External supply of skill groups: a case of industrial management in Taiwan

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Introduction
Manpower planning is one major field of human resource management which aims to acquire the right numbers and types of employees at the right time for organizations. Generally speaking, manpower planning involves three basic phases:
1. analysing manpower demand;
2. analysing manpower supply; and
3. reconciling important discrepancies between demand and supply (Milkovich and Boudreau, 1994).

Demand analysis discusses the desired numbers and types of employees to support projected business activities. A variety of demand forecasting techniques has been studied (Greer and Armstrong, 1980; Kwak et al., 1977; Meehan and Ahmed, 1990; Milkovich et al., 1972; Philipose, 1993). Supply analysis focuses on where and how to acquire the required employees. Basically, there are two types of supply analysis: internal and external. Internal supply analysis forecasts the number of current staff who will still be available in the future, whereas external supply analysis answers the question whether the external labour market can provide adequate numbers of people to supplement internal supply. A substantial portion of the development work on quantitative manpower planning models has been devoted to internal supply models (Atwater et al., 1982; Charnes et al., 1978; Greer et al., 1989; Kwak and Garrett, 1980). Studies on external supply are rather few. When there are discrepancies between demand and supply, specific decisions – for example, adjusting entrance requirements – are undertaken. Note that the discrepancies reflect not only the quantity, but also the competence. It is common that the quantities match; however, the competences do not.

Labour market information concerning the quantity, experience, capability, etc. of the skill group of interest is one key factor in successful manpower planning. Unawareness of this information leads to wrong or inappropriate decisions which may cause fatal effects to the organization. For the three phases of manpower planning, external supply is the only phase that is beyond the control of the organization. External scanning can provide useful information for forecasting the likely availability of different types of employees at various future time periods. In this paper, the external supply of manpower for a particular functional skill group is discussed from quantitative and qualitative points of view. To minimize complication of the problem, the discussion is confined to the supply from domestic academic institutions. People who plan to switch organizations and manpower supply from abroad are excluded. Since graduates from academic institutions constitute the major portion of the labour market, it is sufficient to concentrate the analysis on this part alone.

One trend in the industrialized societies of the world is the continuous increase of labour costs. Another trend is the shifting of the workforce by manufacturing industries towards the service sector (Kao et al., 1996). Managing manufacturing firms today presents a greater challenge than ever before. Timely acquisition of information on the labour market of the industrial management (IM) profession is essential for manpower planning.
planning for manufacturing firms. From the standpoint of industries, sufficient supply of manpower provides the opportunity for stringent selection which improves the quality of staff. From the standpoint of government, over-supply of manpower results in unemployment which is a waste of public resources. On the other hand, insufficient supply of manpower hinders the development of industries. Equilibrium between demand and supply is thus desirable. Young graduates want to pursue careers in business, while employers look for suitably qualified young people to fill vacancies in their organization. Kao et al. (1997) investigated career development in IM in Taiwan, Republic of China. Kao and Lee (1996a) developed an integration model to analyse the demand for IM manpower. This paper studies the external supply of IM manpower for the manufacturing industries in Taiwan from the viewpoints of quantity and quality. The supply is discussed from three education levels, namely, junior college, college, and graduate school.

The discussion of this paper commences with the quantitative analysis, followed by a qualitative analysis. Finally, a conclusion is made.

Quantitative analysis

In Taiwan, higher education is classified into three levels: junior college, college, and graduate school. Junior college education is a two-year vocational training and college education is, in general, a four-year training in a specialized area, after six years of elementary school and six years of high school. (There are a few junior colleges which combine three years of high school education with two years of vocational education to form a five-year programme.) Graduate school education provides advanced training for college graduates in that master and doctoral degrees are offered. Currently, there are 24 junior colleges and 14 colleges in Taiwan which have IM, or related, programmes. For post-graduate studies, 13 colleges offer master degrees and six of those colleges offer doctoral degrees in IM.

Several institutions also have evening schools, where classes are taught in the evening. Since most of the students in evening schools already have jobs during the day, only a few can cast into the labour market after graduation. Another point to note is that, at present, no firms are intending to hire employees with doctoral degrees (Kao and Lee, 1996b). Therefore, this level of education is ignored in the analysis.

To analyse the supply in terms of quantity, the numbers of students who graduated in 1994 and 1995, and who were expected to graduate in 1996, are solicited from those 24 junior colleges and 14 colleges which have IM programmes. The results are summarized in Table I. On average, there are approximately 3,207, 1,159 and 320 students graduating from junior colleges, colleges, and graduate schools, respectively, each year. There are also 1,976 and 204 students graduating from evening schools of junior colleges and colleges, respectively, each year. The total manpower supplied by these three levels of academic institutions is 4,524, 4,607 and 4,927 people in 1994, 1995, and 1996, respectively, for day schools; whereas, for evening schools, the numbers are 2,018, 2,101, and 2,422 for 1994, 1995, and 1996, respectively.

