

MANAGEMENT OF WASTE IN THE OPINION OF THE RESIDENTS OF THE PILCHOWICE COMMUNE

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Introduction/background: The increasing amount of waste, associated with socio-economic development, is a significant problem these days. In order to solve this problem, emphasis must be placed on the satisfaction of residents, who are the producers of waste. Their satisfaction positively influences their involvement in the process. Therefore, all studies and improvements regarding waste management should be made at the local level.

Aim of the paper: The aim of this paper is to use the Customer Satisfaction Index and Servqual methods to examine consumer satisfaction with services. The study examines the satisfaction level of the Pilchowice responders.

Materials and methods: The paper uses surveys and CSI and Servqual methods to analyse the survey results. The article was created on the basis of the diploma thesis.

Results and conclusions: The study showed that for the Pilchowice responders, punctuality and flexibility of services are most important. The attitude of the service staff was rated best. Flexibility, recycling level and access to information need improvement. Possible improvements were suggested in the areas that need to be improved.

Keywords: waste management, urban logistics, Customer Satisfaction Index, Servqual.

1. Introduction

Socio-economic development is inextricably linked to increased consumption and, as a result, also generates an increasing amount of municipal waste. According to World Bank projections, solid waste generation will increase from 2 billion to 3.4 billion tonnes per year over the next 30 years (Kaza et al., 2018). Due to the harmful effects of this waste on public health and the environment, including the potential for soil and water pollution, municipal waste management has become an important area of development for society (Sienkiewicz-Malyjurek, Niczyporuk, 2010; Ilic, Nikolic, 2016; Janmaimool, 2017).

Municipal waste accounts for approximately 7-10% by weight of all waste generated in the European Union, while being one of the most diversified waste streams (EU Parliament and Council Directive 2018/851 of 30 May 2018). Municipal waste management is therefore a challenge and its quality is indicative of the level of socio-economic development, as it requires an effective system for collecting, sorting and tracking waste streams, as well as citizen involvement in the process. However, municipal waste management is not easy, as it requires the cooperation of many actors, the implementation of modern solutions and, above all, the participation of local communities (Sienkiewicz-Małyjurek, 2015; De Melo Ferreira, De Vasconcelos Barros, Soviar, 2017; Singh et al., 2020). Indeed, further municipal waste management processes depend on these communities and their sustainable approach to municipal waste generation and collection. Therefore, the level of service to residents is an important issue, as it results in the level of involvement of local communities in the municipal waste management process. Taking into account that all public matters of local importance, including municipal waste management, are carried out at the local level (Act of 8 March 1990 on Municipal Local Government; Act of 5 June 1998 on Poviats Local Government), the level of public service and its involvement are also of local nature. This state of affairs makes it necessary that research on municipal waste management should also be conducted at the local level. In this paper, research was conducted on the example of the Pilchowice commune, and its aim was to identify the level of service provided to the residents of the Pilchowice commune in the field of municipal waste management and to suggest possible improvements in this respect. The article was created on the basis of the diploma thesis.

2. Introduction to the research problem

Municipal waste is "waste generated in households (...). as well as waste not containing hazardous waste from other generators, which due to its nature or composition is similar to waste generated in households" (Law of 14 December 2012 on waste). Due to their increasing quantity, it is necessary to manage them properly, which is one of the priorities of the pro-environmental activities of the European Union and the Polish environmental policy (Grygorczuk-Petersons, Talaj, 2007; Kaza et al., 2018; Czaplicka-Kolarz, Kruczek, 2018).

The EU Parliament and Council Directive 2018/851 of 30 May 2018 emphasises that waste management should be transformed into "sustainable materials management". The document stresses that the most effective way to reduce the negative impact of waste on the environment is through prevention. European Union Member States should therefore raise awareness among the population, promote the reuse of waste, and set up reuse networks, deposit return and refill systems (Directive EU Parliament and Council 2018/851 of 30 May 2018).

In Poland, the source of municipal waste management regulations is the Waste Act of 14 December 2012. It states that the most important assumption of this mechanism is to carry out management in a way that does not endanger human health and life and the environment, does not pose any threat to soil, water, air, plants and animals, does not cause any nuisance (e.g. smell, noise) and does not cause negative effects for rural areas and areas of particular natural and cultural significance (Act of 14 December 2012 on waste). The basic activities in the field of municipal waste management is to prevent their formation at source, and thus – to minimise the amount of waste arising, to manage it as much as possible and to reduce the amount of waste deposited in landfills. Therefore, the generation of waste should be primarily prevented, further returned to the production cycle and used in the economy, and only in the last place should it be landfilled (Bendkowski, Wengierek, 2002; Kubiak, 2019; Hryb, Ceglarczyk, 2021). Meeting the above requirements is possible by building public awareness of the risks associated with the generation of municipal waste, ways to reduce its number, as well as methods for its collection and storage. It also requires cooperation and a high level of service to local communities.

