Applied Ergonomics 41 (2010) 355–361

Contents lists available at ScienceDirect

Applied Ergonomics

journal homepage: www.elsevier.com/locate/apergo

Sorting and disposing of waste at recycling centres – A users perspective

Jörgen Eklund [a,c,*], Annika Kihlstedt [a], Inga-Lill Engkvist [b]

[a] Division of Industrial Ergonomics, Department of Management and Engineering, Linköping University, SE-581 83 Linköping, Sweden
[b] Division of Physiotherapy, Department of Medicine and Health Sciences, Linköping University, SE-581 83 Linköping, Sweden
[c] Division of Ergonomics, STH, Royal Institute of Technology, Alfred Nobels Allé 10, SE-141 52 Huddinge, Sweden

ARTICLE INFO

Article history:
Received 12 May 2006
Accepted 30 June 2009

Keywords:
Service
Information
Activity
Improvement
Signs

ABSTRACT

This paper investigates Swedish recycling centres from the users' perspective. The aim was to describe the characteristics and experiences of the users and their activities when sorting and disposing of waste, and to identify improvements for the users. The typical recycling centre user is a recently retired man, living in a house with a garden, having travelled 5 km alone in his own car. The users requested longer opening hours and better information available at home and at the recycling centre. The major difficulty for the users is to understand which fraction their waste belongs to, and consequently into which container they should throw it. The most important sources of sorting information, in addition to experience from earlier visits, are signs and asking the personnel. Although the service at recycling centres is perceived positively by a majority of users, substantial improvements can still be made, and a number of such suggestions are given.

1. Introduction

In Sweden, all community inhabitants may dispose of their large sized, hazardous and electrical waste at a local recycling centre. Recycling centres are manned facilities where people can bring, sort and dispose of their waste, assisted by the employees. The waste, such as furniture, refrigerators, electrical and electronic products, wood, garden waste, solvents and paint, is placed in containers, cages and boxes for the different fractions of waste received. However, kitchen waste is not accepted at recycling centres (Engkvist et al., 2004).

This service is provided by each municipality in Sweden and often located in an industrial or sub-urban area. It is mainly financed through fees for household waste collection. Visits are normally free of charge for private users. Small companies are welcome to most recycling centres, although they have to pay for their visits. The condition is that the individuals bring their waste to the recycling centre during opening hours, and that they sort and dispose of their waste in the correct containers intended for different waste fractions (see Fig. 1). Opening hours vary due to the size of the recycling centre, and usually include daytime on several week days, one evening and a few hours on Saturdays. There are usually some 20 containers for different waste fractions available. The way in which the discarded materials or products are allocated to specific waste fractions may differ from one recycling centre to another due to different waste treatment methods. In addition, the labels for each fraction may also differ from one recycling centre to another. For a more detailed description of the Swedish system for waste handling and recycling, see Engkvist et al. (2004).

The system for household waste recycling varies between different countries. The Swedish system to some extent resembles systems in use in the UK, in particular "Civic Amenity sites". There are few studies that have focused the activities of users of recycling facilities, and potential improvements of the recycling centres from a user perspective (Woodard et al., 2004). It has been pointed out clearly that the function of recycling centres is strongly dependent on the attitudes of the public. Even though most people are positive towards sorting and disposing of waste at recycling centres, all are not. Continuous education, publicity and promotion including information to the public are considered important means to increase recycling rates (Williams and Taylor, 2004; Evison and Read, 2001).

This study was part of the multidisciplinary research programme "Recycling centres in Sweden – working conditions, environmental and system performance". The overall purpose of the programme was to form a basis for improving the function of recycling centres with respect to these three fields (Engkvist et al., 2010). Results from this research programme are collected and published in a special issue of Applied Ergonomics (2009, in this issue). This paper is part of the above special issue.