As a matter of fact, the number of students graduating from schools each year is not the actual number that joins the labour market. Many graduates would continue advanced studies; junior college graduates go to colleges and college graduates go to graduate schools or to study abroad. Moreover, female graduates may get married and stay at home, becoming housewives. A published report (Department of Statistics, 1994) indicates that the labour participation rate for junior college students in the last ten years is around 70 per cent. In other words, for every 100 graduates only 70 enter the labour market.

For college students and graduate students this rate is even lower – around 60 per cent. Note that the graduates of evening schools are not counted in calculating the labour participation rate. Enquiries into several institutions reveal that approximately 80 per cent of the students in junior colleges already have jobs, whereas for colleges this ratio is only 20 per cent. With these adjustments, the actual numbers of students who constitute the source of manpower supply are calculated and tabulated in Table II. Taking the numbers in 1994 as an example:

\[3,093 \times 25\% = 773\]
On average, there are approximately 3,568 graduates entering the IM job market each year, among which 2,640 (74.0 per cent) are junior college students, 736 (20.6 per cent) are college students, and 192 (5.4 per cent) are graduate students. The total numbers of students supplied from all three levels of academic institutions are 3,428, 3,503 and 3,774 in the years 1994, 1995 and 1996, respectively.

To grasp some idea of whether the IM manpower supplied by the academic institutions is sufficient for manufacturing industries, the demand for IM manpower estimated by Kao and Lee (1996b) is adopted for comparison. Kao and Lee investigated 100 of the 1,000 leading manufacturing firms in Taiwan to collect reliable data to estimate the total IM manpower demanded by the manufacturing industries as a whole for the years 1994, 1995, and 1996 by applying an integration model. Table III lists the result of their study.

The total demand each year is approximately 3,796 people, among which 1,977 (52.1 per cent) are junior college students, 1,453 (38.3 per cent) are college students, and 366 (9.6 per cent) are graduate students. By comparing Table II with Table III, it is interesting to note that the total supply is quite close to the total demand. Referring to Figure 1, the average supply in three years is 3,568 people, whereas the average demand is 3,796 people, with a shortage of only 228 people. Nonetheless, the education levels do not match. The supply of junior college students is higher than that demanded by industries: 2,640 versus 1,977, with a surplus of 663 persons. The supply of college students and graduate students, on the other hand, is insufficient, and the ratios are 736 to 1,453 for college students and 192 to 366 for graduate students.

This supply-demand comparison is quite informative for both industries and government, in that the industries understand that they may not be able to hire employees with the education levels they expected and the Ministry of Education of the government acquires a rough idea that the enrolment of the IM programmes can be increased in both the bachelor level and the master level. Certainly, a more detailed study is deemed necessary to figure out the appropriate numbers of students for junior colleges, colleges and graduate schools each year so that, in the long run, the supply structure coincides with the demand structure.

Table II
Students of different education levels entering the industrial management labour market

<table>
<thead>
<tr>
<th>Year</th>
<th>Junior college</th>
<th>College</th>
<th>Graduate school</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>2,538</td>
<td>694</td>
<td>196</td>
<td>3,428</td>
</tr>
<tr>
<td>1995</td>
<td>2,615</td>
<td>699</td>
<td>189</td>
<td>3,503</td>
</tr>
<tr>
<td>1996</td>
<td>2,768</td>
<td>815</td>
<td>191</td>
<td>3,774</td>
</tr>
<tr>
<td>Average</td>
<td>2,640</td>
<td>736</td>
<td>192</td>
<td>3,568</td>
</tr>
</tbody>
</table>

Table III
Demand for industrial management manpower from the manufacturing industries

<table>
<thead>
<tr>
<th>Year</th>
<th>Junior college</th>
<th>College</th>
<th>Graduate school</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>1,967</td>
<td>1,398</td>
<td>284</td>
<td>3,649</td>
</tr>
<tr>
<td>1995</td>
<td>1,977</td>
<td>1,453</td>
<td>366</td>
<td>3,796</td>
</tr>
<tr>
<td>1996</td>
<td>1,987</td>
<td>1,508</td>
<td>449</td>
<td>3,944</td>
</tr>
<tr>
<td>Average</td>
<td>1,977</td>
<td>1,453</td>
<td>366</td>
<td>3,796</td>
</tr>
</tbody>
</table>

Figure 1
Supply-demand comparison in terms of quantity

<table>
<thead>
<tr>
<th>Number of persons</th>
<th>Key</th>
<th>Demand</th>
<th>Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3,500</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3,000</td>
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<td></td>
<td></td>
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<td>2,500</td>
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<td>2,000</td>
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<tr>
<td>1,500</td>
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<tr>
<td>1,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[ 304 ]
transcend the specific problems encountered in industries.

Traditionally, production, finance, marketing, and human resources are considered as the four major managerial functions in corporations (Eilon, 1986). As computer technology has advanced rapidly in recent years, information has become a new emerging managerial function. There are many courses directly related to these functions. However, to take those courses, some basic knowledge is required as a prerequisite. The basic knowledge also serves as a basis for logical thinking, and the courses of mathematics, statistics, and economics are some examples. In sum, the training of IM students in this study are classified into six categories: basic knowledge, production, finance, marketing, human resources and information. The required courses of the 24 junior colleges and 14 colleges investigated in this study are collected and categorized accordingly.

