Impact of supervisor support on work ability in an IT company

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Background Work ability is the ability of a worker to perform his job. The authors hypothesized that supervisor support influences the work ability of workers working in an information technology company located in Tokyo.

Aims To assess whether or not support from supervisors influences work ability.

Methods Two surveys using the Brief Job Scale Questionnaire and the Work Ability Index (WAI) were conducted, one in October 2007 and the other in October 2008 on the same cohort. Two cross-sectional analyses and a 1-year longitudinal analysis were conducted using multiple regression analysis. In addition, the relationships between supervisor support and each dimension of WAI were analysed separately.

Results The number of participants was 1157 males. Significant relationships were observed between supervisor support and WAI scores in both survey periods after adjusting for age, job demand, job control, work group size, job rank and job type. The 2007 Supervisor support was a significant predictor of 2008 WAI that raised the possibility that supervisor support does influence WAI scores. From the analysis of each dimension of WAI, a strong relationship between supervisor support and WAI was observed for the sections of the WAI that assessed work capacity but not for the sections that assessed the personal health status of respondents.

Conclusions Supervisor support is an important predictor of work ability. Supervisor support is associated with the questions of the WAI that assess not only work demands but also person’s resources of the work ability model.

Key words Japanese information technology (IT) workers; longitudinal study; Supervisor support; the Brief Job Scale Questionnaire (BJSQ); Work Ability Index (WAI); work-related factor.

Introduction

Recent research on the quality of worklife has yielded a better understanding of work ability. Work ability is defined as the ability of a worker to perform their job, taking into account work demand and physical and mental conditions [1]. The development and universal availability of the Work Ability Index (WAI), a measurement tool developed by Finnish researchers in the 1980s, has given rise to the concept of work ability as represented in Figure 1. Referring to the model, Ilmarinen wrote that ‘Work ability is built on the balance between personal resources and work demand’ [3]. Personal resources consist of health, made up of physical, psychological and social integrity, professional competence, knowledge, skill, sound attitude and motivation [3,4]. Work demand, which is the counterpart to personal resources in the work ability model, comprises work environment, job content, work demand, work organization and community support. The increasing work demands, combined with haste and continuous changes in work organization, create an imbalance between personal resources and work demand, leading to impaired work ability.

Since the concept of work ability has been introduced, researchers have tried to identify factors that influence work ability [4–9]. By the nature of their hierarchal position in the organization and their responsibilities in the management of work, supervisors play an important role at work. Some reports have indicated that interpersonal relationship difficulties, including supervisor support, can cause stress and affect workers’ mental conditions;
low support from supervisors is associated with psychological distress and supervisor support is suggested as one of the most important factors influencing job satisfaction and psychological strain [10,11]. Moreover, several studies have reported that supervisors have the capacity to influence several components of the work ability model (marked by arrows in Figure 1) such as employee motivation, job content, job demand, work organization, management and leadership [12–14]. Some studies have observed a direct association between supervisor support and work ability [5–7].

Ilmarinen emphasized the importance of supervision and management in the work demand dimension of his work ability model [15]. Supervisors are responsible for this dimension and also have a mandate to organize and change the worksite, if necessary.

From these previous observations, the authors hypothesized that supervisor support influences work ability and that greater support leads to higher work ability. The aim of this study was to assess empirically, based on a new set of data, the influence of supervisor support on work ability.

**Methods**

The study was conducted in an information technology company located in Tokyo, Japan. There were three major job ranks in the company: executives, managers and non-management employees. The job types were system engineers, 73% (15–1100 in 2010 Standard Occupation Classification [16]); business people, 15% (41–4000); staff, 11% (13–0000), and executives, 1% (11–1000). Among these categories, the executives did not have supervisors and were therefore excluded from the study. The managers were thus considered to be supervisors as well as subordinates and were included in the analysis. Supervisors comprised 20% of the employees.

The study consisted of two cross-sectional surveys conducted at 1-year interval in October 2007 (Time 1, T1) and October 2008 (Time 2, T2). The questionnaire was posted on the company’s internal Web site, and employees were invited to answer the questions directly on the site. The answering period lasted 1 month (1–31 October) of each year.