One of the aspects building the quality of waste management services is a systemic approach to the process. Only by knowing the standards and procedures at each level of the organisation, i.e. from direct contact with the inhabitants, it is possible to precisely determine the number of containers, vehicles, bins needed, as well as the frequency of municipal waste collection (Fraś, Scholz, Olsztyńska, 2015). Therefore, it is necessary to maintain systematic relations with local communities in order to find out their opinions on the level of service quality in municipal waste management.

3. Research methodology

Two methods were used to identify the level of service of the inhabitants of the Pilchowice commune in the field of municipal waste management: Customer Satisfaction Index – CSI (Woźniak, Zimon, 2016; Kramarz, 2016) and Servqual (Wolniak, Skotnicka-Zasadzień, 2009; Kadłubek, 2011). CSI and Servqual are the most comprehensive methods of measuring service quality that leads to meeting consumer expectations. Comparing the results from both methods may indicate key areas for improvement. Therefore, they are useful methods for examining residents' opinions on waste management.

The data necessary for the analyses were obtained on the basis of surveys carried out in December 2021 in the municipality of Pilchowice. A total of 82 people were surveyed, including 45 women (55%) and 37 men (45%). All respondents were of legal age – 28% aged between 26 and 40, over 25% aged between 41 and 60, just under 26% aged between 18 and 25, and almost 21% aged 61 or over. The majority of people surveyed lived in households consisting of 3-4 household members (45%), 29% lived in 1- or 2-person households,

and the rest (26%) lived in households with 5 people or more. Over 52% of respondents had higher education, 23% had secondary education, 16% had vocational education, while almost 9% had primary education. Research results concern this group of people.

Then, based on the test results obtained, appropriate indicators were calculated to identify the process dimensions requiring improvement. The results of the research refer to the responders' opinions and may be helpful in conducting research in other communes.

4. Results of studies carried out

4.1. Assessment of the quality of municipal waste management based on the CSI

The analysis of the obtained results indicates that the CSI for the municipal waste management process in the Pilchowice commune amounts to 3.568, while the percentage result – 71.35%. This means that the level of service in the municipality can be described as "average" – it is in the upper limit of the range (up to 75%). Responders therefore feel that there are areas that need improvement as they are not meeting their needs or are meeting them inadequately. Detailed results are shown in Table 1.

Table 1.
Calculation of the Customer Satisfaction Index

Satisfaction factors	Assessment of the factor	Factor weight	CSI	CSI max	CSI [%]
Timeliness – waste collection on time, according to the schedule	3.8	0.15	0.555	0.730	76%
The right time – the service provider collects waste at convenient times	3.8	0.08	0.312	0.410	76%
Adequate infrastructure – equipping consumers with bags, waste bins, appropriate equipment	3.8	0.10	0.388	0.510	76%
Proper condition - the way in which the service was performed (e.g. condition of the service site after its completion, collection of all the containers or bags put out according to the regulations)	4.0	0.10	0.392	0.490	80%
Flexibility – easy access to the service, possibility to deposit waste at a convenient time other than on the schedule, e.g. at a USCMW	3.0	0.12	0.363	0.605	60%
Comprehensiveness – rate of recovery of selectively collected waste	3.3	0.11	0.356	0.540	66%
Service price/service quality ratio	3.1	0.09	0.295	0.475	62%
Easy access to comprehensive information about the service	3.3	0.09	0.287	0.435	66%
Ability to react to irregularities, consumer problems and expectations, factual knowledge of employees	3.7	0.09	0.337	0.455	74%
Service attitude – behaviour and appearance of the waste collection crew	4.0	0.07	0.284	0.355	80%
				CSI	3.568
				CSI %	71.35%

The survey indicated that the dimensions of municipal waste management best rated by responders are: attitude of service (80%), proper condition of service (80%), timeliness (76%), proper infrastructure (76%), proper time (76%) and ability to respond to irregularities (74%). All these factors are above 75% or oscillate around this figure, which means that the level of satisfaction in the areas mentioned can be described as "good". The attitude of the service, i.e. the behaviour and appearance of the waste collection crew was rated at 4.0, but the weight of this dimension reaches only 0.07. The correct way of performing the service achieved a similar result – a rating of 4.0 and a weight of 0.1. This means that no further investment is required.