For junior colleges, the Ministry of Education requires each student to take at least 80 credits (one credit is equivalent to 18 hours) for graduation. The average number of credits of required courses for the 24 junior colleges is 56.61, which is approximately 70 per cent of the total number of credits for graduation. Most IM programmes attempt to provide sound training in managerial functions; however, comprehensive coverage does not seem feasible. Of the six categories, production occupies the largest portion of 25.31 credits. Basic knowledge (15.52 credits) ranks the second, followed by finance (6.19 credits), information (5.02 credits), human resources (4.38 credits), and marketing (0.19 credits). Table IV summarizes this result. It is worth noting that only two junior colleges require a course in marketing, which leads to an average number of credits as low as 0.19. The figures in Table IV also indicate that the differences among finance, human resources and information are not significant.

For colleges, the Ministry of Education requires each student to take at least 128 credits before graduation. On average, the total number of credits of the required courses for the 14 investigated colleges is 63.33, which is approximately 50 per cent of the total number of credits. Although college education is two years longer than junior college education, the number of credits for required courses differs only by 6.72. College students obviously have wider choices for electives to develop their own aptitude. Table IV also shows the numbers of credits for those required courses in different categories. The major difference between junior college and college is that basic knowledge occupies the largest portion of credits for college, whereas for junior college the largest portion is production. This result indicates that college education is somewhat different from vocational education in that the emphasis is on basic studies for building up abilities in logical thinking, for solving general problems instead of particular problems. Similar to junior college, the differences among the numbers of credits for finance, human resources and information are also insignificant, and marketing is still the least important subject with a negligible percentage of 0.96 per cent.

For graduate programmes in IM, most colleges in Taiwan do not have any required courses. The graduate students have ample freedom in taking courses to specialize in particular areas. Analysing the required courses from a few master programmes will derive results which are misleading. Therefore, education and training in respect of graduate schools are not discussed.

In an attempt to understand the requirements for IM manpower from manufacturing industries, Kao and Lee (1996) also investigated the training that the manufacturing firms expected an IM student to receive. For the six subjects, the investigated firms were asked to give a score between 0 and 5 to indicate the importance of the corresponding subject to the success of running the business. Table V summarizes the result. The two most important subjects as perceived by the manufacturing firms in Taiwan are production and information for all three education levels.

The other four subjects seem to be equally important. Although there is no common base for comparing this result with the training from schools, two distinctions are still manifested from the figures in these two tables. One is that, in Table V, production and information are equally important.
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Table V
Importance scores of different subjects as perceived by industries

<table>
<thead>
<tr>
<th>Subject</th>
<th>Basic</th>
<th>Production</th>
<th>Finance</th>
<th>Marketing</th>
<th>HR</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junior college</td>
<td>3.64</td>
<td>4.16</td>
<td>3.63</td>
<td>3.68</td>
<td>3.53</td>
<td>4.11</td>
</tr>
<tr>
<td>College</td>
<td>3.77</td>
<td>4.23</td>
<td>3.98</td>
<td>3.88</td>
<td>3.70</td>
<td>4.21</td>
</tr>
<tr>
<td>Total</td>
<td>7.41</td>
<td>8.39</td>
<td>7.61</td>
<td>7.56</td>
<td>7.23</td>
<td>8.32</td>
</tr>
<tr>
<td>Percentage</td>
<td>15.93</td>
<td>18.04</td>
<td>16.36</td>
<td>16.25</td>
<td>15.54</td>
<td>17.88</td>
</tr>
</tbody>
</table>

Figure 2
Supply-demand comparison in terms of quality

Conclusion

This paper studies the external supply of particular skill groups from the viewpoint of quantity as well as quality. Regarding quantity, the students of junior colleges, colleges and graduate schools are considered as the main source of the labour market. As far as quality is concerned, the courses required in schools are adopted as the criteria. The whole concept is illustrated by a case of industrial management in Taiwan. While the total number of students graduating each year is similar to that demanded by manufacturing industries, supplies of students with higher degrees, such as bachelor and master, are less than demanded.

Quality is discussed via the training received in schools, in that six subjects, namely, basic knowledge, production, finance, marketing, human resources and information, are classified. By comparing with the demand from industries, it is found that, except for basic knowledge and production, training in all of the remaining four subjects should be strengthened to cope with the need of the industries.

The external supply analysis described in this paper can be utilized by at least two parties. For government, it provides the Ministry of Education with information on whether some particular programmes should be expanded and what type of courses should be emphasized in higher education. For industries, it gives information on the labour market situation of specific skill groups. With that information, appropriate decisions, such as planning internal supply, adjusting the standard in selection, or designing pre-job training, can be made. Since the concept introduced in this paper is very generic, it can be applied to other skill groups in other countries.

References


