

## Article

# Public Perceptions and Practices of Solid Waste Recycling in the City of Laramie in Wyoming, U.S.A.

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**Abstract:** Managing household solid waste is a growing challenge for many cities. To tackle this problem, cities are turning to recycling, which is an effective tool for solid waste management. This research seeks to understand the public perceptions and practices of recycling in the City of Laramie, Wyoming. Recycling in Laramie began in 1983 with the establishment of the Ark Recycling Center. Laramie officially started its curbside recycling services in September 2011, and in April 2012 the city declared its long-term goal to achieve a 40% diversion rate by 2030. The study involved a mail-back survey to understand the public participation landscape and the factors affecting recycling behaviors and attitudes of residents in Laramie. The quantitative results of the survey responses were used to create a civic engagement score, a recycling importance score, and recycling satisfaction and recycling behavior scores to measure residents' perceptions of the recycling program. In addition, three key informant interviews were conducted to explore the efforts of the city, the University of Wyoming, and Ark Regional Services. The results show that more than 80% of the survey respondents indicated that environmental concern was the major motivation to recycle, which was related to a high level of recycling importance and satisfaction. The study further indicated that Laramie should develop an aggressive educational policy, incentive policies, and a Master Plan to encourage stronger public participation to meet its 40% waste diversion rate by 2030 goal.

**Keywords:** recycling; public perception in recycling; civic engagement; recycling behavior; recycling attitude

## 1. Introduction

The management of household waste has been a critical issue for urban areas in recent years. Recycling is one of the most practiced waste management procedures [1] to address the issue. Recycling includes the methods of separating, collecting, and reprocessing or converting used or waste products into new materials [2]. Recycling is a general practice in many parts of the world, and occurs at a variety of levels, from informal systems to government led efforts such as those in many U.S. municipalities.

Many factors may influence the recycling programs in different locations. Some of these factors include: public participation, recycling behaviors and attitudes, and the role of regulatory structures [3–7]. Public engagement is recognized as critical to build a successful recycling program. Residents should be engaged in planning and pre-implementation to help them understand why a program is needed, how it will benefit them, and to encourage sustained participation and ownership in the program [8–11]. It also provides an opportunity for the stakeholders to discuss unseen problems, create a public consensus on issues, identify possible solutions, and uphold their commitment to the project [12]. A study on solid-waste recycling observed that cities with higher rates of participation

in recycling placed a greater emphasis on citizen involvement during their planning process [13]. When people are personally involved in the policy formulation and decision making, they are motivated to lead the programs to success [14,15]. In an ideal situation, citizens participate in the program's initiation, policy formulation, and decision-making process [14].

Demographic factors such as gender [16–18], age [16,17], income [16–18], and education [16,17] have also been found to influence recycling participation. A study by Meneses and Palacio [17] determined that women are more likely to be engaged in household recycling than their male counterparts. This view is supported by Arcury, Scollay, and Johnson [18] who found that women, because of traditional gender roles associated with their household activities, are more likely to be involved in recycling activities. Another notable factor affecting participation is the age of people living in a community [17,19]. It has been reported that older people of an age of forty or above are more likely to participate in recycling than their younger counterparts [17,20]. There is less agreement on how level of education affects recycling participation. Sidique et al. [16] observed that people with a higher level of education and income are likely to get engaged in recycling activities, whereas Gamba [21] and Meneses and Palacio [17] concluded that the level of education of a person has very little influence on recycling participation.

Individual motivation, attitude, and behavior also might play an important role in making recycling programs successful. Studies of recycling during the 1980s and 1990s focused on the individual/family level using an applied behavior and attitude analysis [22]. In this method, a prior commitment to participate in recycling programs is obtained from the interested individuals. Data from those studies indicated that a prior commitment to recycling resulted in higher levels of participation [23]. More recent research findings on recycling behavior and attitude suggest that convenience, level of satisfaction toward recycling services, and economic incentives also influence individual behaviors and attitudes toward recycling programs. For example, convenience factors such as proximity to a drop off center and frequency of collection services are strong predictors of recycling behavior and attitude [20,24]. Likewise, economic incentives such as rebates from containerized beverage deposits or money saved from the costs of recycling disposal encourage participation [18].

