage, and total compensation costs per hour, Callaghan and Hartmann (1991) found that between 1970 and 1991 employers' payments for various fringe benefits grew from 20 to 28 percent of total compensation for employed workers (p. 26).

Some researchers have related fringe benefit costs to the use of contingent workers. Abraham and Taylor (1996) argued that the soaring cost of health insurance during the 1980s may well have strengthened employers' incentives to contract out tasks to firms not offering health benefits. Davis-Blake and Uzzi (1993) found fringe benefits did not affect the use of both temporary workers and independent contractors, but they noted that this finding may be due to their use of an industry-level fringe benefit measure, which may not be a good indicator of a firm's fringe benefits level. In contrast, Mangum, Mayall, and Nelson (1985) reported that firms with higher fringe benefits used more call-ins and temporary-help service employees, whereas they found no effect of fringe benefit levels on the use of direct-hires. Based on the above reasoning, I predict:

Hypothesis 4: The higher the level of fringe benefits in an organization, the more likely the organization will use temporary workers.

Training costs. Facing increasing economic competition and uncertainty, many employers are using job training to cope with rapid changes in technology, industrial restructuring, market conditions, and demographic shifts (Knoke and Kalleberg 1994). Organizational formal training involves human, physical and financial resources; hence expenditure on training constitutes a substantial part of employment costs. In addition, it takes time for employers to recoup training costs. Hence, organizations tend to retain those employees with formal training. Williamson (1979, 1981) offered a similar argument: employers with firm-specific skills will pursue a long-term employment relationship with regular employees to avoid losing the investment in high training costs. Davis-Blake and Uzzi's (1993) findings that firm-specific training had a negative effect on the use of temporary workers supports this line of argument. I thus infer that if a job involves high training costs, employers will try to retain the regular employees with organizational-specific training and will be less likely to replace the employees with contingent workers; the accompanying hypothesis is:

Hypothesis 5: Jobs involving higher training costs are less likely to be filled by temporary and contracting workers.

Downsizing (Controlling Headcount)

For many employers, the fastest and easiest way to reduce costs is to dismiss workers. At the same time, with several recessions still fresh in their memories and the ongoing 1990-1991 recession, employers are reluctant to hire regular workers (Parker 1993). Under such conditions, downsizing has been increasingly used as a strategic move toward cost-saving. Although it has not been verified that controlling headcount through the use of contingent workers can save costs, many employers have followed the downsizing trend. They believe that controlling headcount can contain costs and do not consider contingent workers as part of headcount (Nollen and Axel 1996).

One major problem downsizing organizations have to face, especially those which turn to temporary or contract workers as substitutes for regular employees, is that they are most likely to use a considerable number of contingent workers. Nollen and Axel (1995) found that "downsized companies often find themselves in this predicament when large numbers of employees are terminated without controls in place to protect vital jobs and prevent a massive talent drain. Seeking an immediate solution, such companies then bring back former employees and temporaries to fill in the gaps" (p. 43). This measure brings in a work force of so-called "permanent temporaries" (Nollen and Axel 1995: 43). Considering that downsizing organizations use contingent workers to prevent a talent drain, I predict:

Hypothesis 6: Organizations that have downsized within the past year will be more likely to use temporary workers than those that have not downsized.

Acquiring Specialized Services

The need for specialized services is another essential reason why organizations adopt contingent work arrangements. Acquiring specialized talent has gained

importance in an era of downsizing and restructuring. Organizations may sometimes find that they do not have the specialized equipment or skills in-house needed to produce a product or deliver a service. Therefore, they have to turn to outside providers--either temporary or contract workers--to perform the specialized tasks. The situation can be either due to the considerations concerning the economies of scale in the provision of the specialized services in question (Abraham and Taylor 1996), or due to organizational strategic concerns (Harrison and Kelley 1993). This reason for using contingent workers includes tow organizational correlates: economies of scale, and product/service diversity.

Economies of Scale (Establishment size)

Contracting arrangements for a particular job may indicate that an organization cannot economically maintain the specialized equipment or skills in-house. In addition, firm size is sometimes used to indicate the extent of economic scale. Therefore, small organizations would be more likely to contract out for this reason (Abraham and Taylor 1996). Harrison and Kelley (1993) held a similar argument regarding subcontracting behavior in terms of their machining production sample, but their indicator of the scale of machining operations is employment in those occupations at the establishment, which is different from establishment size. Although both arguments are focusing on contracting arrangements, similar reasoning can be applied to temporary workers. Because large firms have a larger pool of employees than small firms, they are likely to have employees available to meet temporary skill or service needs.

The argument that large organizations are less likely than small organizations to use temporary workers has been partially supported by past research. Davis-Blake and Uzzi (1993) reported that larger establishments were less likely to use temporary workers than small ones. In contrast, Mangum, Mayall, and Nelson (1985) reported that large organizations were more likely than small organizations to use temporary workers, based on a bivariate relationship.

Based on economies of scale, I infer that:

Hypothesis 7: Larger organizations should be less likely to employ temporary workers.

Product/Service Diversity

As product/service diversity increases, the employer will be more likely to encounter the need for greater capacity or for more specialized skills or tools that cannot be easily accessed in-house. Outside subcontractors may have specialized skills or equipment that the organization needs. Therefore, product/service diversity increases the likelihood of subcontracting out (Harrison and Kelley 1993). Harrison and Kelley (1993) verified this argument in their empirical study on manufacturing industries. Jobs requiring specialized skills or equipment generally involve high complexity. Specialized subcontractors might be able to meet the job requirements, but temporary workers are less likely to fit into such jobs. Davis-Blake and Uzzi (1993) found that temporary workers usually fill in low skill jobs. Thus, I infer that the impact of product/service diversity upon the use of temporary and subcontracting workers will be

different and predict:

Hypothesis 8: The greater an organization's diversity of product/service, the less likely it is that the employer will use temporary workers.

Avoiding Unionization

One main argument on the effect of unionization upon the use of contingent workers is that of union avoidance. While public discussion did not pay much attention to it, supposedly one of the main reasons for the use of contingent work arrangements is to allow organizations to remain union-free or to weaken incumbent unions. It is generally believed that contingent workers are difficult to organize because many contingent workers either do not stay with the same employer for extended periods, or because they work for more than one employer, conditions that leave them at a disadvantage in organizing and mobilizing collective action for their own welfare. Moreover, contingent workers are generally separated from and excluded by the regular employees because some employers use contingent workers to put pressure on regular employees (Parker 1994; Pfeffer and Baron 1988). Hence employers can hamper unions through contingent work arrangements since contingent workers are inherently more difficult to organize and are often in tension with the organized regular employees.

This line of reasoning implies a positive relationship between the use of contingent workers and the intensity of union pressure, because as union pressure increases, employers are more likely to utilize contingent workers to remain union-free or to weaken incumbent unions. Based on this discussion, I predict:

Hypothesis 9: The intensity of union pressure in an organization will be positively associated with the organization's use of temporary workers and subcontracting.

DATA AND MEASURMENT

In this section, I discuss the data and measurement of this research.

Data

The main data used in this research come from the 1991 National Organizations Study (NOS) (Kalleberg, Knoke, Marsden and Spaeth 1991), which consists of data on 727 employers of the respondents and their spouses in the 1991 General Social Survey (GSS). The NOS concentrated on the establishments' human resources policies and practices. Items asked about current staffing procedures, internal job ladders and promotion chains, job training programs, and employee benefits and incentives. Additional items gathered basic information about each organization's formal structures, social demography, environmental situation, and productivity and performance.

Unit of Analysis

In order to take the job heterogeneity in the NOS into consideration, I created a job level data set which concatenated information of the three jobs, core, GSS and managerial jobs, which were collected by the same sequence of questions. By doing so, I transformed the organizational data set into a job-level data set and made *job* the unit of analysis in this research. As a result of this procedure, the sample size was increased from 727 to 1701.

Measurement

Variables used can be broadly divided into two groups: dependent and independent variables. For analytical purposes, independent variables were further classified into two categories, study and control variables. Table 4.4 reports the definitions, means, and standard deviations of all the variables used in this paper by three levels--job, organizational and environmental.

Dependent Variables

Use of temporary workers (coded one if temporary workers were used for the job and zero if not) and the extent of using temporary workers were examined at the job level of analysis. The two measures of temporary work arrangements are based on the same question repeated for three jobs: "About what percentage (of CORE, GSS or MANAGERIAL workers) were temporaries?"

Independent Variables

Independent variables are divided into two groups: study and control variables.

Study Variables

Four sets of variables will be constructed to measure job, organizational, and environmental indicators of the following four reasons for using contingent workers: increasing staffing flexibility, reducing labor costs, acquiring specialized services, and avoiding unionization.

(1) Increasing staffing flexibility

Organizational variation in employment was measured as the standard deviation in an organization's employment of full-timers and part-timers within the past one and three years. *Industrial variation in employment* was measured as the coefficient of variation of monthly employment in various industries over the period from 1989 to 1990. The data come from the BLS "Employment and Earnings".

(2) Reducing labor costs

Three measures of employment costs are constructed. The *pay level* of a job is what most persons in that job earned annually in the organization. *Fringe benefits* is a scale based on 13 items of various benefits including medicare, dental care, life

insurance, sick leave, maternity leave, elderly care, flexible hours, cash or stock bonus, pensions, profit-sharing, drug and alcohol abuse programs, disability insurance, and child care. *Training costs* is a logged expenditure measure representing the training budget divided by the number of persons trained.

Two binary indicators of *downsizing* are used: if an organization has ever cut the number of full-time or part-time employees within the last year, then it is considered a downsizing organization.

(3) Acquiring specialized services

Organizational size is defined as the natural log of an establishment's full plus part-time employees. The indicator of *product/service diversity* is based on employers' evaluations of their organizations' performance in developing new products, services or programs.

(4) Avoiding unionization

No specific NOS survey item asked informants to estimate the degree to which the workforces in their establishment were organized by trade unions. Several items that did appear in the survey, however, are indicative of the presence of organized labor, and these were combined into a *union pressure* scale[3]. These indicators are well correlated with one another, so the scale has an estimated reliability (Cronbach's alpha) of 0.82.

Control variables

Several variables were included to control for human capital, occupational, organizational, governmental, industrial, and geographic factors that were likely to affect the use of contingent workers.

In my research, human capital variables are features of a job (rather than of a current employee) since only job information was available in the NOS data. In order to control for gender effect, the percentage of female employees of a certain job is included. To control for the effects of skills required to perform a job, several measures of occupational complexity from the Dictionary of Occupational Titles (DOT) including information (data), interpersonal (people) and technical (things) complexity; specific vocational preparation (SVP); general educational requirements (GED); and some adaptability and aptitude measures were combined to create two job complexity measures.

Whether an organization is profit or nonprofit could cause fundamental

[3] Marsden, Cook and Knoke (1996) inferred the presence of a union when informants told interviewers that formal training was offered by virtue of provisions in union contracts; when union negotiations were said to be an important criterion in the determination of earnings of core or GSS employees; or when it was anticipated that union relations would be a problem for the establishment over the three-year term. These indicators were combined into the *union pressure* scale

differences in practice patterns. To control for organizational type, I included an indicator variable for nonprofit organizations.

Organizations which were regulated by the government ought to be responsive to the concerns of the government. Government agencies have become more concerned about the well-being of contingent workers recently (Belous 1989; Davis-Blake and Uzzi 1993). A scale measuring the intensity of governmental regulation was used to control for the effect of governmental regulation upon the use of contingent workers.

Some researchers (Abraham 1988, 1990; Abraham and Taylor 1996; Davis-Blake and Uzzi 1993; Mangum, Mayall, and Nelson 1985) have suggested that the use of contingent workers varies by occupation, industry, and region. Using 1980 Census occupation codes, six binary variables for occupational categories were created: (1) managerial, (2) professional and technical, (3) sales and administrative support, (4) service, (5) precision production, craft, and repair, and (6) operator, fabricator, laborer, farming and fishing. Binary variables for nine industries were created based on three-digit SIC codes: (1) agriculture, forestry and mining, (2) manufacturing, (3) construction, (4) infrastructural activities (transportation, communication, and utilities), (5) trade (wholesale and retail), (6) finance, insurance, and real estate, (7) professional services, (8) personal services, (9) public administration.

To control for regional effect, four regional binary variables were added to the models: East, West, South, and Midwest (which serves as the omitted category).

Missing values

In order to preserve cases, I replaced missing values of these variables with the means of nonmissing values. However, if cases had missing values on the dependent variables, they were dropped from an equation.

Empirical Design

This section is an overview of the empirical design for studying the determinants of the use/extent of use of contingent work arrangements.

Statistical Methods

One problem that has not been commonly recognized in research on contingent employment is the censored dependent variable problem--variables whose actual values are not observed for a large proportion of the cases. One of the dependent variables in this research, the proportion of temporary workers in a particular job, is censored. A Tobit analysis is thus appropriate for these data (Maddala 1983; Winship and Mare 1992).

When the research focus was switched to whether or not an employer uses temporary workers for a specific job, the logistic model was applied because the dependent variable was binary.