The company had a code of ethics for its medical personnel. In accordance with these rules, the author obtained authorization from management and ensured that participants had access to all pertinent information. The questionnaires included a section that explained the object of the study, the fact that access to data was limited to authorized personnel from the medical department, the personal nominal information would be deleted after data collection and the results will be published in an academic journal. The study protected the participants’ privacy and participation was voluntary.

Work ability was measured using the WAI. The WAI aims to assess the physical and mental ability of an individual in relation to his work and work ability prognosis [2]. The WAI has seven dimensions: (i) current work ability compared with lifetime best (0–10 points), (ii) work ability in relation to the demand of the job (2–10 points), (iii) number of current diseases diagnosed by a physician (1–7 points), (iv) estimated work impairment due to diseases, (v) sick leave during the past year (1–5 points), (vi) own prognosis of work ability 2 years from now (1, 4 or 7 points) and (vii) mental resources (1–4 points). The overall index is the sum of the ratings of each item. The total score ranges from 7 to 49. The resulting WAI scores were categorized into two groups: inadequate (poor and moderate WAI scores) and adequate (good and excellent WAI scores). The cutoff points for adequate/inadequate work ability were based on age values suggested by Kujala et al. [17]. The inadequate work ability was defined by using a WAI score below 40 points for the younger participants (19–34 years) and below 37 points for the older participants (≥35 years) [18].

The explanatory variable, supervisor support, was measured using the support section of the Brief Job Scale Questionnaire (BJSQ) [19]. BJSQ is a 57-item multidimensional questionnaire, and its aim is to measure job stressors, worksite support and psychological distress of workers. This tool was developed in Japan and is commonly used in workplaces and field studies [20]. It has shown acceptable or high level of internal consistency, reliability and factor-based validity [21]. Supervisor support was assessed using the following three questions: (i) How easy is it for the respondent to talk with his supervisor? (ii) How much can the respondent’s supervisor be relied upon when there are difficulties at work? (iii) How much the participant’s supervisor is willing to listen to a respondent’s personal problems? These items were rated on a Likert-type 4-point scale (from ‘strongly agree’ = 4 to ‘strongly disagree’ = 1) [19].
These three items were added and the total scores ranged from 3 to 12 with a higher score indicating greater support from supervisors. To calculate the relative risks between supervisor support and WAI in the two cross-sectional surveys, the supervisor support scores of each survey were categorized into four groups: very low, low, high and very high, at every quartile score. To analyse the relationship between supervisor support and WAI in the longitudinal results, the supervisor support scores of each survey period were dichotomized based on the median score of each year to yield high supervisor support group and a low supervisor support group. This permitted creation of four dual categories that took into account the changes in supervisor support between the two survey periods low (T1) – low (T2), low (T1) – high (T2), high (T1) – low (T2) and high (T1) – high (T2).

Age, job type, job rank, work group size, job demand and job control [12] were included in regression analyses to control for confounding factors. Job demand and job control were also measured and scored using the items in the BJSQ. Job demand was measured with three items: (i) working hard, (ii) amount of work and (iii) insufficient time to complete work, on a 4-point response scale (from strongly agree = 4 to strongly disagree = 1). Job control was measured with three items: (i) work at own pace, (ii) make decisions at work and (iii) influence over worksite policy, on the same response scale. Total scores for these two scales ranged from 3 to 12, with a higher score indicating a greater degree of job demand or job control [19,20]. Age was measured as a continuous variable.

The influence of supervisor support on work ability was analysed in four steps. First, relative risks and correlation coefficients were calculated to analyse the relationship between supervisor support and WAI scores in each study period. Second, a multiple regression analysis was used to adjust for potential confounding factors. Third, in order to test if the relationship between supervisor support and the WAI scores observed in the cross-sectional analysis was also present in the longitudinal analysis, the authors did a multiple regression analysis in which T1-supervisor support was used as the predictor of T2-WAI adjusted for T1-WAI and also a multiple regression of T1-WAI as predictor of T2-supervisor support adjusted for T1-supervisor support. After confirming that T1-supervisor support is the significant explanatory variable for T2-WAI, each participant’s predicted WAI score (P-WAI) was calculated. The average differences between observed (T2-WAI) and predicted WAI scores (P-WAI) were contrasted against four supervisor support dual categories [22]. And finally, correlation coefficients between supervisor support and each dimension of the WAI were analysed separately.

