

## Innovative worktime arrangements

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New worktime models can be introduced from an employer's point of view for many reasons. They can extend operational time for better utilization of expensive equipment, provide customer-oriented service hours, adjust operational time to the varying needs of personnel, adhere to a given operational time despite a reduction in workhours, avoid dismissals, or improve job attractiveness for qualified personnel. On the other hand, there are also many reasons for changing traditional worktime models from an employee's point of view. For example, new models can help fit private needs to occupational demands, change worktime according to life's phases, provide more autonomy for the organization of worktime or the choice of worktime model, and allow for reduced capacity due to illness or age. The paper primarily presents examples of innovative worktime models (eg, annual worktime, time-autonomous group, variable worktime, choice between different worktime models) but also discusses the possible negative effects of new worktime arrangements.

**Key terms** annual worktime, condensed worktime, flexitime, functional flexitime, optional worktime, part-time, time-autonomous work group, variable worktime.

This paper is not restricted to shift systems. It refers to all kinds of innovative worktime models. A model will be called "innovative", if the following prerequisites are fulfilled: (i) it has noteworthy consequences for the company and the employees and (ii) resistance to change has to be overcome.

We have followed changes in worktime arrangements in many companies in industrial and service sectors. Always, when a new model is discussed that differs substantially from the arrangements in use, fears, doubts, and even resistance are expressed not only by the employees, but also by unions and middle management. If the new model is to be highly accepted, a compromise must be reached that offers improvements for both the company and the employees.

### **Reasons for introducing new worktime models**

There are many reasons for introducing new worktime models both from an employer's and an employee's point of view. First, employers want to adjust operational time

to the varying needs of personnel. There is a fluctuating need for personnel if customer demand varies, if absent personnel has to be replaced, or if machinery breaks down. The unpredictable short-term variation of work demands is the most difficult case to cope with. Second, not only in the service sector, but also in industry, service hours have to be adjusted to the needs of internal and external customers. Third, for a better utilization of expensive equipment, operational time has to be extended. Fourth, although weekly workhours have been reduced in the last decade, employers still want to adhere to old operational times. Fifth, for an employer, the change between dismissals and new employment of an essential part of the staff may be very expensive and problematic because of the loss of know how. For example, during a year with reduced customer demand, it may switch from full-time employment to part-time work (eg, the German VW AG switched from 36.0 to 28.8 hours per week for all employees). Sixth, in the future, it will be more difficult to attract, retain, or motivate highly qualified personnel. Therefore the wishes of these employees have to be taken into consideration more than before.

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On the other hand, there are also many reasons from the employee's point of view for introducing new worktime models. For many gainfully employed women, who have to carry the main burden of child care and domestic work, it is very difficult to fit private needs with occupational demands. In Germany the opening hours of most kindergartens and primary schools are restricted to the morning. As the number of gainfully employed women increases, better solutions have to be found. However, also more and more gainfully employed men would like to have more time for their family, hobbies, and education. The wishes of men and women with respect to worktime are not constant over the whole of their worklife, but, instead, depend on life's phases. In the future, there could be more interruptions in worklife due to parental leave, additional training, sabbaticals, and the care of elderly or ill family members. If organizations want to be more flexible in the future and improve the motivation of their employees, they must begin to delegate responsibility to these employees. They also have to grant more autonomy concerning the organization of worktime or the choice of worktime model. Persons with a reduced work ability due to illness or age may prefer a shorter duration of work per day or week. As people are not machines, their performance varies over 24 hours. Morning types have an earlier circadian peak of performance than evening types. Therefore, it would be ideal if employees could adjust their worktime to their circadian type. The goal of the first introduction of flexitime in German industry was to reduce commuting time between home and workplace. Nowadays this goal could even be better achieved by telework.