Timeliness is an important factor for responders - it is characterised by a weight of 0.15 and a score of 3.8. The results obtained can be considered satisfactory for the responders, and the level of timeliness of the service should be maintained or cases in which the service was not provided on time should be looked into, and it should be determined whether the irregularities were a result of random situations or negligence of the service provider. Adequate infrastructure was rated similarly high as timeliness. Residents of the municipality are provided with adequate infrastructure (waste bags and containers, service provider's fleet), but if a consumer needs an additional bag or container, they must go to the service provider's office in the municipality's neighbouring town, Knurów. The score of 3.8 may therefore be due to difficult access to additional resources. The actual waste collection time achieved a score of 3.8 for a weight of 0.08.

The lowest scores were for flexibility (60%), price/service quality ratio (62%), comprehensiveness (66%) and easy access to comprehensive services (66%). Flexibility scored the lowest with a score of 3.0 for a weight of 0.12. Access to services is important to responders, which means that improvements should be made in this area first. Many responders reported a need for a Unit of Selective Collection of Municipal Waste – such an investment could have a positive impact on the rating of satisfaction with the flexibility of services. Another low-rated dimension is the price/quality ratio of the service, which received a score of 3.1 for a weight of 0.09. It is therefore worth looking into solutions which could lower the price of the service (particularly in the area of transport) and to educate the public about what constitutes the price of waste collection. The degree of waste recovery reached a score of 3.3 for a weight of 0.11 – it therefore needs improvement in the short term, as does flexibility. Responders report that they are not informed about recycling rates or are not satisfied with current recovery and preparation for re-use rates. Many are of the opinion that since it is imposed on them to collect waste separately, the service provider should also care about higher recycling levels. Some respondents thought that the waste after collection by the truck is put into one compartment and mixed with each other, so the selective collection is lost immediately after collection by the service provider. The public should be educated on how residents can contribute to providing good raw material and respond to such concerns to motivate them to separate waste. This task lies with the municipality. The last factor rated low is easy access to

information with a score of 3.3 and a weight of 0.09. The factor is among those that require improvement in the long term. Responders believe that it is difficult to find information on waste and the website of the municipality is unintuitive. It is worth considering the introduction of an application or regular supply of brochures that could dispel residents' doubts on an ongoing basis, e.g. regarding waste that is not easy to allocate to particular fractions.

4.2. Servqual quality assessment of municipal waste management

Analysis of the survey results using the Servqual method allowed to identify differences between expected and perceived quality in the process of municipal waste management in the Pilchowice commune (Table 2). In order to obtain more precise results, the weights for each dimension of the applied method were also determined and amounted to: tangibility (0.19), reliability (0.19), responsiveness (0.17), assurance (0.15), empathy (0.30).

Table 2.

Servqual survey results

Theorem	Quality expected	Perceived quality	Difference
The service provider has a modern transport infrastructure suitably adapted to the municipal waste collection process.	5.4	4.8	-0.6
The infrastructure is properly adapted to the waste collection process – vehicles, buckets, waste bags.	5.7	4.9	-0.8
Unit of Selective Collection of Municipal Waste is suitably equipped and has easy access for the collection of municipal waste.	5.2	3.9	-1.3
Information material on waste collection and disposal is readily available to residents of the municipality and allows them to easily obtain the information they need.	5.7	4.4	-1.3
The service provider shall collect all waste bags or bins placed in front of the property.	5.9	4.8	-1.1
The service provider collects municipal waste according to a fixed schedule.	5.9	5.0	-0.9
The service provider shall leave the place of performance clean.	5.8	5.1	-0.7
The service provider collects waste at convenient times.	5.1	5.0	-0.1
The service provider and the municipality shall inform the consumer comprehensively about the service provided.	5.6	4.5	-1.1
Municipal staff show respect towards consumers, is polite and willing to help in case of difficulties.	5.8	5.4	-0.4
Staff is available to provide expert assistance if problems or difficulties arise in relation to the collection of municipal waste.	5.6	5.3	-0.3
Municipal employees immediately try to identify errors (e.g. in the forms) in order to avoid further irregularities, and if they occur, they refer them to the relevant department.	5.6	5.4	-0.2
The staff of the municipality and the service provider strive to understand the needs of the consumer and treat customer expectations individually.	5.2	4.9	-0.3
Municipal staff is knowledgeable about the waste management process and is able to answer consumer questions in a comprehensive manner.	5.5	5.2	-0.3