Significant betas were observed in multiple regression analysis between WAI scores and supervisor support, controlling for job demand, job control, age, work group size, job rank and job type, in both T1 and T2 periods. (Results not shown.) Supervisor support of both study periods low (T1) and high (T2), high (T1) and low (T2), high (T2), high (T1) and low (T2), and high (T1) and high (T2).

Cronbach’s alphas for the combined three questions that comprised supervisor support were 0.79 for T1 and 0.80 for T2, and the correlation coefficients between the three questions were 0.52, 0.55 and 0.64 for T1 and 0.51, 0.53 and 0.63 for T2.

Relative risks and correlation coefficients between WAI scores and supervisor support for both T1 and T2 surveys are shown in Table 2. All the relative risks and the correlation coefficients reveal a significant relationship between supervisor support and WAI scores.

Table 1. Descriptive information of participants and WAI scores

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 age (years), median</td>
<td>1157</td>
<td>224</td>
</tr>
<tr>
<td>(minimum–maximum)</td>
<td>36 (23–62)</td>
<td>30 (23–54)</td>
</tr>
<tr>
<td>T1 age, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20–29</td>
<td>313 (27)</td>
<td>103 (46)</td>
</tr>
<tr>
<td>30–39</td>
<td>392 (34)</td>
<td>77 (34)</td>
</tr>
<tr>
<td>40–49</td>
<td>330 (29)</td>
<td>39 (17)</td>
</tr>
<tr>
<td>50–59</td>
<td>112 (10)</td>
<td>5 (2)</td>
</tr>
<tr>
<td>60+</td>
<td>10 (1)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>T1 job rank, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subordinator</td>
<td>910 (79)</td>
<td>218 (97)</td>
</tr>
<tr>
<td>Supervisor</td>
<td>247 (21)</td>
<td>6 (3)</td>
</tr>
<tr>
<td>T1 job type, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staffs</td>
<td>63 (5)</td>
<td>32 (14)</td>
</tr>
<tr>
<td>Business people</td>
<td>118 (10)</td>
<td>13 (6)</td>
</tr>
<tr>
<td>System engineers</td>
<td>976 (84)</td>
<td>179 (80)</td>
</tr>
<tr>
<td>T1 work group size (n),</td>
<td></td>
<td></td>
</tr>
<tr>
<td>median (minimum–maximum)</td>
<td>8 (1–38)</td>
<td>10 (2–38)</td>
</tr>
<tr>
<td>T1-WAI score, median</td>
<td>38.5 (15.0–49.0)</td>
<td>38.0 (15.0–48.0)</td>
</tr>
<tr>
<td>(minimum–maximum)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2-WAI score, median</td>
<td>38.0 (14.0–49.0)</td>
<td>37.5 (18.0–45.5)</td>
</tr>
<tr>
<td>(minimum–maximum)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results

The total number of workers in the company was 1595 including 1326 males with a median age of 36 years and 269 females aged 30 years. The total number of participants after exclusions was 1237 males and 256 females, giving a participation rate of 94% of the company’s workforce in the first study period; 80 males and 32 females were excluded from the analysis because they did not participate in the two surveys (6 retirees, 78 resignations and 28 for other reasons). Because of the different ratios of supervisors to subordinates between females and males, they were considered as two different cohorts and the present analysis is restricted to males only. The demographic information on this population is given in Table 1.

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Significant betas were observed in multiple regression analysis between WAI scores and supervisor support, controlling for job demand, job control, age, work group size, job rank and job type, in both T1 and T2 periods.
periods had a significant association to WAI, after controlling for potentially confounding factors.

The result of the longitudinal study using multiple regression models is shown in Table 3. There was a significant association between T1-supervisor support and T2-WAI score but not between T1-WAI score and T2-supervisor support. Table 4 describes the average differences between observed T2-WAI and predicted WAI by supervisor support categories. Three observations can be made from this table. First, there was a significant difference between low–low and low–high supervisor support categories and between high–low and high–high supervisor support categories. This means that in the low–high supervisor support category, workers tend to score WAI significantly higher than predicted compared with the low–low category. The same trend is observed between high–low and high–high categories. Second, the average differences of both supervisor support categories that were low in T2 (low–low and high–low) were negative whereas those that were high in T2 (low–high and high–high) were positive. This means that the workers whose T2-supervisor support was low tended to score T2-WAI lower than predicted, and vice versa. Finally, the categories whose supervisor support changed between T1 and T2 (low–high and high–low) had a larger difference (independent of the sign) than those that did not change (low–low and high–high). This indicates that when supervisor support changed from 1 year to another, the change in WAI score was larger than when supervisor support was more constant.