### Classification of worktime models

There are more than 10 000 worktime models in use all over the world. They can be classified roughly according to the following 4 main characteristics: duration,

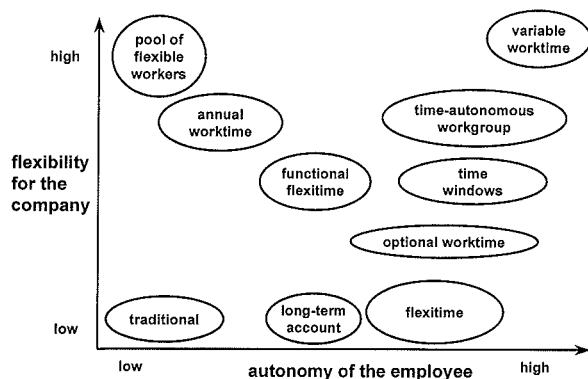


Figure 1. Flexibility for the company and autonomy of the employee with regard to some types of worktime models.

position, distribution, and autonomy. In Germany there has been a considerable reduction in the duration of, for example, weekly worktime in the last decade, down to 35 hours, for instance, in the metal and the printing industries. Parallel to this decrease, in some companies, the regular daily worktime has been increased to 9 hours. Concerning the 2nd characteristic, the position of worktime, an extension of operational times in the evenings, and an extension to Saturdays have also taken place. More and more companies are trying to reduce overtime and flexibly adjust worktimes to the varying needs of personnel. The characteristic "autonomy with regard to worktime" describes the influence of a worker on the duration, position, and distribution of his individual worktime.

### Innovative worktime models

In figure 1, the 2 axes represent 2 dimensions of flexibility: flexibility for the company and autonomy for the employee. There are only a few types of worktime models mentioned in this figure. However, in reality the whole area between the y and x axes is covered by existing worktime arrangements.

In most cases, it is very difficult, or even impossible, to achieve high flexibility in a company without some flexibility being granted to the employees at the same time. A "pool of flexible workers" is an exception.

Annual worktime may be useful in coping with predictable seasonal variations. The customers of a company producing agricultural machines do not place many orders in the early months of the year (1). Therefore, the workers only work 7 hours per day, from Monday to Thursday, during the months of February to April. From May to December they work 8 hours each day from Monday to Friday. In a company in the textile industry the demand varies in short intervals. The employer may demand weekly worktime of between 32 and 48 hours at short notice (ie, only 1 week in advance). A producer of windows may even vary the operational time from 44 to 100 hours per week to meet the fluctuating demand (table 1). When this company changes from a 1- to a 2-shift system, temporary helpers are employed. At the beginning of the year a rough plan is made. It is fine-tuned, at the latest, on Wednesday for the next week. In exceptional cases even day-to-day flexibility can be practiced.

The 3 models mentioned are not innovative with regard to the autonomy of workers. To mitigate the problem of short notice, there are several solutions. At the beginning of the year the days off or free weeks can be classified in green, yellow and red. In red weeks a change from a day off to a workday is possible on short notice. In the yellow weeks a longer period of notification is necessary, or an emergency has to be defined. No change

from days off is possible in green weeks (2). Another method is the long-term planning of additional shifts on Saturdays. If customer demand is unexpectedly low, these additional shifts can be cancelled. Of course, most of the workers prefer to have an unexpected day off than an unexpected workday. Some companies allow the building up of a time account in particular months of the year and recommend or dictate the reduction of the account in other months.

In an association of drivers the work load is highest in the months of May to August (figure 2). The employer wanted to fix a high weekly worktime during these months and a low one during the remaining months. However, the employees wanted to have more autonomy regarding their worktime. They proposed the model shown in figure 2, which was thereafter introduced. The employees are responsible for the work being done, but they decide themselves how long they work each day. They have the possibility to build up their time account by 40 hours each month from May to August and up to 160 hours per year.

Traditional flexitime is very common in Germany. However, the degree of flexibility for the employee in these arrangements currently fluctuates a great deal. Models differ, for example regarding the extension of the core time or the number of hours that can be transferred to the next month and the next year in the time account. More and more employers are experiencing reduced flexibility for the company, missing customer orientation on the part of the employees, and an inclination of some employees to hoard time even if there is not much work to do. The 2 solutions to this problem are to limit the autonomy of the employees or to delegate responsibility to the employee. Table 2 shows the "traffic light" model of a supplier to the automobile industry. In the food industry another company has introduced a similar model, but the limits are  $\pm 80$  and  $\pm 160$  hours.