Cont. table 2

Municipal employees answer questions in detail so that the consumer does not have to ask for details.	5.6	5.2	-0.4
The behaviour of employees collecting waste is characterised by high culture.	5.3	5.1	-0.2
The appearance of employees collecting municipal waste is neat.	4.9	5.1	0.2
The service provider shall provide an appropriate number of containers and bags for the collection of municipal waste.	5.8	4.9	-0.9
The service provider collects waste at the times stated in the schedule	5.5	4.8	-0.7
The service provider shall collect municipal waste in accordance with its offer - it shall collect the types of waste listed in the offer.	6.0	5.3	-0.7
The service provider meets the required levels of recycling and preparation for re-use.	5.5	4.3	-1.2
The service provider shall provide a Unit of Selective Collection of Municipal Waste in the municipality.	4.9	2.6	-2.3

The results of the research indicate that the highest difference (-2.3) is in the sub-item concerning the Unit of Selective Collection of Municipal Waste. Responders are not satisfied with the lack of a waste collection point in the municipality. The statement regarding equipment and access to a USCMW achieved the second lowest score (-1.3). Currently, the nearest USCMW is located in a town neighbouring the commune – Knurów. Surveys conducted show that this causes dissatisfaction among responders. The same result (-1.3) was achieved by the availability of information materials. According to the respondents, access to information is difficult – the reason may be a non-intuitive website that does not contain all information or a schedule sent only by traditional mail once a year. Another low score (-1.2) is the level of recycling assessed by the respondents. Many responders are not sufficiently informed about the levels achieved and base their judgements on popular but false opinions. Responders are convinced that the existing obligation to separate municipal waste should result in much higher levels of recycling, recovery and preparation for reuse. The score of -1.1 was achieved by two statements: collection of all waste bags or bins placed in front of the property and comprehensive information from the Pilchowice Municipal Office. The second statement may be related to the low rating of the office website. The collection of all waste from the property is also a sensitive issue. Not all responders are aware that if the employees collecting waste notice waste in a given fraction that should not be there, they are not obliged to collect it. For the resident, this can be a reason for dissatisfaction, even though the fault lies with him. It is worth creating the possibility to explain such cases in order to be able to find out whether the situation was caused by the inadequate segregation by the resident or by the negligence of the service provider.

The points concerning collection of waste according to the agreed schedule (-0.9) and provision of an appropriate number of containers by the service provider (-0.9) were characterized by a smaller difference. Thus, there are situations where the service provider will not manage to collect waste of a given fraction on time. This situation is acceptable if weather conditions or road conditions make it very difficult or even impossible for vehicles to get to certain streets. This obviously causes dissatisfaction among responders, but does not have a large impact on the assessment of the level of satisfaction with timeliness. Many respondents understand that random factors beyond the service provider's control can hinder the municipal waste collection process. In the case of infrastructure provided by the service provider, dissatisfaction may arise due to difficult access to additional resources. If residents want additional bags or containers, they have to go to a neighbouring municipality. Providing a point within the municipality where additional bags or containers could be collected could significantly improve residents' satisfaction.

The highest scores in the survey oscillated around -0.5. Among these were: assessment of modernity and adequate adaptation of infrastructure (-0.6), respect shown by municipal office staff (-0.4), detailed manner in which officials answer questions (-0.4), professional help from officials (-0.3), attempt to understand residents and their problems (-0.3), adequate knowledge of municipal office staff (-0.3), immediate catching of errors (-0.2), attitude of waste collection staff (-0.2) and convenient time for waste collection (-0.1).

Surveys conducted among responders of the Pilchowice commune also allowed for the calculation of a weighted and unweighted Servqual average. The unweighted average is -0.69, while the weighted average is -0.77. The process itself therefore requires improvement, especially in those areas that drastically underestimate the satisfaction of responders and have been described above.

In summary, the Customer Satisfaction Index and Servqual methods yielded similar results. Both methods showed that low recycling rates and lack of access to the Unit of Selective Collection of Municipal Waste were the dimensions rated lowest by responders in the process under study. The results of both analyses also highlight residents' dissatisfaction with impaired access to information on municipal waste management, but this dimension was rated as less important in the CSI study. Nevertheless, impaired access to information and ineffective public education may be the cause of many problems arising further down the waste management process.

5. Suggestions for improvement

The process of municipal waste management in Pilchowice requires continuous improvement in order to achieve maximum consumer satisfaction. It is particularly valuable to make the public aware of the growing problem of municipal waste and how valuable a raw material it can be.