An additional factor to promote recycling participation is the enforcement of a regulatory structure. Regulatory structures, such as mandatory recycling, require residents to comply with disposal controls, material recycling requirements, and the recycling goals of the city or the state. The mandate is usually enforced by city garbage pick-up crews or by the city's inspectors [25]. Another important policy to motivate recycling is the establishment of an educational policy in recycling ordinances. This policy creates awareness about the importance of recycling and educates the public about its methods and procedures. Recently, many cities have started conducting door-to-door outreach programs to encourage recycling [26]. The City of Boulder, Colorado, in partnership with the University of Colorado at Boulder, launched a program in 2006 that helped the city to reach its 48% diversion rate, which is double the state average [27].

While there are regulations, policies, and laws concerning recycling, there is still a great deal of variation in local recycling programs based on local contexts and priorities. The city of Laramie in Wyoming has a recycling history that dates to 1983 with the establishment of Ark Regional Services, a non-profit organization. Ark started recycling in Laramie to create job opportunities for persons with disabilities, and service was limited to certain parts of the city. It was not until 17 May 2011 that the Laramie City Council approved an Ordinance (No. 1811 (A), 2011) that established its official curbside recycling program as per its Comprehensive Plan 2007. In April 2012, the city announced its long-term goal to reach a 40% diversion rate by 2030 to reflect its commitment to recycling [28]. Given this context, the purpose of this study is to understand the effectiveness of the City of Laramie's current solid waste management landscape using three major themes: understanding the public participation in the recycling planning process in Laramie, analyzing the factors affecting the individual recycling behavior and attitude of the residents via a survey, and highlighting the recycling efforts of key stakeholders via key informant interviews. Using these three major dimensions as the basis for examining recycling in

Laramie, this study aims to evaluate potential opportunities and barriers, and eventually recommend policies to achieve the city's 2030 recycling goal.

## 2. Background

Managing solid waste with increasing population and urbanization remains at the forefront of policy debate discourse across the globe [29]. While recycling is considered an environmentally friendly method to tackle the issue of solid waste, its effectiveness also needs to be critically analyzed. A recent study modeling of the efficiency of recycling programs has indicated that recycling is economically viable and efficient only with high recycling rates for a given city or a region [30]. This supports single-stream recycling programs in urban areas that generate large quantities of recyclable material [29]. In this system, recyclables are collected separately from regular solid waste, which limits possible contamination and increases efficiency [31]. The larger the volume of recyclables entering the Material Recovery Facility (MRF), the lower the processing cost per ton [32]. Despite the volume of materials collected, many recycling programs run by cities and municipalities continue to rely on funding received from external sources [33].

Laramie is a growing city, located in Southeastern Wyoming, USA, (Figure 1) with a population of 32,081 in 2014 [34]. It is home to the University of Wyoming and serves as an access point to many outdoor recreation areas, including the Snowy Range, the Medicine Bow-Rout National Forests, and Vedawoo. People enjoy participating in recreation activities, and consequently tend to care about preserving the environment. In addition, the city has one of the highest employment rates in the state, with a majority of people working in the academic sector [35]. Residents of Laramie tend to have high levels of education and are likely to respond favorably towards environmental protection. This was also evidenced in a recently conducted public forum, in which a significant number of Laramie residents complained about possible harm to the environment caused by an absence of glass recycling in the city [36]. The looming crisis of glass recycling occurred when Ark Regional Services, the sole entity managing glass recycling, ended its services beginning November 2013 [36].