In arrangements with functional flexitime the group of workers guarantees that customers will always find someone to contact or that the necessary service is available. The group decides who is present outside the core time. However everybody has to be at the workplace within the core time.

The highest possible flexibility for a group of workers is obtainable in "time-autonomous work groups". The superior delegates the responsibility for worktime completely to the group and the group guarantees that the work will be done on time. The model of a supplier to the automobile industry has the following characteristics: (i) self-directed teams of 20 to 50 workers, (ii) all workers (even in 2- and 3-shift systems) on variable worktime, (iii) group decision (according to customer demand) about when to work, (iv) financial incentive to the group as a reward for the economical use of worktime, (v) maximum operational time of 142.5 hours per week, and (vi)

individual worktime variable between 18 and 48 hours per week. Before the introduction of the model the workers often had to work on Saturdays and got a supplement for the overtime. In the new model, overtime is compensated by days off. Although sales, and consequently production, have increased considerably, work on Saturdays has been reduced by about 50% simply because the groups have learned to use their worktime more economically.

The highest individual autonomy with regard to worktime is obtainable in models with variable worktime (ie, flexitime without any core time). In an informatics department in the chemical industry each employee decides himself when he works between 0600 and 2000 (table 3). However, German law sets a daily limit of 10 hours (only in exceptional cases are regular 12-hour shifts

**Table 1.** Stepwise increase of reduction in operational time according to varying demand in the course of the year (taken from reference 1).

| Model             | Operational time (hours/week) | Weekdays        | Daily worktime (hours) |
|-------------------|-------------------------------|-----------------|------------------------|
| Dayshift          | 44                            | Monday-Friday   | 8.8                    |
| Dayshift          | 50                            | Monday-Friday   | 8.8                    |
|                   |                               | Saturday        | 6                      |
| Extended dayshift | 55                            | Monday-Friday   | 9.5                    |
|                   |                               | Saturday        | 7.5                    |
| Extended dayshift | 60                            | Monday-Saturday | 10                     |
| Two shifts        | 88                            | Monday-Friday   | 8.8                    |
| Two shifts        | 100                           | Monday-Friday   | 8.8                    |
|                   |                               | Saturday        | 6                      |

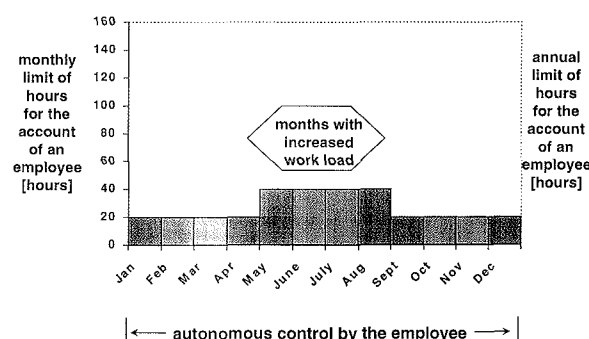


**Figure 2.** Variable annual worktime in the administration of an association of drivers.

**Table 2.** Flexitime with the "traffic light" time account of a supplier to the automobile industry (taken from reference 1).

| Light                    | Significance                                                              |
|--------------------------|---------------------------------------------------------------------------|
| Green ( $\leq 40$ hours) | Only the employee is responsible for the management of the time account   |
| Yellow ( $>40-60$ hours) | Employee and superior try to find a way back jointly to the "green light" |
| Red ( $>60$ hours)       | Only the superior decides, when the employee has to work or not to work   |

allowed). The employee is responsible for the work being done. A similar model has been achieved in the production of weighing machines. The workers decide when they work between 0630 and 1900. They can have  $\pm 72$  hours in their time account. The basis for such very flexible models is the culture of trust, which does not exist in many companies.