A holistic approach is necessary to improve the waste management process in the Pilchowice commune. Beginning with education, the residents can be made aware of how to prevent, collect and segregate municipal waste in order to provide the best quality raw materials for recycling. Large-scale education and encouragement of citizens by the local authorities to adopt solutions such as setting up home composting facilities can also significantly affect recycling levels or reduce landfill levels and can be a big step towards closing the waste management cycle.

The Pilchowice's municipality should also bear in mind that collection of waste should not only take place at source. A system of delivering waste to a collection point set up in the municipality would enable residents to dispose of some waste without having to wait for it to be collected according to the schedule. This would have a significant impact on the level of residents' satisfaction, especially in the case of bulky waste. The establishment of a Unit of Selective Collection of Municipal Waste in the Pilchowice commune would be an investment that would positively affect the level of residents' satisfaction. Such a point could also provide an opportunity to collect bags or containers for waste of various fractions, which would solve the problem of access to proper infrastructure.

It is also worth considering the range of available green solutions that could be implemented to increase recycling and preparing for re-use levels. Encouraging residents to compost bio-waste and economic incentives could reduce the level of biodegradable waste going to landfill. Glass and PET bottles are also a fraction that offers great recycling opportunities. Creating a deposit system in the municipality is a simple solution that could significantly reduce the amount of this type of waste.

Difficult access to information is also a dimension in need of improvement. On the website of the Pilchowice Commune Office it is difficult to find a tab for municipal waste or the schedule of its disposal. Many respondents indicated the need to provide information on municipal waste management by e-mail. Such a form of communication and information about events or changes taking place in the municipality would enable the creation of a well-informed community and, consequently, fewer mistakes, irregularities and misunderstandings not only in the field of waste management but also in other areas of social life. However, one should also bear in mind the older generation, for whom the rapidly progressing digitalisation of processes can be a problem. Almost the same number of respondents were interested in the possibility to obtain information through leaflets or brochures that arrive in the mailboxes of residents.

The low-rated price/quality ratio is also a dimension that needs to be looked at. The cost of the municipal waste collection and disposal service consists of 70% of the transport cost. There are solutions – not yet implemented in the Pilchowice commune – which could lower the price paid by residents. Solutions such as an integrated system, involving split-truck rubbish collection, which makes it possible to collect waste of several fractions, would reduce the number of vehicles required and the frequency of waste collection. Instead of each fraction being collected separately several times a month, it would be possible to collect several fractions at once. Also, the introduction of a two-stage system with a transfer station, which could be established in the vicinity of the new Unit of Selective Collection of Municipal Waste, would reduce the number of vehicles used, road congestion and the environmental footprint. In addition to organisational and technical methods of reducing the price of waste collection, there should also be an open dialogue with residents on what makes up the price of the service and how the introduction of elements such as the Unit of Selective Collection of Municipal Waste increases the price. Municipal waste management is an area where not only the attitude of the organisation managing the process or the service provider is important. Cooperation between residents who produce waste and local authorities may be the key to success in achieving a smoothly functioning closed loop economy.

Summary

Municipal waste management is an area where waste should be prevented from being generated in the first place and only when the waste is generated, it should be recovered or prepared for reuse. Viewing waste as a resource creates many opportunities to reduce landfill levels.

An important element in the waste management process is the attitude of the public, especially as regards sustainable consumption and prevention of municipal waste. It is also important to be aware of the importance of creating uniform waste streams, the producers of which are the inhabitants. It is they who decide at the entrance (at the time of waste collection) what quality streams enter the whole process.

The results of the conducted research indicate that for the residents of the Pilchowice commune the most important factors in the process of municipal waste management are those related to service reliability – among others timeliness and flexibility of services. The residents of the commune assess best the service in the commune office and the attitude of the staff collecting waste. This means that the level of these dimensions should be maintained in order to positively influence community satisfaction. The following dimensions need improvement: flexibility of services, achieved recycling levels and access to comprehensive information. Responders are also not satisfied with recycling levels. Therefore, it is worth considering

solutions such as a deposit system for glass packaging and PET bottles, as well as economic incentives for setting up home composters for biodegradable waste to increase recycling or reduce the amount of landfilled waste of this fraction. Other important solutions include the creation of the Unit of Selective Collection of Municipal Waste, the introduction of split-trucks collecting waste and a two-stage waste collection system. It is important to take a holistic approach to waste management, starting with education of the public, through cooperation between residents, local government and service providers, to continuous implementation of modern organisational and technical solutions.

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