ANALYSIS

Table 1 reports the definitions, means, and standard deviations of the variables used in this paper. Pooling all jobs together, I found that 6 percent of the jobs could be filled with temporary workers for these SMEs. The mean percentage of temporary employees for all kinds of jobs was 2 percent. I examine determinants of whether an SME employer uses temporary workers or not in this section. Table 2 presents the results from the logistic models representing whether or not temporary work arrangements are used for all jobs together. Each model includes the control variables and the group of study variables associated with a particular perspective. The perspectives and the corresponding model titles are "Increasing Staffing Flexibility" (Model 1), "Reducing Labor Costs" (Model 2), "Acquiring Specialized Services" (Model 3), "Avoiding Unionization" (Model 4), and an integrative model (Model 5).

Determinants of the Use of Temporary Workers

Employers use contingent workers to increase staffing flexibility, to reduce labor costs, to acquire specialized services, and to avoid unionization. Based on the results from Model 1 through Model 5 in Table 2, I had the following findings:

Increasing staffing flexibility. As predicted, organizational fluctuation of part-time employment was important for explaining the use of temporary workers and had a significant positive association with the use of temps. This finding also implies that in deciding the use of temps for a particular job, employers resort to past experiences of employing part-time workers. The significant and positive coefficient of decentralization indicator support the hypothesis that the more decentralized the organizational decision-making structure is, the more likely the organization will employ temporary workers.

Reducing labor costs. Contrary to usual predictions, employment costs such as the pay level and training cost (per trainee) of a job had a negative effect on temporary worker use, while the fringe benefits' measure was not a significant predictor. This result did not support the common argument that the primary motivation for using contingent workers was to save on employment costs; otherwise, the increase of costs should have driven employers to use more temporary workers. One possible interpretation of these negative coefficients is that many of the jobs analyzed were central to the organization's success and were performed by workers who are more difficult to replace. If employers have invested high costs in rewarding and training such employees, they are less likely to replace those employees with contingent workers.

As predicted, one of the downsizing indicators, organizations having downsized their part-time employees, was strongly related to the use of temporary workers. The positive coefficient here showed that organizations which had laid off part-time workers were more likely to use temporary work arrangements.

Acquiring specialized services. I found that both measures indicating the extent of specialization of functions, size of employment and organization's diversity of

products/services, were significant predictors.

An organization's employment size was positively related to the probability that it used temporary workers. Although it was not anticipated that the size variable would have a positive coefficient, the result is consistent with Mangum, Mayall, and Nelson's (1985) findings. This result implied that larger organizations are more likely to employ temporary workers.

As anticipated, product diversity had a significant negative effect on the use of temporary workers. One interpretation is that product/service diversity creates the need for specialized expertise which generally involves high complexity, but temporary workers were less likely to fit into such jobs because in general they lacked the necessary specialized skill. This finding supplemented Davis-Blake and Uzzi's (1993) findings that temporary workers usually filled jobs low in skills.

Avoiding unionization. Union pressure, as anticipated, had a positive effect on the use of temporary workers. This evidence supported the union avoidance argument, i.e., as the union pressure increased, employers were more likely to use temporary workers to remain union-free or to weaken existing unions.

Control variables. In general, control variables had the expected signs, though some of them were not statistically significant. Occupation generally had no effect on the use of temporary workers except for the managerial occupation that also served as the managerial job indicator. Moreover, the highly significant and negative coefficient of the managerial job indicator indicated the extremely low usage of temporary work arrangement for managerial jobs. Nonprofit organizations seemed to be more likely to employ temporary workers. Temporary work arrangements were more frequently used in professional and personal service than in manufacturing industries. I also found temporary workers were used less frequently in the East than in the Midwest.

Determinants of the Extent of Employers' Use of Temporary Workers

This section analyzes the determinants of the extent of using temporary workers. The following discussion on the determinants of the extent of using temporary workers is based on Table 3, and is arranged under the headings as the previous section.

Increasing staffing flexibility. As in predicting whether an employer used temporary workers or not, organizational fluctuation of part-time employment was important for explaining the extent of using temporary workers. As predicted, part-time employment variation had a significant positive association with extent of use. This finding implies that in deciding the degree of temping for a particular job, employers resort to past experiences of employing part-time workers.

Reducing labor costs. As seen earlier, in the logit analysis, the pay level of a job and training cost was significant and negatively associated with the extent of using temporary workers. In contrast, the fringe benefit indicator was not a significant predictor. Again, these results did not support the common argument that the primary motivation for using contingent workers was to save on employment costs. Instead, if

employers had invested high costs in rewarding and training those employees, they were less likely to replace them by contingent workers.

Downsizing indicators predicted the extent of using temporary workers in ways that are similar to their prediction of the use of temporary workers. As predicted, one of the downsizing indicators (organizations downsizing their part-time employees) was strongly related to the extent of temporary worker use. The positive coefficient here showed that organizations which had laid off part-time workers were more likely to increase their use of temporary work arrangements.

Acquiring specialized services . Similar to the result for whether or not an employer used temporary workers, both measures indicating the extent of specialization of functions for an organization were significant. An organization's employment size was positively related to the extent of using temporary workers. This deserves further investigation. Product/service diversity, as anticipated, had a significant negative effect on the extent of temporary worker use; this implied that temporary workers were less likely to fit into such complex jobs because in general they lacked complex organization-specific skills.

Avoiding unionization. Union pressure had a positive effect on the extent of using temporary workers. This evidence supported the union avoidance argument.

Control variables. Occupation generally had no effect on the use of temporary workers except for the managerial occupation. The higher the percentage of female workers for a job, the stronger the extent of using temporary workers. More temporary workers were used by those organizations in the personal service industry than in others. One area indicator was significant; the extent of temping was less serious for organizations in the East.

SUMMARY AND DISCUSSION

This paper draws on theories from organizational sociology, economics, and the sociology of labor markets to examine the factors that influence US SMEs' use of temporary workers. The objective of this paper is to explain how the use of temporary workers allows SMEs to achieve staffing flexibility, lower labor costs, obtain specialized services, deal with union pressure, and improve employees' commitment and competence. To test these hypotheses, I identify features of jobs, organizations, and environments which are likely to predict the use of temporary workers.

The results pertaining to the use of temporaries are mixed with respect to the main hypotheses. Evidence shows that temporaries are used to achieve staffing flexibility that is provided by part-time workers and that is facilitated by higher degree of decentralization on the decision making of using contingent workers; and they are used more by firms that face union pressure. On the other hand, temporaries are less likely to be employed in jobs where labor costs such as pay and training cost are high; and they appear not to be used to obtain specialized services, because in general temporaries lacked such specialized skills.

The above findings provide some practical implications for SMEs' human resources management practices, particularly for contingent labor deployment. However, there are a couple of points need to be noted: First, the data set used here was not aimed at the use of temporary workers, therefore some crucial information about the use of temporary arrangements are not available. This problem suggests that more representative and systematic data need to be collected. Second, this research studies the causes of SMEs' use of temporary workers, but does not explore labor market consequences of this use due to lack of appropriate data. This is definitely a very urgent and promising field to be researched considering the rapid growth of the contingent workers.

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Table 1. Table of Variables by Level in This Research

Variable	Definition	mean	s.d.
Job Level Variables			
% of temporaries	% of temporary workers in a job.	0.02	0.13
Use of temporaries	A dichotomous variable coded 1 if the job uses temporaries.	0.06	0.24
Ln(mode)	The natural logarithm of the annual earnings of most employees in the job earned.	10.07	0.73
Unionization	A proportion measures the intensity of union pressure used by Marsden, Cook and Knoke's (1996) by drawing on three questions of union influence in the NOS questionnaire.	0.30	0.24
Core job	A dichotomous variable coded 1 if the job is a core job.	0.44	0.50
Job complexity	A combined measure of several measures of occupational complexity from the DOT included information (data), interpersonal (people) and technical (things) complexity, specific vocational preparation (SVP), general educational requirement (GED), and some adaptability and aptitude.	2.87	5.63
% of female employees	% of female workers in the job	0.44	0.39
Managerial	A binary variable for the job's occupation.	0.42	0.49
professional, and technical	A binary variable for the job's occupation.	0.13	0.33
sales and administrative support	A binary variable for the job's occupation.	0.16	0.37
Service	A binary variable for the job's occupation.	0.08	0.28
precision, craft, and repair	A binary variable for the job's occupation.	0.07	0.26
operator, fabricator, laborer, and farmer (omitted)	A binary variable for the job's occupation.	0.13	0.34
Organizational Level Variables			
Decentralization	A scale measured by the level at which the decision on using contingent work arrangements is made.	2.72	0.94
Organization's full-timer variation	The standard variation of an organization's employment of full-timers within the past one and three years.	8.22	18.58
Organization's part-timer variation	The standard variation of an organization's employment of part-timers within the past one and three years.	6.00	16.57
Fringe	The proportion of 13 items of various benefits including medicare, dental care, life insurance, sick leave, maternity leave, elderly care, flexible hours, cash or stock bonus, pensions, profit-sharing, drug and alcohol abuse programs, disability insuranc	0.54	0.24
Training expenditure	A logged expenditure measure represents the training budget divided by the number of persons trained.	4.15	3.03
Formal job training	A dichotomous variable coded 1 if the organization provided any employees with formal job training in the past two years.	0.69	0.46
Downsizing full-timer	A binary indicators of downsizing based on a question asking if the organization has ever cut the number of full-time employees within one year.	0.20	0.40
Downsizing part-timer	A binary indicators of downsizing based on a question asking if the organization has ever cut the number of part-time employees within one year.	0.07	0.26

Establishment size	Natural log of establishment's full-plus part-time employees.	3.57	1.58
Product/service diversity	Employer's evaluation of his/her organization's performance in the development of new products, services or programs with that of other similar organizations. (-1= worse; 0 = about the same; 1 = some better; 2 = much better)	0.96	0.78
Non-profit organization	A dichotomous variable coded 1 if the organization is a non-profit organization.	0.29	0.40
Government regulation	A scale measuring the intensity of governmental regulation. The scale is from 1 to 5.	3.28	1.26
Environment Level Variables			
Industrial employment variation	The coefficient of variation of monthly employment in various industries over the period from 1989 to 1990 by using data in "Employment and Earnings".	0.11	0.26
Manufacturing (omitted)	A binary variable for the organization's industry.	0.15	0.35
Construction and agr., mining	A binary variable for the organization's industry.	0.07	0.26
transport, communication, utility	A binary variable for the organization's industry.	0.09	0.28
trade	A binary variable for the organization's industry.	0.20	0.40
finance, insurance, real estate	A binary variable for the organization's industry.	0.07	0.25
Professional service	A binary variable for the organization's industry.	0.24	0.43
Personal service	A binary variable for the organization's industry.	0.12	0.32
public administration	A binary variable for the organization's industry.	0.07	0.25
East	A binary variable indicated the organization's area.	0.34	0.47
Midwest (omitted)	A binary variable indicated the organization's area.	0.37	0.48
South	A binary variable indicated the organization's area.	0.16	0.37
West	A binary variable indicated the organization's area.	0.13	0.34

Table 2. The Determinants of Use of Temporary Workers: Logistic Regression Results

	Model 1	Model 2	Model 3	Model 4	Model 5
Study variables	ß (s.e. (ß))	ß (s.e. (ß))	ß (s.e. (ß))	ß (s.e. (ß))	ß (s.e.(ß))
Staffing Flexibility					
Emp. variation	-.516 (.878)				-.509 (.898)
Varemp (full)	-.007 (.008)				-.004 (.009)
Varemp (part)	.013** (.006)				.012* (.007)
Decentralization	.331*** (.108)				.268** (.115)
Labor Cost					
Mode of earnings		-.314** (.151)			-.277* (.160)
Training cost		-.054 (.050)			-.101* (.054)
Fringe		.427 (.676)			-.556 (.854)
Empf1dec (full)		-.202 (.361)			-.222 (.366)
Empp1dec (part)		1.203*** (.431)			.831* (.447)
Specialized Services					
Size			.280*** (.100)		.351*** (.129)
Diversity			-.483*** (.168)		-.483*** (.176)
Avoiding Unionization					
Union pressure				.765 (.631)	1.368** (.676)
Control variables					
Core job	.472 (.300)	.431 (.303)	.550* (.305)	.440 (.299)	.540* (.306)
Job complexity	-.043 (.039)	-.026 (.039)	-.019 (.040)	-.041 (.039)	-.012 (.041)
Perwoman	.005 (.004)	.004 (.004)	.006 (.004)	.006 (.004)	.005 (.004)
Nonprofit	.827** (.372)	.771** (.381)	.541 (.381)	.726* (.373)	.627 (.401)
Governmental regulation	.095 (.119)	.108 (.123)	.001 (.127)	.057 (.119)	.072 (.133)
Occupation					
Managerial	-1.641** (.753)	-1.781** (.761)	-1.969*** (.765)	-1.607** (.751)	-1.859** (.769)
Professional, and technical	-.663 (.692)	-.737 (.698)	-1.002 (.712)	-.718 (.696)	-.922 (.703)
Sales & adm. Support	.278 (.506)	.054 (.506)	-.027 (.515)	.080 (.500)	.059 (.524)

Service	.064	-.104	-.242	-.093	-.256
	(.527)	(.525)	(.536)	(.519)	(.551)
Precision, craft, and repair	.483	.434	.326	.343	.476
	(.524)	(.525)	(.531)	(.519)	(.538)
Operator, farmer & laborer (omitted)					
Industry					
Construction	-.328	-1.119	-.395	-.934	-.263
	(.874)	(.719)	(.733)	(.704)	(.889)
Communication, transport & utility	-.094	-.409	.028	-.279	.088
	(.596)	(.596)	(.608)	(.592)	(.616)
Trade	-.599	-1.152**	-.537	-.808	-.660
	(.572)	(.583)	(.578)	(.558)	(.602)
Finance, insurance, real estate	-1.112	-1.168	-.531	-1.142	-.578
	(.891)	(.897)	(.900)	(.869)	(.973)
Professional service	.832	.433	.887	.485	1.018*
	(.579)	(.586)	(.596)	(.571)	(.608)
Personal service	.612	.409	1.022*	.451	1.001*
	(.505)	(.519)	(.537)	(.494)	(.555)
Public administration	-1.019	-1.385	-1.018	-1.282	-.720
	(.921)	(.920)	(.931)	(.911)	(.945)
Manufacturing (omitted)					
Area					
East	-.509	-.592*	-.609*	-.605**	-506
	(.317)	(.315)	(.315)	(.313)	(.326)
South	-.478	-.544	-.578	-.489	-.542
	(.392)	(.389)	(.391)	(.386)	(.403)
West	-.107	-.035	-.090	-.099	.033
	(.375)	(.374)	(.375)	(.367)	(.387)
Midwest (omitted)					
N	1274	1274	1274	1274	1274
-2 log likelihood	476.074	478.291	475.507	488.724	450.288
? ^{2} (df)	105.32****	103.10****	105.88****	92.67****	131.10****
Pseudo R^2	.181	.177	.182	.159	.226

* p<.10; ** p <.05; *** p<.01; **** p<.001.

