

Verification of Variable Classification across the Indices

We used principal factor analysis with varimax rotation to verify our classification of variables into indices. The variables were split into three sub-groups matching the three components (Work/Training, Pay/Promotion and Knowledge), and a factor analysis was run on each sub-group separately in order to reduce the number of variables in each factor analysis.ⁱ Even with this split, our data set of 106 engineers was relatively small for the number of variables in the sub-groups (44, 30 and 61 variables in Work/Training, Pay/Promotion, and Knowledge respectively). We thus used factor analysis only to ascertain that variables determined to be “external” were not found in a factor that had “internal” variables. A factor loading cutoff of 0.5 was used. There were 15 factors in each analysis, but only those with alpha > 1 and with more than one variable were used for index validation. All factors with alpha < 1 had at most one variable with a loading > 0.5, so these factors were not useful for our purposes. The results are shown in **Tables 1** through **3**. These tables contain the number of factors, the variables for each index, and whether the factor was designated as external or internal when the indices were formed.

ⁱ As a check for our split into sub-groups, a single factor analysis was done on the entire data set, which included the vendors (thus enlarging our dataset to 163). No factors were found to include a combination of Work/Training, Pay/Promotion and/or Knowledge data. The factors formed were very similar to those we found after splitting into sub-groups and removing the vendors.

Table 1. Pay/Promotion Factors*

Factor Number	Variables with Loadings >0.5	External or Internal Index
1	Pay: patents, presented papers, published papers; Promotion: patents, presented papers, published papers	External
2	Pay: <i>effective communicating outside team but inside company</i> , share knowledge, team participation, creativity and initiative, <i>suggestions and improvements, skills</i>	Internal
3	Pay: seniority; Promotion: seniority	Internal
4	Pay: meeting targets; Promotion: meeting targets	Internal
5	Pay: <i>skills</i> ; Promotion: skills	Internal
6	Promotion: team participation, share knowledge	Internal
7	Pay: cooperation with supervisors; Promotion: cooperation with supervisors	Internal
8	Pay: staying within budget; Promotion: staying within budget	Internal
9	Pay: <i>effective communicating outside team but inside company</i> ; Promotion: effective communicating outside team but inside company	Internal
10	Pay: <i>suggestions and improvements</i> ; Promotion: suggestions and improvements	Internal
11	Pay: developing contacts; Promotion: developing contacts	External

*Note: Description of variables can be found in Tables 3.a-3.b. Variables in italics are found in two factors; however, these factors are always both internal or both external.

Table 2. Work/Training Factors*

Factor Number	Variables with Loadings >0.5	External or Internal Index
1	Training Used: communication, design of experiments, leadership & supervisory skills, problem solving methods	Internal
2	On The Job Training: communication, design of experiments, leadership & supervisory skills, problem solving methods, writing	Internal
3	Average tenure at companies, current company tenure	External
4	Classroom Training: communication, leadership & supervisory skills, <i>science</i> , writing	Internal
5	Classroom Training: <i>science</i> ; Training Used: science	Internal
6	Administrative Work, Classroom Time	Internal

*Note: Description of variables can be found in Tables 3.a-3.b. Variables in italics are found in two factors; however, these factors are always both internal or both external.

Table 3. Knowledge Factors

Factor Number	Variables with Loadings >0.5	External or Internal Index
1	Technical Information Acquisition: Own Fab – newsletter; Other IC Companies – popular press, conferences, patents; Equipment Vendors – public newsletters, popular press, journals, conferences, tradeshow, patents Important Sources of Technical Information: patents	Internal
2	Technical Information Acquisition: Other IC Companies – face-to-face, visit, telephone, email	External
3	Technical Information Acquisition: Own Fab – email, telephone; Other Fab in Company – email, telephone	Internal
4	Technical Information Acquisition: Own Fab – electronic memo; Other Fab in Company – hard-copy memo, electronic memo	Internal
5	Technical Information Acquisition: Equipment Vendors – telephone, face-to-face, facilities visit Important Sources of Technical Information: material suppliers	External

6	Technical Information Acquisition: Own Fab – face-to-face; Other Fab in Company – meetings, face-to-face	Internal
7	Advice Sought, Advice Fulfilled	External
8	Company Documents Not Consulted (single variable so excluded)	External
9	Technical Information Acquisition: Other IC Companies – reverse engineering Consulted: approached co-worker	Internal
10	Technical Information Acquisition: Other IC Companies – consortium, Consulted: approached someone from outside company	External