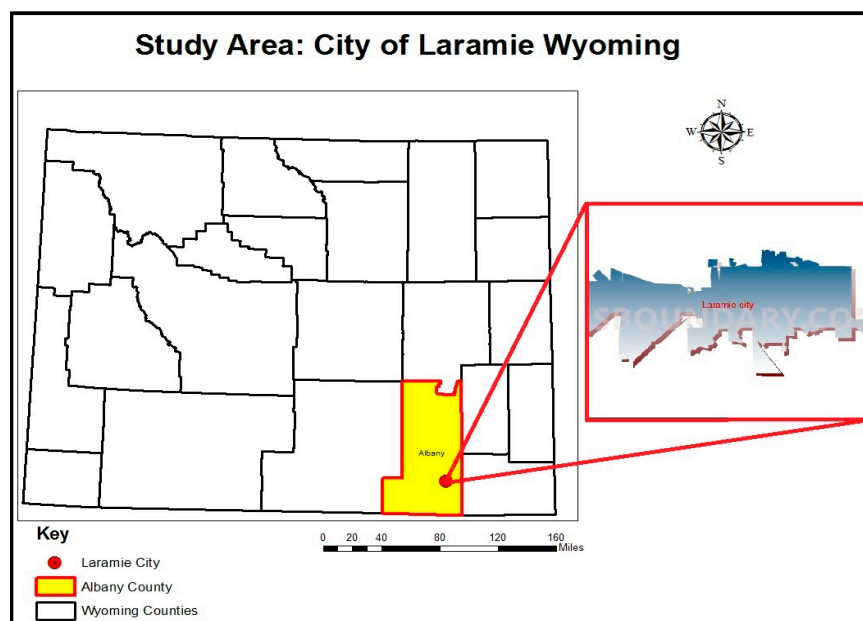


Figure 1. Location of the Study Area.

Prior to 2014, the three major stakeholders involved in recycling in Laramie were the City of Laramie Solid Waste Division, the University of Wyoming, and Ark Regional Services. The collaboration of the City Solid Waste Division, The University of Wyoming Recycling Program, and Ark Regional Services provided an effective recycling program with the establishment of single-stream recycling in the year 2011. In the year 2012, the city reported that approximately 907 tons (7%) of total residential waste was recycled and sent to market (Personal Communication with City Solid Waste Manager, 5 April 2013). However, Ark ended its recycling services in 2014 due to cost and insufficient revenue. The City of Laramie and the University of Wyoming are continuing their recycling programs.

The annual average volume of solid waste generated in the city of Laramie is about 36,400 tons [37]. In the year 2016, the City of Laramie's recycling and diversion program recycled and diverted over 5750 tons of materials from landfill. These diverted and recycled material include single stream recycling (25.09%), compost (68.70%), tires (2.40%) electronic waste (0.67%), scrap metal (2.9%), household hazardous waste (0.14%), mulch (0.58%), and auto batteries (0.11%) [38]. The composition of the city's current single-stream recycling is about 77% paper, 11% plastics, 6% metals, and 6% residue and others [28].

### 3. Data Collection

In order to understand Laramie's recycling landscape, a survey was created with three main sections that utilized an exploratory research design to obtain a greater and deeper understanding of the phenomenon [39]. The first section requested information about the respondents' socio-economic status, such as years of residence in Laramie, persons per household, annual income, education level, profession, and age. This information was collected to see if these attributes had any relation to recycling participation and engagement. The second section included questions to understand public participation and engagement in the city's public gatherings and hearings, use of a city hotline to provide feedback and comments, attendance at planning meetings, and participation in public outreach and education in connection to recycling in Laramie. The third section of the survey included questions to understand the factors that affected residents' recycling behavior and attitude, specifically their motivation for recycling, the importance of recycling to them, and the level of satisfaction towards recycling services. The questionnaire used structured and semi-structured questions to address both quantitative and qualitative aspects of residents' perception and practice of recycling in Laramie.

Altogether, 180 residents, 60 each from three council wards of the city, were randomly selected using Excel from approximately 10,000 residential home addresses obtained from the Albany County Assessor's office. An equal number of respondents from each ward were considered to represent the population and to maintain homogeneity and neutrality in the analysis and interpretation of the study. A mail-back survey was sent to all of the selected residential addresses (Figure 2). The response rate for the survey was 49.4%, with 89 residents taking part. Among them, 30 respondents (33.71%) represented Ward number one, 31 (34.83%) represented ward number two, and 28 respondents (31.46%) represented ward number three. The non-response rate (50.6%) may have non-response bias if some non-responders had a different view compared to those who responded; in that case, the results of the survey would have been affected. To supplement the survey results, and to highlight key stakeholders' recycling efforts in Laramie, three key informant interviews were conducted with the City Solid Waste Manager, the University of Wyoming Recycling Manager, and the Director of Ark Regional Recycling Services, Laramie. These personal semi-structured interviews were conducted on 5 April, 9 April, and 18 April 2013, respectively, and each interview lasted for an hour. These interviews played an important role in providing in-depth information about the status of recycling in Laramie.