Logistic regression coefficients are reported. Standard errors are in parentheses. The two-sided z-test was applied to test all variables.

Table 3. The Determinants of the Intensity of Employers' Use of Temporary Workers: Tobit Models

	Model 1	Model 2	Model 3	Model 4	Model 5
Study variables	ß (s.e. (ß))	ß (s.e. (ß))	ß (s.e. (ß))	ß (s.e. (ß))	ß (s.e. (ß))
Staffing Flexibility					
Emp. variation	-.241 (.389)				-.235 (.394)
Varemp (full)	-.004 (.004)				-.003 (.004)
Varemp (part)	.007** (.003)				.006* (.003)
Decentralization	.157*** (.054)				.135** (.056)
Labor Cost					
Mode of earnings		-.176** (.078)			-.157** (.080)
Training cost		-.022 (.024)			-.039 (.025)
Fringe		.112 (.319)			-.136 (.390)
Empf1dec (full)		-.096 (.166)			-.101 (.166)
Empp1dec (part)		.468** (.215)			.317 (.212)
Specialized Services					
Size			.096** (.047)		.109* (.059)
Diversity			-.225*** (.082)		-.218*** (.083)
Avoiding Unionization					
Union pressure				.314 (.304)	.532* (.323)
Control variables					
Core job	.120 (.138)	.086 (.139)	.140 (.141)	.100 (.138)	.121 (.138)
Job complexity	-.021 (.019)	-.015 (.019)	-.013 (.019)	-.021 (.019)	-.011 (.019)
Perwoman	.003* (.002)	.003 (.002)	.003* (.002)	.003* (.002)	.003 (.002)
Nonprofit	.278 (.179)	.255 (.182)	.166 (.182)	.243 (.179)	.181 (.185)
G. regulation	.038 (.057)	.052 (.059)	.009 (.060)	.019 (.057)	.048 (.062)
Occupation					
Managerial	-.708** (.339)	-.739** (.345)	-.842** (.350)	-.690** (.341)	-.756** (.347)

Professional, and technical	-.194 (.312)	-.199 (.317)	-.334 (.324)	-.237 (.318)	-.251 (.316)
Sales & adm. Support	.153 (.231)	.067 (.233)	.028 (.234)	.064 (.232)	.074 (.234)
Service	.110 (.243)	.016 (.244)	-.029 (.248)	.025 (.245)	-.030 (.247)
Precision, craft, and repair	.329 (.240)	.293 (.241)	.270 (.242)	.262 (.240)	.355 (.243)
Operator, farmer & laborer (omitted)					
Industry					
Construction	.067 (.379)	-.321 (.308)	-.120 (.314)	-.228 (.298)	.018 (.388)
Communication, transport & utility	.030 (.269)	-.136 (.276)	-.004 (.275)	-.070 (.270)	.061 (.278)
Trade	-.257 (.251)	-.489* (.259)	-.304 (.254)	-.359 (.251)	-.278 (.261)
Finance, insurance, real estate	-.567 (.420)	-.597 (.421)	-.366 (.411)	-.573 (.406)	-.357 (.433)
Professional service	.378 (.263)	.208 (.266)	.341 (.269)	.243 (.260)	.444 (.276)
Personal service	.383* (.232)	.287 (.239)	.477** (.246)	.306 (.231)	.527** (.251)
Public administration	-.277 (.401)	-.450 (.402)	-.336 (.403)	-.418 (.400)	-.110 (.403)
Manufacturing (omitted)					
Area					
East	-.274* (.148)	-.278* (.148)	-.304** (.150)	-.292** (.148)	-.267* (.150)
South	-.267 (.183)	-.302* (.186)	-.286 (.183)	-.269 (.183)	-.304 (.189)
West	-.083 (.177)	-.020 (.177)	-.053 (.178)	-.063 (.176)	-.015 (.179)
Midwest (omitted)					
N	1274	1274	1274	1274	1274
-2 log likelihood	508.424	511.810	511.715	521.871	487.008
? ^{2} (df)	104.98****	101.59****	101.69****	91.53****	126.40****
Psuedo R^2	.171	.166	.166	.149	.206

* p<.10; ** p <.05; *** p<.01; **** p<.001.

Tobit regression coefficients are reported. Standard errors are in parentheses. The two-sided t-test was applied to test all variables.

TRAINING PRACTICES AND THEIR EFFECTIVENESS: THE EXPERIENCE OF SMALL AND MEDIUM-SIZE ENTERPRISES IN CHINESE TAIPEI

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TRAINING PRACTICES AND THEIR EFFECTIVENESS: THE EXPERIENCE OF SMALL AND MEDIUM-SIZE ENTERPRISES IN CHINESE TAIPEI

ABSTRACT

To determine whether training programs produce real benefits for small and medium-size enterprises (SMEs), we must investigate the relationships between those programs and their effects on the business performance of SMEs. Although a number of previous studies have attempted to accomplish this task, serious inadequacies, such as inconsistent definitions of training and "rough" methods of training classification and measurement, have raised doubts about the validity of their findings. To remedy these inadequacies and more accurately assess the relationships between training and training effectiveness, this study employs a comprehensive measurement of training including training organization, expenditure, duration, process, and delivery methods. Its findings show that firms with sophisticated training systems and strong management support for training are most successful at maximizing the effectiveness of their training programs.

INTRODUCTION AND RESEARCH OBJECTIVE

An educated and well-trained work force is considered to be essential to the maintenance of a business firm's competitive advantage in a global economy. It is also believed that training can and should be a powerful agent to facilitate a firm's expansion and the development of its capabilities, thus enhancing profitability (Cosh, Duncan, and Hughes, 1998). However, Westhead and Storey (1997) suggest that employees in small and medium-size enterprises (SMEs) are much less likely to receive training than their counterparts in larger organizations. They offer two possible explanations to account for this phenomenon. One is "ignorance," which suggests that small business owners are not aware of the benefits of training and consequently provides less than an optimal amount of it to their employees. Another is the "market-forces" explanation, according to which business owners provide a less-than-optimal level of training because they anticipate that the costs associated with training may exceed the benefits (returns) to be derived from it.

These two opposing arguments have important policy implications. If ignorance is the major reason for inadequate training, then either owners/managers are poorly informed or training programs have not been marketed with sufficient vigor, or both. Such a situation would justify government intervention in the form of minimum training requirements or direct training subsidies for SMEs. If, on the other hand, the market-forces explanation is found to be superior, then government intervention could prove totally ineffective. If we are to intelligently decide which policy direction to follow, we must first carefully examine the relationship between training programs and business performance, and determine the type and extent of benefits which training brings to SMEs.

Despite the growing importance of SME research during the last decade, very little attention has been paid to the effectiveness of training programs for small and medium-size businesses. Cosh, Duncan, and Hughes (1998), Marshall et al (1993, 1995), and Westhead and Storey (1996, 1997) have attempted to rectify this situation. However, their studies are inconclusive and their focus is strictly limited to Western society. Consequently, additional research on this issue from a greater variety of perspectives has been encouraged (Westhead and Storey, 1996).

In a survey of 1,480 SMEs in Canada, Baldwin et al (1994) found both the proportions of employees receiving training and training expenditure per employee to be negatively correlated with business profitability. They also discovered that the most successful firms tend to train fewer workers than less-successful ones. A study by Wynarczyk et al (1993) of fast-growth SMEs in the UK showed an insignificant relationship between the provision of training and firm performance when other related variables were controlled. Another survey conducted by the Cambridge Small Business Centre in the UK (1992), found no clear link between firm growth and the provision of training. Storey and Westhead (1994) after examining previous research on the relationship between training and small-business performance, concluded that the association between these two variables is not well established. Finally, Marshall et al (1995) suggested that management-training projects have little effect on the

performance of small firms, though they may be successful in larger companies with greater management skill and capacity.

Westhead and Storey claimed that the studies they had reviewed (1997) had failed to substantiate an alleged link between training and improved performance. Noting that training in SMEs may vary according to knowledge or skills conveyed, duration, proportion of the work force participating, and modes of delivery, they advocated studying the effects on firm performance of training programs classified according to their specific contents.

More recently, Cosh, Duncan, and Hughes (1998) investigated a sample of 1,640 UK SMEs that had participated in surveys in 1991 and 1995. As a result of their investigation, they found a positive link between training and firm survival, but one that was not statistically significant. The authors also examined the relationship between formal training and business performance in terms of employment growth and profitability. They found that training was strongly related to employment and sales growth, but unrelated to profit margins. In a subsequent review, Kitching (1998) faulted this investigation for defining "formal training" in a manner subject to differing interpretations by respondents. In addition he criticized the assignment of firms to trainer and non-trainer categories, based on the presence or absence of formal training programs, as "too rough" a system of classification. Kitching suggested a more sensitive conceptualization of the term "training investment," one which takes account of differences in the nature and duration of training and the extent of employee coverage.

Like earlier research by Westhead and Storey (1997) and Kitching (1998), this study seeks to examine the relationship between training systems and their effectiveness. However, it employs a concept of training that is more comprehensive than that of other studies, one that includes training organization, expenditures, duration, employee coverage, and delivery methods. A key aim is to profile differences in the training practices of SMEs in Chinese Taipei and in the effectiveness of training programs conducted by such firms.

METHODOLOGY

Data Source

The population from which our sample was drawn is the "name list of manufacturing firms in Chinese Taipei," an electronic file maintained by the Ministry of Economic Affairs. This list contains data on 7,686 firms with a work force of between 50 and 300 employees. Six hundred firms, randomly selected from the population to ensure representation by all size categories, were sent questionnaires regarding their training practices. Of the 568 questionnaires received by these firms (32 were undeliverable), 144 completed questionnaires were returned, for an effective response rate of 25.4%. A comparison of participating firms with non-participating ones showed no significant difference in firm size.

The average number of employees per sample firm was 146. Classified by ascending order of scale, 30.8% of the sample firms had fewer than 100 employees,

36.3% had between 100 and 200 employees, and 32.9% had between 200 and 300 employees. The typical sample firm had been in business for 22 years. Trade unions had been established at 31.6% of the respondent firms, but not at the remaining 68.4%. Ninety-six percent of the sample firms are privately owned, and the remainder are state-owned enterprises.

Classifying Respondent Firms by Training Effectiveness

Respondents were asked to rank the performance of their establishments with regard to ten aspects of training-related effectiveness, in accordance with a five-point scale ranging from "very good" (5) to "very bad" (1). The ten aspects are: product or service quality, work motivation, ability and knowledge, operational safety, profitability, work efficiency, job satisfaction, and the reduction of material wastage and absenteeism. Using the scores for these training-effectiveness indicators, this study employed cluster analysis to categorize the responding firms into "better" and "worse" performance groups. (See Table 1.) As a result, 84 firms were placed in the better training-effectiveness category and 46 in the worse category. (Since 14 of the sample firms did not complete the questionnaire, only 130 firms were classified in this manner.) The two groups were seen to be significantly different with regard to performance on the ten training-effectiveness indicators ($p<0.01$). The cluster analysis procedure showed that the average scores of the firms in the better group were all higher than firms that in the worse group.

Is training effectiveness related to organizational characteristics? Data show that although the average number of employees per firm in the better training-effectiveness group (155) is a little higher than that of the worse group (141), there is no statistically significant difference between them. The better training-effectiveness group also has a larger amount of capital per firm (US$69 million) than the worse group (US$11 million); however, there is no significant difference here either. The only significant difference is that the average firm age (22 years) in the better group is considerably greater than that in the worse one (17 years). The implication is that perceived training effectiveness is not related to firm size as represented by employee number and amount of capital, but that older SMEs seem to achieve better training results than younger ones.

TRAINING ORGANIZATION AND EXPENDITURES, AND TRAINING PROVISIONS

Training consists of organized learning activities capable of improving individual performance through changes in knowledge, skills, or attitudes (Nadler, 1980). The training process includes such activities as identifying employee-training needs, designing annual training plans, devising training objectives, choosing delivery methods, implementing training programs, evaluating training results, and documenting training records. As an organizational subsystem (Goldstein, 1993), training must be closely coordinated with overall business strategy and the activities of line departments. Therefore, setting up a specific department within a firm to organize and implement employee training and development may result in more effective training.