Relative risks and correlation coefficients between WAI score and supervisor support for each dimension of WAI in T1 and T2 are shown in Table 5. Significant relative risks and correlation coefficients between each WAI dimension and supervisor support were observed for WAI dimension 1 (W-1), W-2, W-6 and W-7 in both study periods, whereas W-3, W-4 and W-5 showed no significance or significance but small relative risks and correlation coefficients.

### Discussion

In this study, the two cross-sectional surveys showed a significant relationship between supervisor support and work ability as measured by WAI scores, after adjustment for job demand, job control and other confounding factors. The result of the longitudinal analysis showed that T1-supervisor support was a significant predictor of T2-WAI, but T1-WAI was not a predictor for T2-supervisor support. This implies that supervisor support contributes to work ability independently of job demand and job control.

This study had some remarkable features. Participation rate was high. The proportion of employees who participated in the study was 94% of the total number of employees at T1 and 93% at T2, which makes it reasonable to assume that the results are representative. The study design comprised two cross-sectional surveys and one longitudinal analysis. The results of the two cross-sectional studies were similar. This indicated the stability of the relationships between WAI and supervisor support.

This study has some limitations. First, it was conducted in a Japanese company, all the participants were computer workers, and there were no blue-collar workers.
Table 5. RRs and 95% CI and correlation coefficients (r) between WAI and supervisor support for each dimension of WAI in T1 and T2

<table>
<thead>
<tr>
<th>WAI</th>
<th>RR</th>
<th>95% CI</th>
<th>r</th>
<th>RR</th>
<th>95% CI</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1.59</td>
<td>1.41–1.78</td>
<td>0.32**</td>
<td>1.56</td>
<td>1.38–1.76</td>
<td>0.30**</td>
</tr>
<tr>
<td>Current work ability compared with lifetime best (W-1)</td>
<td>1.61</td>
<td>1.40–1.84</td>
<td>0.29**</td>
<td>1.51</td>
<td>1.33–1.72</td>
<td>0.27***</td>
</tr>
<tr>
<td>Work ability in relation to the demands of the job (W-2)</td>
<td>1.96</td>
<td>1.66–2.32</td>
<td>0.31**</td>
<td>1.72</td>
<td>1.47–2.02</td>
<td>0.30**</td>
</tr>
<tr>
<td>Number of current diseases diagnosed by a physician (W-3)</td>
<td>0.99</td>
<td>0.85–1.14</td>
<td>0.01</td>
<td>1.00</td>
<td>0.88–1.15</td>
<td>0.01</td>
</tr>
<tr>
<td>Estimated work impairment due to diseases (W-4)</td>
<td>1.13</td>
<td>0.95–1.35</td>
<td>0.04</td>
<td>1.19</td>
<td>1.02–1.39</td>
<td>0.08**</td>
</tr>
<tr>
<td>Sick leave during the past year (W-5)</td>
<td>1.12</td>
<td>0.97–1.29</td>
<td>0.05</td>
<td>1.17</td>
<td>1.02–1.35</td>
<td>0.09**</td>
</tr>
<tr>
<td>Own prognosis of work ability 2 years from now (W-6)</td>
<td>1.43</td>
<td>1.24–1.64</td>
<td>0.15**</td>
<td>1.28</td>
<td>1.11–1.47</td>
<td>0.11**</td>
</tr>
<tr>
<td>Mental resources (W-7)</td>
<td>2.03</td>
<td>1.75–2.34</td>
<td>0.37**</td>
<td>1.70</td>
<td>1.48–1.95</td>
<td>0.33**</td>
</tr>
</tbody>
</table>

RR, relative risks. The RRs and correlation coefficients of supervisor support were calculated with data from T1 when T1-WAI was used and with data from T2 when T2-WAI was used. Supervisor support and all WAI dimension scores of T1 and T2 were divided at median score to calculate the RRs, respectively.