The aim of this paper was 1) to describe the characteristics of the users and their activities when sorting and disposing of their waste

* Corresponding author. Royal Institute of Technology, Division of Ergonomics, SE-141 52 Huddinge, Sweden. Tel.: +46 8 7904866.
E-mail address: jorgen.eklund@sth.kth.se (J. Eklund).

0003-6870/$ – see front matter © 2009 Elsevier Ltd. All rights reserved.
doi:10.1016/j.apergo.2009.06.011

Fig. 1. An overview of vehicles and users at a recycling centre, and how users carry waste to the different waste fractions.

2) to identify important conditions supporting user activities 3) to describe user experiences from recycling centres 4) to identify improvement opportunities.

2. Method

Issues identified as important for recycling centres in a previous study (Engkvist et al., 2004) constituted the basis for the present study. Data was collected at 16 recycling centres, visited by the research team. The 16 recycling centres were spread all over Sweden, with a distance of 900 km from the south to the north. Data collection from users was performed using questionnaires, interviews, observation, documentation and document studies. The number of items and number of respondents are shown in Table 1. Response rate varied between 84 and 100%. A detailed description of the methods and their development is presented in Engkvist et al. (2010).

For users who declined to fill in a questionnaire or to participate in a long interview, a short interview was made. In addition, 163 users were observed during their visit. Documents and complementary data were collected, and notes and photographs were taken at the 16 recycling centres. This included all signs, the labels, text and symbols used for each waste fraction, colour combinations used, placement of the signs, background and light conditions. Explanations regarding the type of waste that was or was not intended to be disposed of in the containers for each fraction were also documented.

The questionnaire to users covered 64 items, focusing the visit that specific day: background factors of the user, characteristics of the visit, description of discarded waste and sorting quality, information and service, accidents, injuries, and external environment. It was distributed to the users after they had disposed of their waste and collected before they left. The interviews were mostly open and covered aspect on; background factors, description of the visit and discarded waste, information and service, external environment and recycling centre design. Users for interviews or questionnaires were chosen at random. The short interview included 7 questions on; reason for not participating in the full study, characteristics of the present visit, description of discarded waste, sorting quality, information and service.

The interview with the managers included questions concerning background information about the recycling centre, accidents, information and communication, and questions about the downstream actors to the recycling centres.

Some questions were asked in several instruments, while others were only asked in one instrument. Consequently, the number of respondents varied accordingly.

An observation schedule was designed for visual observations of user activities and waste characteristics. These included time of arrival and departure, type of vehicle used, type and amount of waste, the various fractions and number of containers visited, means of transport, user behaviour, user characteristics, crowdedness and weather conditions. For a more detailed description of study design and validation procedures, see Engkvist et al. (2010).

Table 1
Instruments on which the results are based, number of items and number of respondents.

Instruments	Number of items	Users	Managers
		Number of respondents	Number of respondents
Users			
Questionnaire	64	317	
Interview	35	77	
Short interview	7	57	
Observation	11	163	
Managers			
Interview	61		16

3. Results

3.1. User characteristics

Based on the 394 responses from the user questionnaires and interviews, the users were mainly men (79%). Their ages varied between 15 and 83 years, with a mean value of 51 years. The most common age of the users was 65–66 years, i.e. persons who had just retired. The majority lived in a house or a detached house (80%) and only a minority (18%) lived in flats. The private users travelled between 0.4 and 40 km (mean 5 km) to the recycling centre. The occupational users had to travel a somewhat greater distance from their work to the recycling centre (mean 9 km). The vast majority came by car (98%). This figure includes a few pick-up trucks and vans. The rest used a moped, bike or a work vehicle. Most persons owned the car they used (91%). Otherwise it was rented or borrowed. Most of the users came alone (64%), and another 33% had one passenger. Only a few users (5%) visited the recycling centre for the first time during the last year. Some (12%) were regular users, i.e. they had made over 25 visits during the last year. An estimation based on all user data indicated that each person visited the recycling centre 8–9 times a year on average. Although there were only some 10% occupational users, they accounted for approximately twice as many visits per year compared with the private users.