Twenty-seven firms (33.8%) in the better training-effectiveness group responded "yes" to the question of whether they had set up a unit or department in charge of training affairs, while only eight firms (20.0%) in the worse training-effectiveness group did so. The proportion of firms establishing an independent training unit is significantly lower in the worse-effectiveness group than in the better one. This finding implies that establishing a specific department responsible for training does have a positive impact on training effectiveness. However, before taking action on this finding, an SME should first conduct a careful cost-benefit analysis to determine whether it is large enough to reap economies of scale from establishing a separate unit responsible for training.

We may also expect the size of the training budget to be related to training effectiveness. The present study shows that the average annual training expenditure per employee for the better training-effectiveness group was US$182, higher than the US$138 spent by the worse training-effectiveness group. However, the difference between the two amounts was not statistically significant. Another important indicator is the percentage of total payroll spent on training. The mean percentage for this indicator was 0.93% for the better training-effectiveness group and 0.84% for the worse one, although the difference was not significant. One possible explanation why no strong positive relationship emerged between training expenditure and training effectiveness is the way that training expenditure was calculated in this study. Specifically, the cost of maintaining an independent training staff, which was found to be more prevalent in the better training-effectiveness group, was not factored into the total cost of training. This practice would obviously place a downward bias on training expenditures incurred by larger firms, those, which are likely to spend the most on training, and thereby weaken the statistical relationship between training expenditure and training effectiveness.

In a comparison with training expenditures in other countries (Lynch, 1994), this study found that the percentage of total payroll spent on average by firms of Chinese Taipei on training exceeded that of Japanese firms (0.4%) and roughly approximated the average percentage spent by Canadian firms (0.90%). However, the 0.93% of payroll expended by the average firm of Chinese Taipei on training was well below the 1.8% spent by the typical firm in the United States (including large firms), 1.8% in West Germany, 1.5% in the Netherlands, and 1.7% in Australia. The percentages for these other countries were obtained by surveys taken ten to 15 years ago (1984-89), and we may expect that in the interim the gap in training expenditure between Western firms and SMEs of Chinese Taipei have, if anything, widened even further.

This study found a statistically significant relationship between the percentage of employees that received training and training effectiveness ($p<0.1$). Firms in the better training-effectiveness group reported that 45.7% of their staff had received some type of training in 1998, versus 36.3% for the worse group. Differences were also reported according to position and job function. In the better firms, managers and supervisors received an average of 33.5 hours of training in 1998, professional and technical employees 32.4 hours, and clerical and manual workers 20.8 hours, respectively. The corresponding figures for firms in the worse group — 27.2, 22.0, and 14.2 hours —were considerably lower. However, the only job position to show a statistically significant difference ($p<0.1$) in training time across the two types of firms was that of professional

and technical employee. Data used in this study indicate that the extent of training coverage and emphasis on technical training are closely related to training effectiveness, especially in the manufacturing sector.

MANAGING THE TRAINING PROCESS AND ENHANCING TRAINING EFFECTIVENESS

The training process includes such items as needs assessment, the setting of goals and objectives, the delivery of training services, the evaluation of results, and the coordination of training activities with other HRM functions. All of these steps are essential to the success of a training program.

Assessing the need for training is particularly important, because if this is not done an organization cannot be assured that the right type of training is being provided to its employees. As Table 2 indicates, there is a significant positive relationship between needs assessment and training effectiveness ($p<0.1$). About 70% of the SMEs in the better training-effectiveness group had conducted needs analysis, while only 64.0% in the worse group had done so.

Training objectives provide a link between needs and results, helping to identify the type of instruction required in order closing performance gaps. Training objectives also serve as benchmarks against which to evaluate progress achieved in the realization of organizational goals. This study finds a significant difference ($p<0.05$) between the proportion of firms in the better training-effectiveness group that designate training objectives (75.6%) and that in the worse group (57.8%) that do so. The implication is that firms that have a clear vision of their training objectives and know for what purposes training is being provided are more likely to achieve better training effectiveness.

This study does not find a significant relationship between results evaluation and training effectiveness, even though firms in the better training-effectiveness group are more likely to evaluate the effectiveness of their training programs than those in the other group are. However, the proportion of firms that submit the results of training evaluation to higher-level management is markedly greater ($p<0.01$) in the better training-effectiveness group (78.5%) than in the worse one (48.8%). Similarly, the practice of applying the results of training evaluation to other HRM functions (promotions, job assignments, and the determination of compensation) is much more common in the better group (38.7%) than in the worse one (14.3%). This finding suggests that while there may not be a strong linkage between the evaluation of training results and training effectiveness, the manner in which SMEs employ evaluation results may have an important impact on the success of their training programs.

CATEGORIES OF TRAINING AND DELIVERY METHODS

There are three major venues for the delivery of training services: on-the-job, on-site off-the-job, and off-site off-the-job. Schuler and Jackson (1996) suggested that decisions concerning delivery sites and methods might be constrained by the type of learning that is to occur, as well as by considerations of cost and time. Table 2 lists three

venues and 14 delivery methods employed by firms participating in this study. Respondents were asked to report the frequency with which their organizations adopted each method, with 1 standing for "never," 2 for "seldom," 3 for "sometimes," 4 for "often," and 5 for "always." Also presented are mean frequency scores and ANOVA test results for firms in the better and worse training-effectiveness groups.

On-the-job training allows trainees to learn how to perform their jobs under direct supervision. This type of training can be implemented by using such methods as apprenticeship training, job rotation, and assignment to a task-force team. Data indicate that SMEs in the better training-effectiveness group consistently employ all three methods of on-the-job training more frequently than do those in the worse group. However, the only statistically significant difference between the two groups was found to occur in the frequency with which they adopted the task-force-assignment method.

Many methods can be used to deliver training at the workplace but off the job, ranging from the traditional lecture to high-tech Internet learning. Firms in the better training-effectiveness group were seen to employ all nine off-the-job-training methods more frequently than did those in the other group. Moreover, there were found to be statistically significant differences in the frequency with which these groups employed all nine methods, with the exceptions of case studies and Internet teaching.

Two common methods by which business firms of Chinese Taipei deliver off-site training services to employees are enrolling them in college courses part-time and sending them to participate in workshops overseas. Since off-site training tends to be quite expensive, SMEs of Chinese Taipei employ it far less frequently than on-the-job or on-site training. Firms in the better training-effectiveness group are more likely to use both of the off-site training methods mentioned above than are firms in the worse group. This implies that the breadth and depth with which firms apply methods of delivering training are strongly and positively related to training effectiveness.

MANAGEMENT SUPPORT AND TRAINING EFFECTIVENESS

SME owners and managers play a pivotal role in making decisions relating to the provision of formal, job-related training (Matlay, 1996). The literature suggests that owners and managers of smaller firms tend to demand less training than those of larger ones do (Westhead and Storey, 1997). One possible explanation of this tendency is that time-related pressures and the high direct cost of training may make SMEs reluctant to invest in training or to allow their employees to attend training courses. If top management does not provide support for or undertake a commitment to employee training, a firm may focus little attention on training activities. We may thus expect a strong correlation to exist between the degree of management support for training and training effectiveness.

The present study poses two questions designed to evaluate the degree of management support for training. The first one asks whether line managers in a respondent firm encourage subordinates to participate in training programs. Possible response range from 1, "strongly disagree" to 5, "strongly agree." The second question

asks whether, during business downturns and economic recessions, top management usually gives priority to cutting training expenditures in an effort to reduce operating costs. Responses to this question are: 1, "strongly agree"; 2, "agree"; 3, "it is hard to say"; 4, "disagree"; and 5, "strongly disagree." (Note that the order of ranking responses is the reverse of that used for the previous question.) The mean score for responses to these two questions is used to indicate management support for training. The mean score for firms in the better training-effectiveness group (3.69) is markedly higher than that for firms in the worse group (3.26), and an ANOVA test indicates that the difference between the two is significant at $p<0.01$. Thus management support is shown to be strongly related to training effectiveness.

RESEARCH IMPLICATIONS

The findings of this study have important implications for both academic researchers and training specialists. Previous studies attempted to estimate the impact of training on firm performance but did not achieve consistent findings. One of the major reasons for this inconsistency is the widely varying definition of training that these studies employed. Many of them measured only the amount of training provided. However, the provision of training may vary in the types of knowledge or skills conveyed, duration, numbers and percentages of employees covered, and modes of delivery. As a result of such variances, some types of training are more effective in improving individual firm performance than others improve. This study presents evidence that firms that have achieved greater effectiveness in training tend to have a more sophisticated training organization and training system than do those firms whose training methods have been less effective. The implication is that future studies seeking to investigate the relationship between training and performance should take special care in measuring training effectiveness. Simply determining whether formal training is offered and the amount of it that is provided to employees is not adequate, since poor training programs, even those that provide many hours of instruction, may not benefit individual employees or firm performance at all.

To managers and training specialists in SMEs, the findings of this study provide clear direction and guidance. Maintaining a separate unit responsible for training affairs helps improve training effectiveness. However, owners and managers of SMEs should evaluate the costs and benefits of establishing such an independent training unit before they take that step. Amid intensifying global competition and rapid technological change, expanding the proportion of the work force that receives training and increasing training hours, especially for professional and technical staff, are also conducive to better training effectiveness.

The training process in firms that have achieved better training effectiveness is more comprehensive than that in firms that have been less successful in training. In general, a firm that has conducted needs assessment, devised training objectives, submitted training results to management, and coordinated training activities with other HRM practices is more likely to achieve success in training than are those firms that have not made such efforts. For this reason, instituting a more comprehensive training process in SMEs is strongly encouraged. Also recommended is that training specialists should seek

to improve their knowledge of various training delivery methods and apply that knowledge broadly and frequently in implementing training programs.

Finally, but certainly not least important, are the commitment and support of top management for training. This study reveals a very strong relationship between management support and training effectiveness. With the size of the training budget, number of training hours, and proportion of training coverage all varying directly with the degree of management support, support from management may be the most critical element of all in achieving training effectiveness.

LIMITATIONS

The training-effectiveness indicators used in this study are based on subjective responses to questions about the impact of training on enhancing product or service quality, work motivation, ability, knowledge, and so on. A few scholars believe that subjective measures may be as reliable as more objective indicators (Dess & Robinson, 1984). However, since objective indicators are believed to achieve greater accuracy, it is hoped that future studies, time and resources permitting, will employ both subjective and objective measures of training effectiveness, so that comparisons can be made between the two.

A second limitation of this study is that a causal relationship between methods of delivering training and training effectiveness has not been established. Since the data used are cross-sectional, the only conclusion that can be made here is that better training systems are strongly correlated with training effectiveness. Longitudinal data must be collected and studied over the long term, or comparison made with an appropriate control group (Westhead and Storey, 1997), if we are to determine whether there is a causal linkage between comprehensive training systems and improved business performance. Furthermore, even if improvement in training systems leads to more effective training, how can we be certain that the benefits of better training justify its cost? Utility analysis may be helpful in answering such questions. Finally, due to the limited size of our sample, conclusions reached by this study may not be entirely applicable to very small manufacturing firms or service-sector firms in Chinese Taipei.

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Table 1. Results of Cluster Analysis of Training Effectiveness

Aspects of training effectiveness	Cluster mean		
	Better Training-Effectiveness Group (N=84)	Worse Training-Effectiveness Group (N=46)	F-Value
1. Enhanced product or service quality	3.96	3.00	107.6***
2. Inproved work motivation	3.81	3.09	40.9***
3. Reduced turnover rate	3.31	2.70	23.2***
4. Improved ability and knowledge	4.17	3.50	48.1***
5. Improved operational safety	4.07	3.37	51.6***
6. Decreased materials wastage	3.70	2.85	58.5***
7. Improved profitability	3.55	2.76	47.9***
8. Increased work efficiency	3.88	3.00	63.1***
9. Increased job satisfaction	3.77	2.91	68.9***
10. Reduced absenteeism	3.42	2.59	47.1***

Note: The scale ranging from “strongly agree (5)” to “strongly disagree (1)”.
*** : $p<0.01$

Table 2. Mean Frequency of Adoption of Training Delivery Methods by Two Training-Effectiveness Groups

Types of training and delivery methods	Better Training-Effectiveness Group	Worse Training-Effectiveness Group	F-Value
On-job-training			
Job rotation	2.79	2.57	1.39
Apprenticeship training	2.94	2.86	.09
Assigning trainee as member of task force	3.34	2.32	28.68***
On-site off-job-training			
Lecture	3.18	2.67	5.84**
Group discussion	3.27	2.89	4.12**
Role playing	2.27	1.86	5.55**
Sensitivity training	1.88	1.44	7.38***
Videotapes	2.60	2.05	7.90***
Simulations	2.50	2.09	5.18**
Case study	2.91	2.64	1.83
Computer software	2.56	1.95	8.30***
Internet teaching	1.84	1.64	1.39
Off-site off-job training			
Part-time college courses	2.10	1.64	6.47***
Overseas workshops	2.13	1.41	15.53***

Note: The scale is scored as 1 for "never," 2 for "seldom," 3 for "sometimes," 4 for "often," and 5 for "always." ** : $p<0.05$; *** : $p<0.01$.