The last type of model in figure 1 is "optional worktime" which is characterized by the worker having the option to choose his worktime at regular intervals. For

**Table 3.** Variable worktime in an informatics department in the chemical industry.

| Characteristic             | Delienation      |
|----------------------------|------------------|
| Earliest start of worktime | 0600             |
| Latest end of worktime     | 2000             |
| Maximum daily worktime     | 10 hours         |
| Weekly worktime            | 37.5 hours       |
| Annual worktime            | 1957.5 hours     |
| Limits of the time account | +75 or -75 hours |

**Table 4.** Examples of optional part-time work in the administration of a producer of biscuits

| Work / leisure time                                                                               | Part-time (%) |
|---------------------------------------------------------------------------------------------------|---------------|
| One week of work and 1 week off, plus 13 variable workdays per year                               | 55            |
| Three days of work per week and 2 days off                                                        | about 60      |
| Two days of work per week fixed, 1 day of work per week flexible and 2 days off                   | about 60      |
| Three days of work per week fixed, 26 days of work per year variable and rest off                 | about 70      |
| Thirty weeks of work and 13 weeks off (flexible)                                                  | about 75      |
| First quarter of the year 100% work, third quarter 60% work, fourth quarter 40% work and rest off | about 50      |

**Table 5.** Potential disadvantages of new worktime arrangements for the employees.

| Characteristics of the worktime arrangement                                         | Potential disadvantages                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shift work                                                                          | Sleep deficits, increased fatigue, disturbances of appetite, gastrointestinal diseases, cardiovascular diseases, reduction of social contacts, disturbances of family life, increase of errors and accidents |
| No choice between different worktime models                                         | Decreased satisfaction with worktime, no adaptation of worktime to changing preferences and needs in different phases of life or reduced work capacity                                                       |
| No autonomy concerning actual worktime, in particular short-term notice of worktime | Decreased satisfaction with worktime, difficulty to fit in child care and family life, difficulty to plan leisure-time activities, restriction of social contacts                                            |
| Condensed worktime (per day, week, month)                                           | Loss of sleep and increased fatigue, decrement in job performance, increase in accident risk, increased exposure to toxic substances or physical hazards, long-term health effects                           |

instance, in a Swedish company, each year the employees choose between 10 alternatives. They have to indicate which arrangement they like best and which is second best. With the help of an optimizing computer program the company tries to fulfill as many wishes as possible. In other companies the employees choose the amount of worktime (eg, 40%, 65%, 73%, 98% of a full-time worker) and the position of worktime (eg, every 2nd week, 9 months of the year or not during school holidays). The worktime model of a software house has the following options to choose from: (i) option between weekly worktimes (30—40 hours per week, steps: 30 minutes), (ii) option between annual holidays (20—40 days per year, steps: 1 day), and (iii) income increased or reduced in comparison with "normal" worktime (38.5 hours per week, 30 days of holiday per year). As the preferences of employees vary over their lifetime, optional worktimes are a good solution for adjusting worktime to different phases of life. Of course, a balance has to be found between the demands of the company and the wishes of the employees. The examples in table 4 fulfill this prerequisite. Another model of optional worktime has been explained elsewhere (3).

### **Reservations regarding new worktime models**

Although there are many possibilities for innovative worktime models, there are also problems and pitfalls. There are 4 main areas of concern which can occur separately or together, as shown in table 5. Many studies have shown the problems caused by different kinds of shift work [eg, review of Colquhoun et al (4)].

In addition to the problems caused by shift work the fact that one has an option or has no choice between different worktime models may have a strong influence on satisfaction with worktime (3, 5—9). If there is a discrepancy between preference and reality, satisfaction can be low and the feeling of burn-out high (8). The preferences and needs of employees in reference to worktime can vary considerably, depending, for example, on age, gender, personality, hobbies, and phase of life (3, 9—11). If work ability is reduced at the end of worklife or before, the redesigning of jobs, health promotion, training, and, last but not least, the reduction of worktime may help the employee cope with his or her problem (12).

The third area of concern refers to the short-term effects of flexible worktime models. If the autonomy of the employees is very low and if the employer often changes worktime at short notice, there will be negative effects on satisfaction with worktime (13). If the employee has no autonomy, it is very difficult to fit in child care and family life with occupational life. Furthermore, it is impossible to plan leisure-time activities with friends.

Rosa (14) has reviewed studies referring to extended workshifts. Some, but not all, of the studies have shown the negative effects listed in table 5. However, no well-controlled longitudinal studies exist which analyze long-term health effects. Folkard (15) has combined the data of 4 studies to analyze the trend of accidents over the course of a shift. Besides a secondary peak between the 2nd and 4th hour, he found an exponential increase in accidents with extended workshifts.