**P < 0.01.

Although the multiple regression analysis adjusted for job type, it included only three job types. This can be considered a limitation as the results can only be applied to computer workers and may not apply to workers in general. Second, the outcome measures in this study were subjective and self-reported. This may entail some bias. Other factors that may modulate the relationship between supervisor support and work ability such as level of education [8,9] and the frequency of interaction with the supervisor [23] were not available for this study and should be collected in future studies.

The results of this study have similarities with three previous studies [5–7] that reported a significant relationship between WAI and supervisor support. De Croon et al. [6] reported that low supervisor support was significantly predictive of low work ability among a group of workers with rheumatoid arthritis. Tuomi et al. [5] in a study of aging workers reported that an increase in satisfaction with the supervisor’s attitude was the strongest factor associated with improvement in work ability. Pohjonen [7] observed a significant relationship between supervisor support and work ability in a cohort of female blue-collar workers.

The results indicate a possible causal relationship between supervisor support and work ability. When supervisor support increases, so does WAI and when supervisor support decreases, WAI scores decrease. The worker who has high supervisor support tends to exhibit increased motivation and/or control over his work. On the other hand, the worker who receives low support is more likely to be overwhelmed by work demand, have decreased motivation and decreased work ability. However, this causal interpretation must be regarded with reservation. The interplay between supervisor support and WAI may be more complex than a simple cause and effect relationship. There is a possibility that an increased WAI by itself can lead to increased support. An employee who became more motivated and less uncooperative may be perceived as more receptive to supervisor support or as a worker’s work ability decreases, a supervisor may provide more support to the worker.

Some authors have proposed that the relationship between supervisor support and WAI was actually the result of two well-known influential factors: job demand and job control [6,24–27]. They argued that an imbalance between these two factors entails stress and mental tension, and this impact on the relation between the supervisor and the employee, leading to an impaired WAI. In this study, the authors adjusted for job demand and job control and supervisor support still showed a significant relationship to WAI, indicating that supervisor support influences WAI independently of job demand and job control. To investigate the existence of a causal relationship between supervisor support and WAI, additional research is needed.

In the course of the two surveys, some workers changed supervisors. To verify if such a change affects perceived support, the author divided the participants into two groups: Group 1 having the same supervisor in both surveys T1 and T2 and Group 2 having different supervisors. The relationship between supervisor support and WAI was the same in each group. From this result, it can be said that whether or not an individual had the same supervisor in both questionnaires does not influence the results. In terms of the relationship between supervisor support and WAI scores, the supervisor’s attitude is more important than who the supervisor is.
The results of this study show a relationship between supervisor support and total WAI score. Since WAI is an amalgamation of several questions that relate to diverse dimensions, it became necessary to analyse each question separately to understand which dimension is associated with supervisor support [28]. The results showed a significant relationship between supervisor support and W-1, W-2, W-6 and W-7. These four dimensions bear a significant relationship with supervisor support and explain by themselves the relationship between supervisor support and the total WAI score. Among these dimensions, W-7 carries the strongest association with supervisor support. This implies that supervisor support has its strongest effect on workers’ mental condition. Dimension W-2 relates to work while dimensions W-1, W-6 and W-7 relate to value dimension of personal resources in the model shown on Figure 1. It has been considered that supervisor support mainly affects work in the work ability model [15]. The results indicate that supervisor support also affects personal resources.

Supervisor support had no or a negligible relative risk with dimensions W-3, W-4 and W-5 that relate to workers’ sickness. This was expected since there are no obvious reasons why supervisor support would influence the frequency of medically diagnosed diseases.

According to previous reports and the results of this study, it can be concluded that supervisor support is an important predictor of work ability. Moreover, supervisor support is associated with the parts of the WAI that assess work demands as well as personal resources of the work ability model. This emphasizes the importance of managerial support at the worksite.

Key points
- Supervisor support is an important predictor of workers’ work ability.
- Supervisor support contributes to work ability independently of job demand and job control.
- The sections of work capacity in the Work Ability Index had a strong relationship with supervisor support.

Conflicts of interest
None declared.

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