RESEARCH OF CORE COMPETENCE FOR R&D PERSONS AT IC COMPANIES IN CHINESE TAIPEI

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RESEARCH OF CORE COMPETENCE FOR R&D PERSONS AT IC COMPANIES IN CHINESE TAIPEI

ABSTRACT

This research extracts some essences of Intelligence Capital(or IC. here after) and refers them to aspects of key competence currently defined or used by different organization. Based on three developed IC indices, a theoretical and practical study aimed at the feature of technical creativity and key competence of R&D person at high-technology, especially IC(Integrated Circuit) companies has been followed. In addition, employees' education distribution from five high-tech enterprises(TSMC, Weltrend, Holtek, Realtek and Vanguard International Semiconductor) in Chinese, Taipei, were especially ranked at this research, as become the background of later proposed checklist, which will serve the purpose of key competence assessment for R&D personnel at Taiwain's high-tech enterprises particularly. At last, it is also suggested that enterprise should implement a set of standardized assessment to measure R&D person's key competence since recruiting. Thereafter, it consequently benefits, such as, R&D person recruiting efficiency, later technology driven speed, and may even reducing engineer resign rate , eventually keeps enterprise with good competition.

KEY WORDs: high-tech enterprise ? core competence ? attitude? intellectual agility

INTRODUCTION

In current day, high-tech industry receives dramatic competition just as area, R&D human resource becomes especially important factor for enterprises in promoting their competition. So far, there seems no suitable checklist for high-tech enterprise to evaluate what type of core intelligence should R&D human possess? This research, therefore, focus on subjects like, how enterprise analyze and evaluate core intelligence of their R&D person? What correlation exists between core intelligence and their future achievement? Are there some models or instruments can be used during recruiting R&D people? All subjects are points, which need to be concerned for all high-tech enterprises in Chinese, Taipei.

How enterprise recruit new R&D person efficiently become more important especially in economic recession time. For example, twenty years ago a sales manager of Casio left. Cost, including training and possible trouble cause of task disconnection, was equal to $185,000, while ten years later, it jumped to $418,000. In addition, the cost of absence, American enterprise needs at least waste $350,000,000 and more annually. Similar study at Chinese, Taipei also claims, cost at least NT1,500,000 for an electronic engineer quit out from high-tech enterprise. Besides that, many researches also point out that improper recruiting will increase human resource spending and other draw backs. Such as, employee resign, absence of illness, organization's bad work attitude, group counsel…etc.. Although engineer resign rate sometime is helpful for organization's human resource bringing up to date, it also costs a lot (Kao & Chan, 1999).

This research extracts some essences of Intelligence Capital(or IC. here after) and refers them to the aspects of key competence currently defined or used by different organization. Based on three developed IC indices, a theoretical and practical study aimed at the feature of technical creativity and key competence of R&D person at high-tech, especially IC(Integrated Circuit) companies have been followed. In addition, employees' education distribution from five high-tech enterprises(TSMC, Weltrend, Holtek, Realtek and Vanguard International Semiconductor), were especially ranked at this research, as become the background of later proposed checklist, which will serve the purpose of key competence assessment for R&D personnel at high-tech enterprises particularly. At last, it is also suggested that enterprise should implement a set of standardized assessment to measure R&D person's key competence since recruiting. Thereafter, it consequently benefits, such as R&D person recruiting efficiency, later technology driven speed, and may even reducing engineer resign rate , eventually keeps enterprise with good competition.

THE RESEARCH OF HIGH-TECH ENTERPRISES

Technology development and innovation has made economic evolution at this century significantly grown. It is more obvious at high-tech enterprises in Chinese, Taipei have created major economic efficiency at recent years. To begin with, high-tech enterprise at this research is first confined by four following dimensions (Ministry of Economic, 1998):

- Property: 1. New technology. 2. The technology with pioneering, international competition, the development of technology, and the improvement of marketing.

- Profile of enterprise: 1. The ratios of R&D cost in total production; 2. The ratios of employees' occupation; 3. The ratios of R&D cost and the technical levels of employees.

- Product of enterprise: 1. The amount of patents; 2. The revenue rate on innovated product sales; 3. The complexity of product and innovation.

- Overall: 1. High-tech employees, the ratios of R&D cost in sales quota, and the global market share; 2. The employee rates, amount of production, dependence, marketing, knowledge degree, power of production, related efficiency, the cost of R&D, the problem of money concentration, land, water resource, energy spend and pollution.

High-tech companies are encouraged with incentive from government and growth in a steady speed in Chinese, Taipei. The current condition trends to be in a mature period. To further march to new target of forming technology island. ? How to increase enterprise's R&D competence? becomes one of the most important strategy of enterprises in the future. Analyze from employees' condition in three consecutive years. Some common features, such as high education degree, young, and short working experience are found.

Profile of Employees (such as working department, average age, and average service duration).

Employees at the five companies mentioned before, including TSMC, Weltrend, Holtek, Realtek, and VIS, have the common characteristics of high schooling, young, and little working experience. We would get ideas for the characteristics of the employees from the annual report of these businesses(TSMC, 1998; Weltrend, 1998; Holtek, 1998; Realtek, 1998; VIS, 1998). (TSMC, 1998; Weltrend, 1998; Holtek, 1998; Realtek, 1998; VIS, 1998).

Table 1-1 -The Number of Employees (by position category) at TSMC

Year	Direct Employees	Engineering Division	Management Division	Total
1995	1,578	1,372	462	3,412
1996	1,830	1,715	572	4,117
1997	2,712	2,200	681	5,593

Table 1-2-The Number of Employees at TSMC

Year	*Total Number*	*Average Age*	*Average Service Duration*
1995	3,412	28	3.3
1996	4,117	28	3.3
1997	5,593	28	3.3

Table 2 -The Number of Employees (by Division Category) at Weltrend

Year	*Administration /Finance*	*Sales*	*Technique*	*Total*	*Average Age*	*Average Service Duration*
1995	6	8	39	53	30	2.6
1996	7	7	42	56	31.5	3.5
1997	6	7	48	62	32.5	4.2

Table 3- The Number of Employees(by Division Category) in Holtek

Year	*1995*	*1996*	*1997*
Engineer	454	609	894
Administration/ Sales	171	201	187
Technician	333	340	440
Driver/Guard/Janitor	12	12	12
Total	970	1162	1533
Average Age	28.5	29.7	30.6
Average Service Duration	2.8	2.9	2.8

Table 4 -The Number of Employees in Realtek

Year	*1995*	*1996*	*1997*
R&D	117(54%)	109(54%)	118(54%)
Administration/ Sales	76(35%)	71(35%)	74(34%)
Quality Controlling	24(11%)	23(11%)	27(12%)
Total	217	203	219
Average Age	31	31	32
Average Service Duration	4	4	4

Table 5 - The Number of Employees (by Division Category) in VIS

Year	*1995*	*1996*	*1997*
Direct Employee	1160	1007	680
Indirect Employee	731	581	361
Total	1891	1588	1041
Average Age	29.2	28.8	29.8
Average Service Duration	0.82	1.34	2.7

There are findings can be extracted from above tables. First, the average age of employees at theses companies are between 28 and 32.5 year-old, and have work experience from 0.52 to 4 years. Second, the population of engineers is higher than that administrative staff. Except that with professional context, the R&D of the technology needs engineers with the ability throwing themselves into product improvement and with unique creative thinking ability. From this point, it can be found that if employees with product improvement ability or potentials or ability to do the R&D job is important in the high-tech enterprises.

Profile of Employees' education

Employees at the five companies mentioned before, including TSMC, Weltrend, Holtek, Realtek, and VIS, have the common characteristics of high schooling, young, and little working experience. We would get ideas for the characteristics of the employees from the annual report of these businesses(TSMC, 1998; Weltrend, 1998; Holtek, 1998; Realtek, 1998; VIS, 1998).

Table 6 -The Ratio of Employees' education background at TSMC

Year	*Doctor Degree*	*Master Degree*	*University/ Collage Degree*	*Senior High School*	*Under Senior High School*	*Total*
1995	1.6	15.3	38.7	43.3	1.1	100
1996	1.8	19	37.8	41.3	0.1	100
1997	1.8	20	37.6	40.5	0.1	100

Table 7-The Ratio of Employees' education background in Weltrend

Year	*Doctor Degree*	*Master Degree*	*University/ Collage Degree*	*Senior High School*	*Total*
1995	1	5	39	8	53
1996	1	5	42	8	56
1997	2	5	42	12	61

Table 8 - The Ratio of Employees' education background at Holtek

Year	*Doctor Degree*	*Master Degree*	*University/ Collage Degree*	*Senior High School*	*Under Senior High School*
1995	0.1%	12.27%	54.12%	32.47%	1.03%
1996	0.6%	17.9%	53.53%	27.19%	0.77%
1997	0.65%	18.4%	56.88%	23.42%	0.65%

Table 9- The Ratio of Employees' education background at Realtek

Year	*Doctor/ Master Degree*	*University/Collage Degree*	*Senior High School*
1995	19%	60%	21%
1996	20%	58%	22%
1997	29%	51%	20%

Table10 - The Ratio of Employees' education background in VIS

Year	*Doctor Degree*	*Master Degree*	*University/ Collage Degree*	*Senior High School*	*Under Senior High School*
1995	45	214	418	356	8
1996	57	369	626	528	8
Growing Rate	26.6%	72.4%	50%	48.3%	0
1997	63	428	771	621	8
Growing Rate	0.1%	16%	23%	17.6%	0

In the beginning of high-tech enterprises, the original main human power is graduated from senior high school, college, and university. But it appears from above data that the trend is more and more needs to recruit more bachelor, master, and doctor to join this working field. Because R&D of high-tech company requires not only professional knowledge but also the ability in improving products and creativity. Therefore, high-tech industries value the importance of employees' potential talent in product improvement or in R&D. The developments of human resources mainly depend on the trend of enterprises' need; it makes business thriving and vigorous when raising the employees' capabilities and cultivating the core competency of business.

THE CORE COMPETENCE OF THE R&D HUMAN RESOURCE IN HIGH-TECH ENTERPRISE

The flourishing achievement on economical development in past 30 years in Chinese, Taipei have gained the international recognition. In recent years, because the prosperous development on industrial enterprises, many talent persons from ITRI (Industrial Technology Research Institute, a high-tech research institute sponsored by government.) were recruited to the private enterprises. The R&D capabilities have been improved(ITRI, 1998).

At the meantime, besides the output of semiconductor are the fourth place in the world, computer hardware get the third place, and many products get the first place of market share(ITRI, 1998). These achievements are contributed by the efforts of R&D staff and other members in the high-tech industries.

There are still several expectations for the R&D developments at the high-tech enterprises in Chinese, Taipei. So it is important to explore the core competence and its related theory of the R&D human resource in high-tech enterprise. It is going to be discussed by the following three dimensions, first is core competence, second is attitude, and the third is intellectual agility:

1. *The core competence*: Competence generates value through the knowledge, skills, talents and know-how of employees. And with the core competence, enterprise could surpass others' competition and get a new market share. The core competence, in this classification, indicates the technical or academic knowledge, which is belonging to enterprise's property. It represents some part of competition, but not all. One kind of core competence can create many kinds of product. One kind of product could also be created by many kinds of core competence. Only the company holder can decide which kind of monetary property or realty is belong to core or non-core property (Roos, et al., 1997). For example,

   a) At VIS (Vanguard International semiconductor, 1998), the core competencies are the process of product development and manufacturing of DRAM.

   b) The competitive advantages of TSMC is R&D for production process(TSMC, 1998) . The core competence of TSMC is on logical memory, advanced process module, CAD, and mask process, …etc.

   c) Holtek focuses on logical IC products (54.3%)(Holtek, 1998) . The rest of its products includes communication IC (9.2%), peripheral IC (8.7%), consumer electronic IC (36.4%), memory IC (12.5%), and wafer foundry (33.2%). Holtek's expertise is at diverse technologies of process, such as photo-electronic, high-voltage, special low-voltage, and non-volatile…etc. R&D for IC, Memory Process, 3C Integration, and System-on-wafer…etc. are all Holtek's core competence.

   d) Weltrend is doing business in the R&D, production, testing and sale of the products of digital & analogue combined application-specific IC (ASIC), Digital

IC and Analogue IC (Weltrend, 1998). Weltrend's products include Peripheral ICs, Consumer Electronics ICs, and ASICs…etc. Therefore, the core competency of Weltrend is focused on R&D and testing of electronic products.

e) Realtek is developing, manufacturing and selling the following products: consumer electronics ICs, peripheral & multimedia ICs, other ASIC and related application software(Realtek, 1998,) . Table 11 shows the sales percentage of all products and annual growth of Realtek in 1997. It also indicates the core competence of Realtek.

Table 11 -Realtek 1997 Annual Sales & Growth Report (Unit: NT$ 1,000)

1997 Net income	*Consumer electronics Div.*	*Peripheral & Multimedia Div.*	*Communication & Network Div.*
1,835,728	545,743	535,057	754,928
Sales (%)	29.8%	29.1%	41.1%
Growth (%)	22.5%	2.4%	40.3%

From above tables, it appears that the core competence can not be separated from enterprise's competition. And it also can be concluded by some examples of indicators in this competence field, such as :

- Percentage of company employees holding an advanced degree
- IT literacy
- Hours of training per employee
- Average duration of employment

2. *The behavior and work attitude*: knowledge and skills are not everything. Companies need employees who are capable and willing to use their skills and abilities to the advantage of the company and who can motivate the whole company to reach its goal.