If a company wants to change worktime arrangements in any way or if a group of workers wants to test a new model, it is very important (i) to try to reach a winning situation on both sides (ie, a compromise which has advantages for both the company and the workers), (ii) to collect information about possible negative and positive effects on the company and the workers in connection with the new model under consideration, and (iii) to measure or determine these effects during a test period.

### Concluding remarks

As innovative worktime models offer many opportunities for both employees and employers, all those concerned should have the courage to experiment with new models. However, each new worktime arrangement should be instituted cautiously with the participation of the workers and then evaluated carefully. The conclusion of Rosa (14) concerning extended workshifts is valid for all kinds of new worktime models. He states that "appropriate attention should be given to staffing levels, workload, job rotation, environmental exposures, emergency contingencies, rest breaks, commuting time, and social or domestic responsibilities" [p. 51]. Furthermore, certain minimum limits should be fixed by law to reduce any possible negative effects on employees (15).

### References

1. Kutscher J, Weidinger M, Hof A. Flexible Arbeitszeitgestaltung: Praxishandbuch zur Einführung innovativer Arbeitszeitmodelle. Wiesbaden: Gabler, 1996.
2. Bosch G. Jahresarbeitszeiten — Flexibilität auch für Stammbeschäftigten. *J Sozialforschung* 1996;36(1):3—21.
3. Hornberger S, Knauth P. Use of an optional working time model by shiftworkers: an intervention study. Presented at the XIII International Symposium on Night and Shiftwork, 23—27 June 1997.
4. Colquhoun WP, Costa G, Folkard S, Knauth P, editors. Shiftwork: problems and solutions. Frankfurt a.M. (Berlin, Bern): Peter Lang Verlag, 1996.
5. DeHaan EG. Improving shiftwork schedules in a bus company: towards more autonomy. In: Costa G, Cesana G, Kogi K, Wedderburn A, editors. Shiftwork: health, sleep and performance. Frankfurt a.M. (Bern): Peter Lang Verlag, 1990:448—54.
6. Barton J, Smith L, Totterdell E, Spelten E, Folkard S. Does individual choice determine shift systems acceptability? *Ergonomics* 1993;36(1—3):93—9.
7. Blüssing A. Sozialverträglichkeit von Arbeitszeitstrukturen — Untersuchungen eines neuen Konzeptes in der Krankenpflege. *WSI Mitt* 1993;3:145—63.
8. Baba VV, Jamal M, Fang Y. Discrepancy theory and shift work: a test of unique predictive capacity hypothesis. Presented at the 25th International Congress on Occupational Health, 16 — 20 September 1996.
9. Dix J. Adaptation to permanent night work: the number of consecutive nights and motivated choice. *Ergonomics* 1993;36(1—3):29—36.
10. van Limborg C. Compensation for inconvenience: the utility of shift systems. *Work Stress* 1995;9(2/3):342—50.
11. Hornberger S, Knauth P. Interindividual differences in the subjective valuation of leisure time utility. *Ergonomics* 1993;36(1—3):255—64.
12. Goedhard WJA. Aging and work 3. In: ICOH Scientific Committee. Aging and work. The Hague: Pamans Offsetdrukkerij bv, 1996.
13. Ottman W, DeVol D, Schwarzenau P, Kylian H, Knauth P, Klimmer F, et al. Überlegungen zu einer ausgleichsorientierten Schichtplangestaltung bei Tätigkeiten mit unregelmäßigem Dienst, I: Vorschläge zur Neugestaltung der Personaldisposition im Außenübertragungsdienst einer Fernsehanstalt. *Z Arbeitswiss* 1985;39:90—6.
14. Rosa RR. Extended workshifts and excessive fatigue. *J Sleep Res* 1995;4:51—6.
15. Folkard S. Effects on performance efficiency. In: Colquhoun WP, Costa G, Folkard S, Knauth P, editors. Shiftwork: problems and solutions. Frankfurt a.M. (Berlin, Bern): Peter Lang Verlag, 1996:65—87.