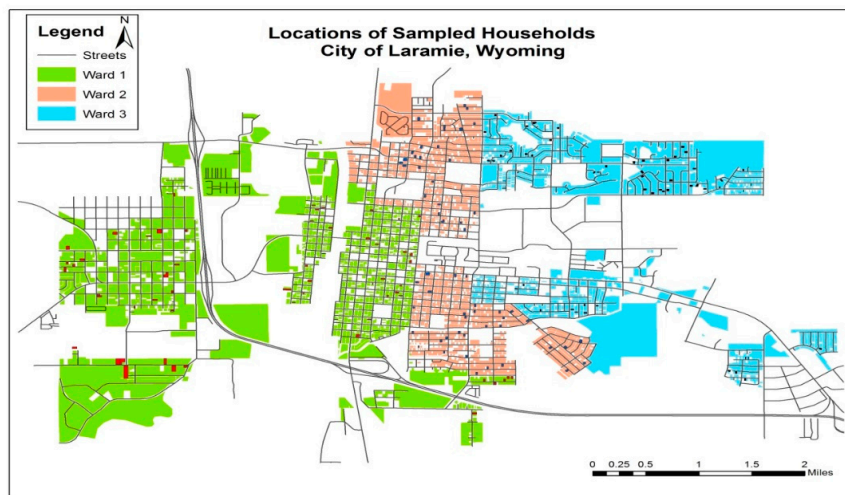


Figure 2. Distribution of Sampled Households.

#### 4. Analysis, Results, and Discussion

##### 4.1. Public Participation: Civic Engagement Score

Public participation is considered a very important component in recycling programs. It includes the rigorous engagement of people from program initiation to implementation. Engagement of the public in the planning process ensures the identification and incorporation of public needs and preferences in recycling programs [40]. In the context of Laramie, to understand respondents' level of participation and engagement, they were asked three questions: (a) *Did you attend the city's public meetings and hearings conducted?* (b) *Did you use public hotline to make comments about city's recycling planning process?* And (c) *Did you attend any planning meetings of the city?* The responses to these questions were analyzed quantitatively with (Yes = 2 and No = 1). A cumulative civic engagement score for each respondent was calculated by summing up the ordinal values corresponding to their responses and dividing by six (the highest possible ordinal value that a respondent could achieve from the three responses) to obtain the minimum score of 0.5 and maximum of 1 (Figure 3).

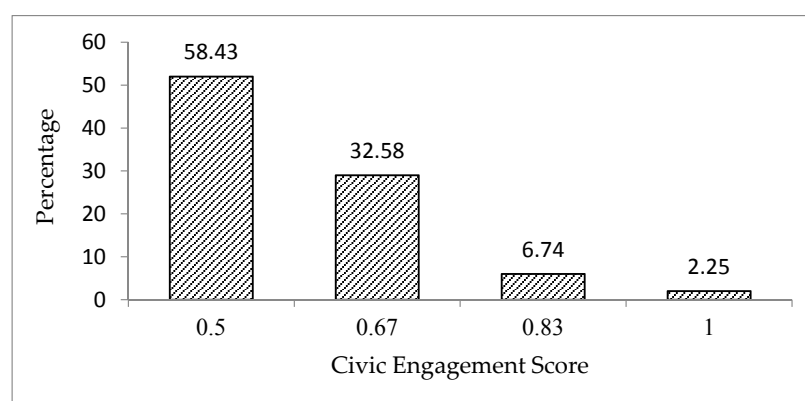


Figure 3. Distribution of Civic Engagement Score.