Attitude, therefore, is a 'soft' component. The company has very little impact on this side. Attitude depends mostly on personality traits and therefore can be improved very little by company efforts. Attitude, primary included by three factors: Motivation, behavior, and conduct, covers the value generated by the behavior of the employees on the workplace(Roos, et al., 1997). And it also can be concluded by some examples of indicators in this attitude field, such as:

- Communicated with others very well
- Get along with others very well
- With work empathy
- Explore difficult problem with comrades to solve the problem

McKinsey and Procter & Gamble companies believe that the work attitude is at least as important as competence, and both have known to hire university graduates with non-specialist degrees(such as architecture, physics or humanities) and give them specific training afterwards: thus, they select an attitude in the candidates and then create the competencies.

3. *Intellectual agility*: In a fast changing world like ours, the ability to apply knowledge in very different situations, as well as the ability to innovate and transform ideas in products, is crucial to the success of a company. Intellectual agility indicates the ability to see common factors in two distinct pieces of information and link them together, and the ability to improve both knowledge and company output through innovation and adaptation.

Intellectual agility is tightly linked to competence, more so than attitude is. If competence is the content, intellectual agility is the ability to use the knowledge and skills, building on it, applying it in practical contexts and increasing it through learning. Intellectual agility can include the following wits, such as: innovation, imitation, adaptation, and packaging. Especially, innovation can create an ability on the basis of exist knowledge and push an enterprise successfully into a multiple goals.

Intellectual agility also has some examples of indicator, such as :

- Savings from implemented suggestions from employees
- New solutions/ products/processes suggested
- Background variety index(individual and group level)
- Company diversification index

CONCLUSION & SUGGESTION

Conclusion

As we know that the most popular IQ tests in the whole world are Binet & Wechsler(Wechsler,1958). It's for measurement and appraisal of adult intelligence. Since the evaluation tools were the product forty years ago. It also convinced us those tests are improper for test high-tech R&D person living in this high-tech era. Many scholars also doubt about the problems of intelligence recent years, such as, if the test with discrimination to different tribes, culture, educated or not …etc..(Hallahan & Kauffman, 1991). So the conclusion is that there is no such a proper instrument for measuring high-tech R&D person.

The core competence is composed by lots of knowledge skills and technologies. And with core competence, the enterprise could surpass comrade's competition and get into a new market. From above exploration it is found that the core competence can not be separated from enterprise's competition. And only the company holder can decide which kind of monetary property or realty belongs to core or non-core property.

Conclusion is made after exploring and studying on R&D human resource of several high-tech enterprises and related core competence theory. It is firmed if the enterprise can have a set of instrument to evaluate R&D people's core competence at the recruiting stage. It will help not only upgrade high-tech enterprises' recruiting efficiency, but also promote R&D person's technical creativity and enterprise's competition at market.

Suggestion

This research has explored the core competencies of the R&D human resource in high-tech enterprise. It's found that the key essences to impact the development of enterprise is if their employee's ability is equal to the core competence which is needed by the company. Therefore, It can be concluded and also suggested the items of the checklist for the core competence of the R&D human resource in high-tech enterprise after synthesizing the above theory and some high-tech company's employee performance assessment forms. The following lists five directions: The first is professional attitude and enthusiasm, the second is professional knowledge and ability, the third is communication/team work/ work with others effectively, the fourth is justification and problem solving, and the fifth is innovation and improvement. The following is items of the checklist for the core competence of the R&D human resource in high-tech enterprise:

1. Professional attitude and enthusiasm

- Predicting and understanding the needs of the business, and managing it carefully.
- Aiming actively to the content of business which is provided by the company, giving it an evaluation and according to the result, takes an improvement action plan.
- Planning and participating every communication and coordination actively between tasks, smoothing the work proceeding.
- Joining TQM activity aggressively, and applying TQM's concept at work to promote the quality of the task.
- Demanding self to reach the request of work quality strongly.
- Obeying the work standard when the work is proceeding.
- Valuing and protecting the customer's Intellectual Property Right (IPR).

2. Professional knowledge and ability

- Studying consecutively related professional knowledge and skills and applying it properly in order to reach the best performance.
- Owning professional knowledge and skills to adapt current work needs.
- Owning the ability of project management.

- Being able to definitely understand and develop the skills which can reach the needs of task.

- Being able to actively take timing, not to need to be pushed or waked, can keep time management and accomplish task of his part with alignment.

3. munication/teamwork/effectively work with others

- Being able to coordinate with other related department/person and make work smoothly proceeding.

- Being able to quickly learn how to do a new additional task and also can discuss with comrade about the difficult task and its steps.

- Having different ideal from comrades, still respect them and effectively work with different personality people to accomplish the achievement.

- Cooperating through teamwork, with the most effectively route to reach the achievement.

4. Justification and problem solving

- Analyzing actively which task should be improved, reasonably explaining and proposing a recommendation.

- Being able to apply multiple thinking method, reasonably justifies the source of problem, and finds the best strategy to solve the problem.

- Being able to perceive potential problem, prevents it before and after in advance.

- Being able to find the best idea to solve problem in an extremely short time.

5. Innovation and improvement

- Being able to improve and apply tried concept and method to solve problem under a new additional task condition.

- Being able to introduce the concept of new knowledge and skill into available program.

- Having the aspect which is over imagined for work innovation and improvement., and it really benefits to the task improvement.

- Being able to understand the same enterprises' activities and working methods, and can propose a more innovated method.

R&D person is contributing more and more influence to life of enterprise in this technology booming era. Enterprise needs ceaseless innovation to support highly competitive market. The cultivation of R&D person can not be accomplished in one day or one night. However, without a standardized assessment for enterprise's recruiting, the

loss is not only enterprise can not find suitable R&D person but also review. Sometimes hiring wrong person might badly retard progression. Therefore, how to aim at the feature of technical creativity and key competence of R&D person at high-tech and excite teamwork's cooperation to generate creative ideas or inventions with performance index are main target of this research.

At last, this research recommends a set of assessment tools to measure applicants' key competence when they are recruited and help enterprises select suitable R&D persons. It will benefit high-tech R&D recruiting efficiency, later technology driven speed, and may even reducing engineer resign rate, eventually keeps enterprise with good competition.

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MALAYSIA'S FINANCIAL CRISIS AND CONTRACTION IN HUMAN RESOURCE: POLICIES AND LESSONS FOR SMIS

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MALAYSIA'S FINANCIAL CRISIS AND CONTRACTION IN HUMAN RESOURCE: POLICIES AND LESSONS FOR SMIS

ABSTRACT

The economic crisis, which has recently occurred in Malaysia, has affected not only the economy in aggregate, but also to the labor market. The 6.7 per cent contraction of the economy in 1998 caused the employment growth to slacken and the unemployment rate to soar to 3.9 per cent. The 3.9 per cent unemployment rate was of great concern, as rising unemployment had implications on efforts to reduce poverty. The crisis has also resulted in the closure of some SMIs enterprises, particularly when tight monetary policies were implemented at the beginning of the crisis, causing disruption in operations and severe liquidity problems. The widespread of the crisis in Malaysia has triggered policy makers to immediately address the shortcomings pertaining to the labor market. The facilitating and regulatory role played by the Government in the labor market had eased tension among workers arising from the economic crisis. The harmonious industrial environment had in a way helped to expedite the economic recovery. The holistic approach by the government in addressing the labor issues incorporated both the demand and supply sides of the labor market. Accessibility of information is considered important, thus the government making it compulsory for employers to report any step taken that can give a signal to the labor market. In addition, policies designed during period of crisis involved the players in the market, the employers and employees. The holistic approach did not segregate policies according to sectors, ownership, gender or sizes of firms. Firms irrespective of the ownership functions and sizes are treated equally when addressing labor issues. Thus employees working in small and medium industries should not expect to receive better or lesser treatments when confronting economic crisis.

INTRODUCTION

The economic crisis which has recently occurred in East Asia, has affected not only the economy in aggregate, but also more important the labor market. Thus, this paper attempts to analyze the effect of the economic crisis on the labor market in Malaysia. The macroeconomic overview will be discussed in the first section, followed by manpower demand and supply, the issues of retrenchment and human resource contraction, and the current and future trends in retrenchment. After highlighting the structure and performance of the market, this paper proceeds with policy responses and conclusion. The case provided in this paper could provide lessons to small and medium industries (SMIs) in the developing countries.

MACROECONOMIC OVERVIEW

Before the Thai baht came under attack and was devalued in July 1997, the countries of East Asia were prosperous. By July 1997, however, the economies of East Asia suddenly experienced economic turmoil and began collapsing one after another. Since then, the crisis has spread from the currency to banking and financial sectors, and then to the real economy. It has affected giant corporations, medium to small enterprises and individual workers as well as governments. As consequences, banks and businesses collapsed, some government leaders were replaced, and millions of workers lost their jobs.

Perhaps the clearest and harshest examples of the effects of the crisis are in Indonesia's economic and social situation. The rupiah plunged by as much as 80 per cent of its value, and the stock market shed 50 per cent of its value. Per capita income has dropped from US$1,100 in 1996 to US$460 or less in 1998. Some 6.6 million workers have lost their jobs since the beginning of the crisis. It is estimated that about 30 to 45 per cent of the population living below the poverty line.

While in Malaysia, the Malaysian economy had experienced high economic growths for almost ten years. During 1988-1997 periods, the GDP grew at an average rate of above 8.0 per cent per annum.[1] The high growth rates for this period was accompanied by low rates of inflation, rising per capita income and reduction in the incidence of poverty. For the period January-July 1997, the CPI in Malaysia averaged 2.7 per cent, compared to 4.5 per cent in South Korea, 5.6 per cent in Thailand and 11.6 per cent in Indonesia.[2] The per capita income increased significantly in 1997.

From the human resource perspective, this high economic growth was accompanied by very low rates of unemployment. The unemployment rate in 1997 was only about 2.6 per cent. If this figure is to be compared with the unemployment rate in the Organization of Economic Cooperation and Development (OECD) countries, which was about 7.5 per cent, the Malaysia's unemployment status is considered to be at full employment level, as the 2.6 per cent accounted the natural rate of unemployment.

[1] Excluding the year 1992 with 7.8 per cent per annum.
[2] IMF, *International Financial Statistics*, Aug. 1998.

The financial crisis spread very quickly to the other regional economies. The crisis has spread from one country to another, and also extended beyond the Asian region, to Russia and Brazil, and the whole world. Having experienced 8.0 per cent economic growth for ten consecutive years, the contagion effect of the financial crisis that erupted due to currency devaluation in Asian countries spread to impact the Malaysian economy in mid 1997. It did not only adversely affected the real economy and weakened the financial sector, but also had some socio-economic implications to the nation.

The real Gross Domestic Product (GDP) registered a negative growth for the first time since 1985 beginning in the first quarter of 1998 with –2.8 per cent and further down to –9.0 in third quarter of 1998 (Table 1). This clearly shows that after 10 years of good performance, high economic growth began to slow down towards the end of 1997 with 7.7 per cent, slightly lower than the 8.6 per cent of the preceding year. The labor market was not being affected at the onset of the crisis as the unemployment rate maintained at 2.6 per cent in 1997(Table 2).

Table 1: Quarterly GDP Growth Rate 1995-1998

	1995	**1996**	**1997**	**1998**	**1999**
1st Q	10.1	6.8	9.2	-2.8	-1.1
2nd Q	10.7	7.6	8.4	-6.8	4.1
3rd Q	9.3	8.8	7.5	-9.0	
4th Q	7.5	11.0	6.0	-8.1	

Source: White Paper on the Status of Malaysian Economy, April 1999.

Table 2: Macroeconomic Framework

	1988	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
GDP Growth rate (%)	8.9	9.0	9.7	8.6	7.8	8.3	9.3	9.4	8.6	7.7	-6.7
Unemployment rate (%)						3.0	2.9	2.8	2.6	2.6	3.9
Per Capita Income (RM at current price)						8,024	8,996	10,068	11,228	12,051	11,835
Consumer Price Index (%)	2.6	2.8	2.6	4.4	4.8	3.6	3.7	3.4	3.5	2.7	5.3
National Saving rate (% of GNP)						34.7	34.4	35.3	38.5	39.4	41.2
Net Bank Negara Reserve (RM million)						76.4	68.2	63.8	70.0	59.1	99.4

Source: IMF, International Financial Statistics, and August 1998.
White Paper on the Status of Malaysian Economy, April 1999.

However, the prolonged financial crisis and economic downturn have deeply affected the scenario of employment. They have caused an unemployment crisis to gather force. The 6.7 per cent contraction of the economy in 1998 caused the employment growth to slacken and the unemployment rate to soar to 3.9 per cent. The 3.9 per cent unemployment rate was of great concern, as rising unemployment had implications on efforts to reduce poverty.

The crisis has also resulted in the closure of some SMIs enterprises, particularly when tight monetary policies were implemented at the beginning of the crisis, causing disruption in operations and severe liquidity problems. Data from Ministry of International Trade and Industry (MITI) shows that by the end of 1998, an estimated 10 per cent of SMIs in the manufacturing sector has ceased operation due to the crisis.

MANPOWER DEMAND AND SUPPLY

In 1998, a total of 74,610 vacancies were reported to the Department of Manpower (DOM), Ministry of Human Resource (MHR), an increase of 15.7 per cent compared to 64,643 vacancies in 1997. The vacancies represented only a portion of the actual number of vacancies in the labor market since employers are not required to report them to DOM.

Vacancies trend by sector and state did not differ much between the years 1997 and 1998. The majority of the vacancies reported were in the manufacturing sector: 63.1 per cent in 1997 compared with 69.9 per cent in 1998. State wise, Penang recorded the highest number of vacancies reported (9,408) in 1997 compared to 16,833 in 1998. Vacancies in production and related, equipment transport operator and manual workers category constituted 75.3 per cent of total vacancies reported in 1998 compared with 52.4 per cent in 1997.

In the first quarter of 1999, a total of 19,403 vacancies were reported to the DOM, MHR. In the second quarter, the number increased to 26,091 vacancies, an increase of 43 per cent compared to the same quarter in 1998. Further details are as shown in Table 3 below.

Table 3: New Registrants and Vacancies Reported

	Second Quarter		Change(%)	First Quarter 1999
	1998	1999		
New Registrants	33,497	34,407	+2.7	30,017
Vacancies	18,240	26,091	+43.0	19,403

Source: Department of Manpower, Ministry of Human Resource.

Employment opportunities were also apparent in terms of the number of new registrants registered in Employees Provident Fund's (EPF) record. From January to September 1998, the EPF registered a total of 285,825 new members representing an average of 31,760 new members per month during the period.

Demand for manpower is further evidenced in the number of foreign workers application received by the Technical Committee on Foreign Workers at the Ministry of Home Affairs (MHA). From February to 19 November 1998, the Committee has considered applications for the importation and redistribution of 179,480 foreign

workers in the plantation and manufacturing sectors. Of the total, 49.5 per cent was approved by the MHA. The per centage approved was quite low so as to ensure that locals are not deprived of job opportunities.

According to the Business Expectation Survey of Limited Companies 1998 (Department of Statistics), industries that indicated positive growth in employment include: coconut (4.5per cent), palm oil (4.8per cent), insurance, real estates and business services (4.2per cent), retail (3.6per cent) and wholesale (0.8per cent). Industries in the manufacturing sector that recorded growth in employment include crude oil refineries (10.9per cent), industrial chemicals (4.3per cent), wood and wood and cork products except furniture (3.3per cent), other chemical products (1.6per cent), textile (1.5per cent) and rubber products (0.3per cent).

On the supply side, there were 33,345 active registered job seekers with DOM in 1998 (job seekers) compared with 23,762 in 1997. The average number of new registrants also increased to 10,116 per month in 1998 compared with an average of 7,624 registrants per month in 1997. The increase can be attributed to the intensive efforts undertaken by DOM and Labor Department to register workers who had been retrenched.

ISSUES OF RETRENCHMENT AND HUMAN RESOURCE CONTRACTION

Retrenchment occurs when an employee's service is terminated, as the company can no longer provide work for the employee. Retrenchment is often due to reduced demand for the company's products or services, financial losses, mergers, organizational restructuring, bankruptcy, closing of plants, relocation across international boundaries, and changes in technology such as automation at the operational level. Excess of workers due to one of the above reasons will eventually result in retrenchment.

Retrenchment has almost become a taboo among Malaysian employees following the economic downturn. Negative implications on the retrenched workers should not be overlooked, as loss of job is likely to cause financial problems, psychological stress and even physical illness. A worker who lost his job will face difficulties servicing loans and once savings are used up, may not be able to support himself or his family. Financial problems due to loss of employment, coupled with mental stress and embarrassment can lead to ill health.

From an employer's point of view, retrenchment is to be avoided by all means as it causes a loss of public confidence in the company. It will not only lower the morale amongst remaining employees, but also tighten the cash flow, as funds must be set aside for payment of termination benefits. Before retrenching staff, an employer will usually consider other alternatives such as cost cutting, job freeze, early retirement, tight control upon overhead, reduced working hours and wages.

Employees who are entitled to retrenchment benefits are those covered by the Employment Act and its 1980 regulations on termination and lay-off benefits.

Besides, employees covered by a collective agreement or contract of employment with a termination provision are also entitled to such benefits.

Although the Malaysian industrial law recognizes the right for employer to determine the appropriate size of its workforce, a worker whose service is terminated for any reason can claim unfair dismissal through the machinery of the Department of Industrial Relations and the Industrial Court. The Court will judge whether the retrenchment is genuine and reasonable procedures have been followed before dismissing workers. Should the worker choose to challenge the termination, he can claim unfair dismissal according to the procedures in the Industrial Relations Act Section 20.

According to the Act, the quantum of benefits depends upon the worker's length of service. Employees with less than a year's service are not entitled to benefits. For those with 1 to 2 years of service, they are entitled to 10 days' wages for every year of service. For 2 to 5 years of service, 15 days' wages for every year of service, whilst for more than 5 years of service, they are entitled to 20 days' wages for every year of service. For an incomplete year, the payment is pro-rata.

The recent economic downturn in Malaysia has an impact on the working class when it raises negative implication on the employment scenario. Many companies opted to terminate workers since the crisis broke out in 1997. Based on the statistics provided by the MHR, 18,863 workers were retrenched by over 140 companies[3]. Seventy-eights per cent of them were from manufacturing sector, while the rest were from transport, commerce, mining and construction sectors. The layoff scenario also had a negative impact on the serving employees, as there were uncertainty on their jobs. In addition, there was also a growing concern among the trade unions and MHR that employers were taking advantage of the economic slowdown to implement unnecessary pay cut and other measures that would seriously jeopardize the well being of the employees.

The economic situation had worsened in 1998, resulting in contraction in employment growth: rising retrenchment and high unemployment rate. A total of 83,865 workers were retrenched in 1998 compared with only 18,863 workers in 1997. Out of the figure, 20,082 of them were in Selangor, 16,884 in Penang and 10,863 in F.T Kuala Lumpur.

Table 4: Number of Retrenched by State, 1998

State	Number Retrenched (%)
Selangor	20,082 (23.9)
Penang	16,884 (20.1)
F.T Kuala Lumpur	10,863 (13.0)
Others	36,036 (43.0)
Total	83,865 (100.0)

Source: Labor Market Report, Malaysia, 1998.

[3] This figure might be underreported since mandatory reporting of employers started only in 1998.

The highest number of retrenchment for 1998 was registered in the third quarter involving 26,238 workers. However the number of retrenched workers decreased significantly to 18,116 workers in the fourth quarter ie. a decrease of 31 per cent. Overall, the fourth quarter registered the lowest retrenchment for 1998.

The manufacturing sector recorded the highest number of retrenchment in each quarter where, in 1998, 53.8 per cent or 45,151 workers retrenched were from this sector. In terms of category of occupations, the majority of the workers retrenched were from the production and related, transport equipment operator and manual worker category, representing 53.8 per cent or 45,196 workers.

Table 5: Number Retrenched by Sector, 1998

Sector	Number Retrenched (%)
Manufacturing	45,151 (53.8)
Wholesale and Retail Trade, Restaurant and Hotel	10,434 (12.4)
Construction	9,334 (8.8)
Finance, Insurance, Real Estate and Business Services	6,596 (7.9)
Agriculture, Forestry, Livestock and Fishing	5,108 (6.1)
Community, Social and Personal Services	4,242 (5.1)
Others	3,000 (3.6)
Total	83,865 (100)

Source: Labor Market Report, Malaysia, 1998.

Table 6: Distribution by Category of Occupations

Category of Occupation	Number Retrenched (%)
Prod. and Related Workers, Transport Equipment Workers and Laborers	
** Skilled Workers	15,971(19.0)
** Unskilled Workers	14,708(17.5)
** Semi-Skilled Workers	14,517(17.3)
Professional, Technical and Related Workers	12,125(14.5)
Clerical Workers	9,927(11.8)
Administrative and Managerial Workers	6,275 (7.5)
Others	10,342 (12.3)
Total	83,865 (100.0)

Source: Labor Market Report, Malaysia, 1998.

The retrenchment did not only occur in large corporations, but SMIs also opted for dismissing their workers when facing with the economic crisis. In 1998, about 16,521 number of workers being retrenched were from the SMIs.

Table 7: Retrenchment by SMI

State	Number
Selangor	3,304
Pulau Pinang	1,734
F.T. Kuala Lumpur	1,487
Johor	3,303
Trengganu	743
Other states	5,950
Total	16,521

Source: SMI Development Corporation
Labor Market Report, 1998

There were many reasons given by employers cited in the Labor Market Report 1998 for retrenching their workers as shown in Table 9. About 59.9 per cent or 2,867 employers stated reduction in demand for products as the main reason for retrenchment. Another 11 per cent reported high production cost, 8.1 per cent reorganizing their companies, 6.4 per cent had closed their operation, 2.4 had sold their companies and 12.3 per cent stated other reasons for retrenchment.

Table 8: Reason for Retrenchment

Reason for Retrenchment	No. of Employers
Reduction in Demand for Product	2,867 (59.9)
High production cost	526 (11.0)
Company Reorganisation	386 (8.1)
Closure	307 (6.4)
Sale of Company	114 (2.4)
Others	589 (12.3)
Total	4,789 (100.0)

Source: Labor Market Report, Malaysia 1998.

In terms of equity, the distribution are as follows: 69.5 per cent or 3,330 companies were Malaysian owned, 17.9 per cent or 857 companies foreign owned and 12.6 per cent or 601 joint-venture companies.

Certain quarters claimed that retrenchment amongst women was very high. In 1998, 42.3 per cent or 36,284 of 83,865 workers retrenched were women. A majority of the women 64.5 per cent or 23,387 were from the manufacturing sector. In terms of occupational category, some 59.1 per cent or 21,450 workers were from the production and related, transport equipment operator and manual worker category.

Clerical and related workers also exhibited high number of women retrenched representing 17.6 per cent of the total or 6,390 workers.

It is observed that women workers who were retrenched came from the sector and category that employed high number of women workers. It is easier to get alternative jobs in the said sector and category. Women are not victimize in retrenchment exercise as employers are required to institute retrenchment according to LIFO (Last In First Out) principle rather than gender.

CURRENT AND FUTURE RETRENCHMENT TREND

As the economic crisis was getting deeper, the Government had taken a reversal approach in its policies from tight monetary and fiscal policies to expansionary fiscal and monetary policies in middle 1998. This was to induce investment in the economy, and it has shown some positive result especially in relation to the retrenchment figure. In terms of the weekly retrenchment figures, it has shown a declining trend after reaching its peak in the middle July 1998. The weekly number of workers retrenched has dropped from 5,245 in the middle of July 1998 to 316 in late August 1999 (Refer to Appendix I - Graph 1). For the year 1999, as at September 4, a total of 25,592 workers were retrenched. Details sectors are as shown in Appendix II.

The government and Bank of America forecasted the economy will recover and achieve a growth rate of 1.0 per cent in 1999, whilst Goldman Sachs, an international investment bank, forecasted a 2.0 per cent growth in 1999. Based on these forecasted economic growths, the labor market is expected to continue to remain stable.

Table 9 below shows comparison of retrenchment for the second quarter 1998/99 and first quarter 1999. Retrenchment showed a downward trend. The figure for the second quarter 1999 dropped 44.9 per cent to 10,403 workers compared to 18,693 workers in the same quarter last year.

Table 9: Number of Workers Retrenched and Number of Employers Involved

	Second Quarter		Change(%)	First Quarter 1999
	1998	1999		
No. of workers	18,693	10,304	-44.9	11,454
No. of Employers	1,277	680	-46.8	735

Source: Labor Department, Peninsular Malaysia.
Labor Department, Sabah.
Labor Department, Sarawak.

Table 10: Retrenchment by State, September 1999

State	Number Retrenched (%)
Selangor	6,474 (25.3)
F.T Kuala Lumpur	4,852 (19.0)
Perak	3,761 (14.7)
Penang	2,655 (10.4)
Kedah/Perlis	1,991 (7.8)
Johor	1,720 (6.7)
Other States	4,139 (16.2)
Total	25,592(100.0)

Source: Labor Market Report, 1998.

Table 11: Number Retrenched by Sector, September 1999

Sector	Number Retrenched (%)
Manufacturing	13,967 (54.6)
Wholesale and Retail Trade, Restaurant and Hotel	3,072 (12.0)
Construction	2,525 (9.9)
Finance, Insurance, Real Estate and Business Services	2,338 (9.1)
Agriculture, Forestry, Livestock and Fishing	1,332 (5.2)
Community, Social and Personal Services	1,246 (4.9)
Others	1,112 (4.3)
Total	25,592 (100.0)

Source: Labor Market Report, 1998.

POLICY RESPONSES

The preceding section has shown that the economic crisis has contracted the work force not only the large but also the SMIs. The widespread of the crisis in Malaysia has triggered policy makers to immediately address the shortcomings pertaining to the labor market. As the economic situation has deeply affected the scenario of employment, it emerges that Malaysia is not only lacking in accurate information on labor market, but also lack of proper human resource (HR) planning in the long run. Labor market information is the information on the interplay of relationship between labor supplies (availability of manpower) and labor demand (availability of vacancies).

At the national level, labor market information is needed for the efficient allocation of human resources throughout the country to influence labor market actions. At the middle level, institutions and persons use labor market information to

match and facilitate supply and demand of labor. The direct participants in the labor market, such as the job seekers or employers, use labor market information either to guide them in their search for employment or in selecting the best-qualified job seekers. On the whole, labor market information can be used to balance the supply of and demand for labor with maximum utilization.

Beginning from January 1998, MHR initiated proactive measures by closely monitoring developments in the collection of labor market data on retrenchment, job vacancies, registration of retrenched workers, re-training, and industrial relation such as the number of strikes, workers involved and man-days lost due to strikes and picket. In addition, employers involved in retrenchment have been encouraged to provide exit services that includes interview techniques, counseling and career guidance to facilitate workers in finding alternative jobs. In retrenchment cases that involve large number of cases, the Labor Department, DOM and Industrial Relations Department under the MHR, gave in-situ service to employers and workers in various aspects such as statutory retrenchment benefits, registration and emplacement to alternative jobs with the cooperation of other employers that demand for workers [4]. The Government has established task forces at district and national levels comprising representatives from relevant Government departments, employers and workers' unions.

Various incentives were given to employers to encourage training and retraining of workers as alternative to retrenchment such as exemption from paying Human Resource Development Council (HRDC) levy to employers facing financial difficulties and credited unclaimed levy amounting to RM66 million to employers' account to encourage employers to continue training their workforce even during the economic downturn. The Government has also established a Training Scheme for Retrenched Workers under HRDC with an initial allocation of RM5 million in May 1998. Workers retrenched from sectors covered by HRDC are eligible to apply for training for any courses up to diploma level. As of 31 December 1998, 572 applications were approved with financial assistance of RM2.52 million.

In ensuring the well being of retrenched workers, stepped-up efforts were taken in ensuring that employers pay retrenchment benefits to their workers. As an example, in the case of Saship in Labuan, the Industrial Relations Department (IR) under MHR had persuaded the management to arrange for staggered payments to the 700 affected workers. As at the end of December 1998, approximately RM4 million was already paid-out and the remaining RM4 million was paid in January 1999, RM500 per worker before Hari Raya (Muslim Festival) and the remainder at the end of January 1999. The Employment Act 1955 was also amended with effective from August 1998, where employers are required to retrench foreign workers before retrenching local workers. This step is taken to ensure that the job opportunities of local workers are secured.

[4] Read-Rite Company retrenched more than 4,000 workers in Penang, In this case, most of the workers were able to secure alternative jobs before the actual effective date of retrenchment.

Measures taken by MHR have helped to maintain the harmonious industrial relations environment. Data from MHR shows that in 1998, 12 strikes involving 1,777 workers with 2,635 man-days lost were recorded compared to five strikes involving 812 workers with 2,396 man-days lost in 1997. Even though, the number of strikes increased significantly, the number of man-days lost almost remain unchanged. Only 14 pickets were recorded in 1998 compared with 34 pickets in 1997. Similarly the number of industrial disputes where the number dropped from 463 disputes involving 139,187 workers in 1997 to 448 disputes involving 85,053 workers in 1998, thus signifying a stable working labor environment.

Overall, the MHR is urging the companies to be empathetic and to consider other retrenchment alternatives such as reduced working hours and working days, flexible working time, pay cut, voluntary lay-off, and making an offer to employees to resign voluntarily. In general, employers responded positively to the government's call in taking the above measures before resorting to retrenchment. Employers are required to report the implementation of these alternatives to the Labor Department at least one month before the effective date of retrenchment. From August to December 1998, most employers (or 67.2 per cent) chose pay cuts compared to voluntary separation scheme (28.4per cent) and voluntary lay-off (4.4per cent). The number of employers and employees involved between August to December 1998 are shown in the following Table 12:

Table 12: Alternative for Retrenchment

Measures	No. of Employers	No. of Employees
Pay-Cut	795	22,514
Voluntary Lay-Off	52	6,342
Voluntary Separation	336	6,193

Source: Ministry of Human Resource, 1998.

During the economic downturn, industrial harmony is maintained with the cooperation of all parties: workers, employers and the government. Efforts undertaken by the Labor Department and the Industrial Relations Department under MHR have been successful in preventing industrial disputes and maintaining harmonious industrial relations between employers and workers.

CONCLUSION

Economic crisis has not only affected employment in the large corporations but also in small and medium industries. Despite of the contraction of 6.7 per cent of the economy, the retrenchment rate in Malaysia represented only one per cent of the total employment. The low retrenchment rate was accompanied by harmonious industrial environment. This was made possible by the holistic approach taken by the government in addressing the immediate issues confronting the labor market during the economic crisis. The facilitating and regulatory role played by the Government in

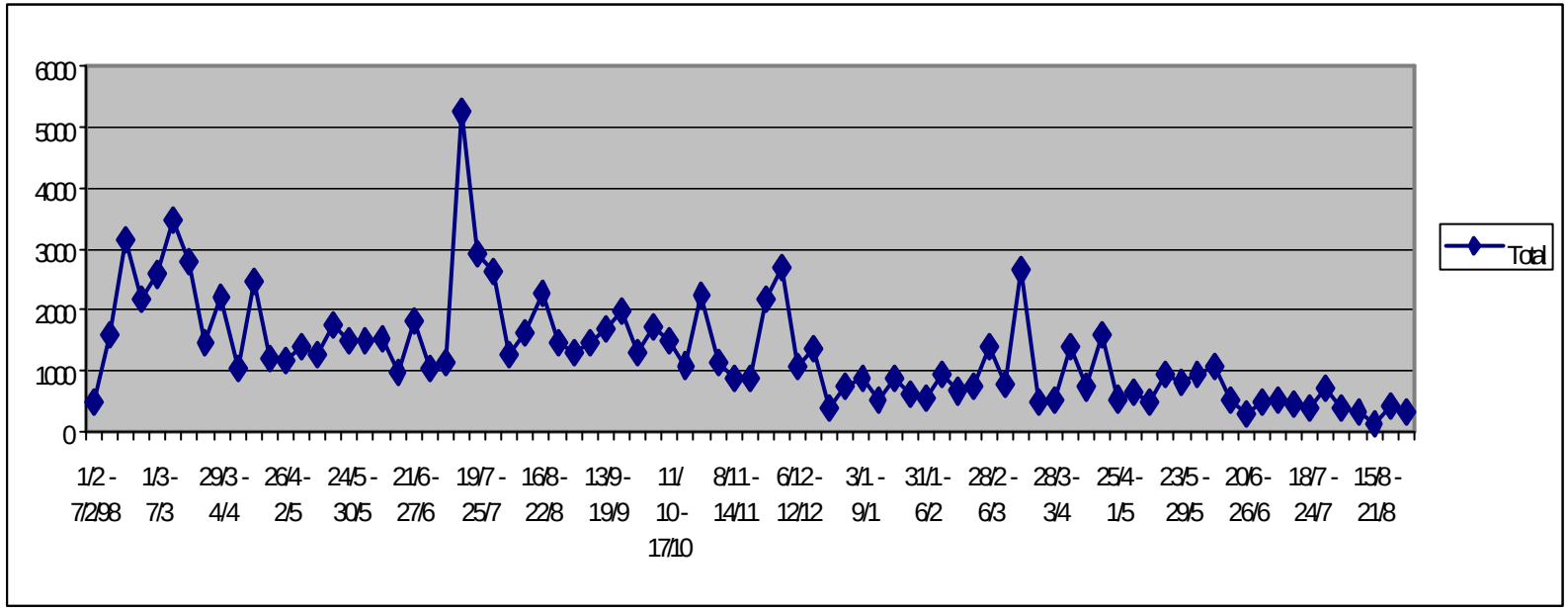
the labor market had eased tension among workers arising from the economic crisis. The harmonious industrial environment had in a way helped to expedite the economic recovery.

The holistic approach by the government in addressing the labor issues incorporated both the demand and supply sides of the labor market. Accessibility of information is considered important, thus the government making it compulsory for employers to report any step taken that can give a signal to the labor market. In addition, policies designed during period of crisis involved the players in the market, the employers and employees. The holistic approach did not segregate policies according to sectors, ownership, gender or sizes of firms. Firms irrespective of the ownership functions and sizes are treated equally when addressing labor issues. Thus employees working in small and medium industries should not expect to receive better or lesser treatments when confronting economic crisis.

As employees working in SMI are not likely to be given special treatment during economic crisis, they are expected to be more productive as compared to their counterparts working in large industries. SMI should focus on the export market rather then relying on the domestic market for expansion, as only 20 per cent of SMI were involved in exports. Thus employees in SMI should be more aggressive and competitive rather than being complacent in order to compete in the international market. Being able to capture the export market, means less likely for employees working in SMI to be retrenched in case of economic crisis reoccurring.

APPENDIX I

Graph 1: weekly Retrenchment Trend, Feb 1998 – 3 Jul 1999



APPENDIX II

Weekly Retrenchment Data by Sector, 1 February 1998 - 4 September 1999

Week	Total	Manufacturing	Construction	Commerce	Finance	Others
1/2 - 7/2/98	480	231	60	129	29	31
8/2 – 14/2	1,583	390	263	630	151	149
15/2 - 21/2	3,159	2,744	117	134	135	29
22/2 - 28/2	2,173	1,327	313	136	207	190
1/3 - 7/3	2,578	1,159	990	141	211	77
8/3 - 14/3	3,460	2,301	303	195	248	413
15/3 - 21/3	2,797	1,776	231	445	155	190
22/3 - 28/3	1,463	255	379	325	128	376
29/3 - 4/4	2,200	883	116	216	193	792
5/4 - 11/4	1,041	308	44	158	269	262
12/4 - 18/4	2,473	727	220	310	306	910
19/4 - 25/4	1,181	215	112	266	260	328
26/4 - 2/5	1,150	545	231	91	97	186
3/5 - 9/5	1,381	683	109	213	97	279
10/5 - 16/5	1,262	513	279	203	144	123
17/5 - 23/5	1,741	834	252	176	140	339
24/5 - 30/5	1,487	718	164	188	63	354
31/5 - 6/6	1,467	773	211	245	82	156
7/6 - 13/6	1,519	826	123	254	69	247
14/6 - 20/6	974	185	127	197	302	163
21/6 - 27/6	1,812	776	579	222	95	140
28/6 - 4/7	1,033	590	109	103	209	22
5/7 - 11/7	1,127	593	169	124	118	123
12/7 - 18/7	5,245	4,715	17	296	110	107
19/7 -25/7	2,919	2,108	232	318	122	139
26/7 - 1/8	2,622	1,278	122	317	143	762
2/8 - 8/8	1,266	567	113	211	241	134
9/8 - 15/8	1,600	1,077	137	161	129	96
16/8 - 22/8	2,277	1,256	337	132	128	424
23/8 - 29/8	1,448	330	201	221	548	148
30/8 - 5/9	1,278	88	279	379	175	357
6/9 - 12/9	1,444	573	91	383	141	259
13/9 - 19/9	1,684	818	114	397	59	296
20/9 - 26/9	1,984	1,420	211	185	48	120
27/9 - 3/10	1,299	444	252	212	154	237
4/10 - 10/10	1,711	1,092	218	185	67	149
11/10 - 17/10	1,465	733	201	257	126	148
18/10 - 24/10	1,080	459	171	117	94	239
25/10 - 31/10	2,214	928	254	162	121	749
1/11 - 7/11	1,132	547	208	156	64	157
8/11 - 14/11	878	199	134	129	61	355
15/11 - 21/11	854	389	108	224	46	87
22/11 - 28/11	2,171	1,280	81	445	15	350
29/11 - 5/12	2,685	154	171	106	72	2,182
6/12 - 12/12	1,047	414	46	93	43	451
13/12 - 19/12	1,350	1,150	69	33	57	41
20/12 - 26/12	371	126	20	90	15	120
27/12 - 2/1/99	734	341	44	127	92	130
3/1 - 9/1	868	260	453	38	45	72
10/1 - 16/1	503	161	34	147	74	87
17/1 - 23/1	864	537	11	72	148	96
24/1 - 30/1	616	444	30	49	24	69
31/1 - 6/2	544	157	102	52	7	226

7/2 - 13/2	946	506	208	48	78	106
14/2 - 20/2	659	266	39	127	98	129
21/2 - 27/2	737	331	36	158	28	184
28/2 - 6/3	1,381	1,114	50	122	43	52
7/3 - 13/3	774	401	89	162	35	87
14/3 - 20/3	2,637	1,954	81	102	337	163
21/3 - 27/3	478	68	50	120	80	160
28/3 - 3/4	496	41	146	65	75	169
4/4 - 10/4	1,395	1,022	186	41	74	72
11/4 - 17/4	720	375	38	64	62	181
18/4 - 24/4	1,581	1,043	65	77	101	295
25/4 - 1/5	521	126	145	104	19	127
2/5 - 8/5	623	312	52	134	19	106
9/5 - 15/5	481	50	58	60	127	186
16/5 - 22/5	935	471	123	31	144	166
23/5 - 29/5	793	348	41	193	94	117
30/5 - 5/6	919	578	67	61	171	42
6/6 - 12/6	1,061	874	17	59	50	61
13/6 - 19/6	516	212	13	162	47	82
20/6 - 26/6	274	130	24	44	26	50
27/6 - 3/7	471	182	36	192	45	16
4/7 - 10/7	514	366	28	50	30	40
11/7 - 17/7	428	320	37	20	17	34
18/7 - 24/7	383	86	57	114	36	90
25/7 - 31/7	698	268	29	196	33	172
1/8 - 7/8	374	272	5	57	35	5
8/8 - 14/8	331	140	21	24	40	106
15/8 - 21/8	127	42	17	39	17	12
22/8 - 28/8	408	337	1	5	12	53
29/8 - 4/9	316	67	132	30	59	28

Source: Ministry of Human Resource, 1999.

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