The results show that the cumulative civic engagement scores in relation to public participation in the pre-implementation phase of Laramie's recycling are relatively low. Out of 89, fifty-two (58.43%) respondents scored 0.5 (the lowest possible score), and only thirty-seven (41.57%) scored 0.67 or higher (Figure 3). The low scores of (<0.67) were affected by respondents' three levels of participation in the pre-implementation phase of recycling planning. First, it is because an overwhelmingly 81

out of 89 (92.14%) of the respondents never attended any public meetings and hearings in relation to the recycling program in Laramie. Only a very few, 7 respondents (7.87%), attended public meetings/hearings (Figure 4). Second, the survey results showed that 75 out of 89 (66.29%) never used the city's hotline, and only about 1/3 (33.71%) of the respondents used the City Solid Waste Manager's office hotline, allowing them to make comments and provide feedback about the city's recycling program and services (Figure 5). The third important element affecting the civic engagement score was the respondents' low level of attendance in the city's planning meetings. The results show only 33.7% of the respondents participated in the City Council's planning meetings (Figure 6).

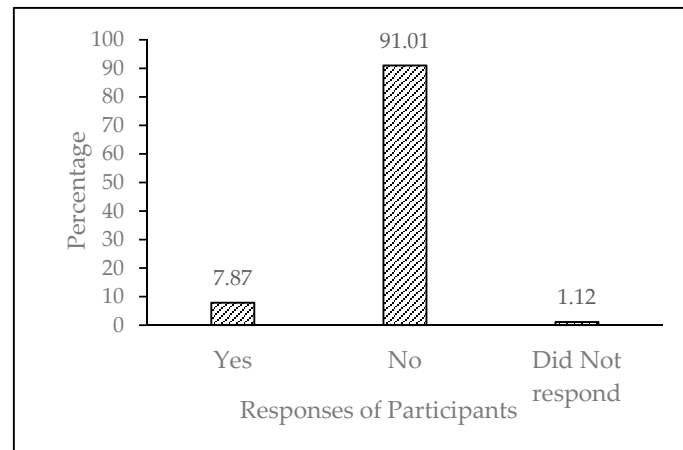


Figure 4. Attendance in Public Meetings and Hearings.

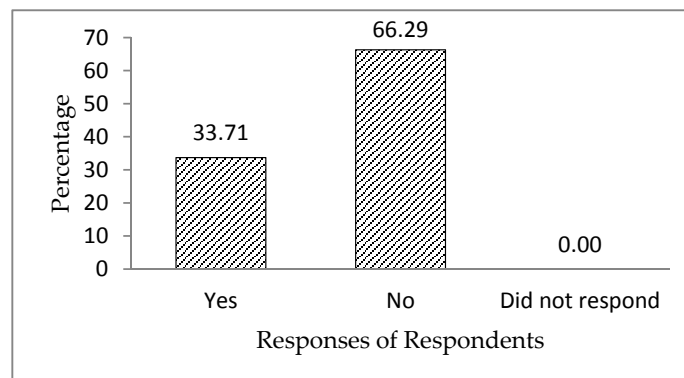


Figure 5. Use of Public Hotline.

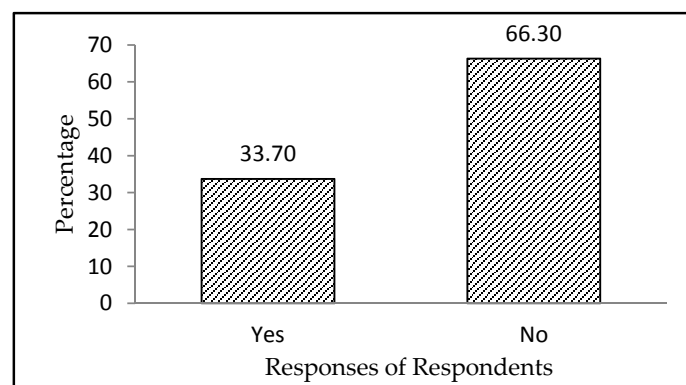


Figure 6. Involvement in Planning Meetings.



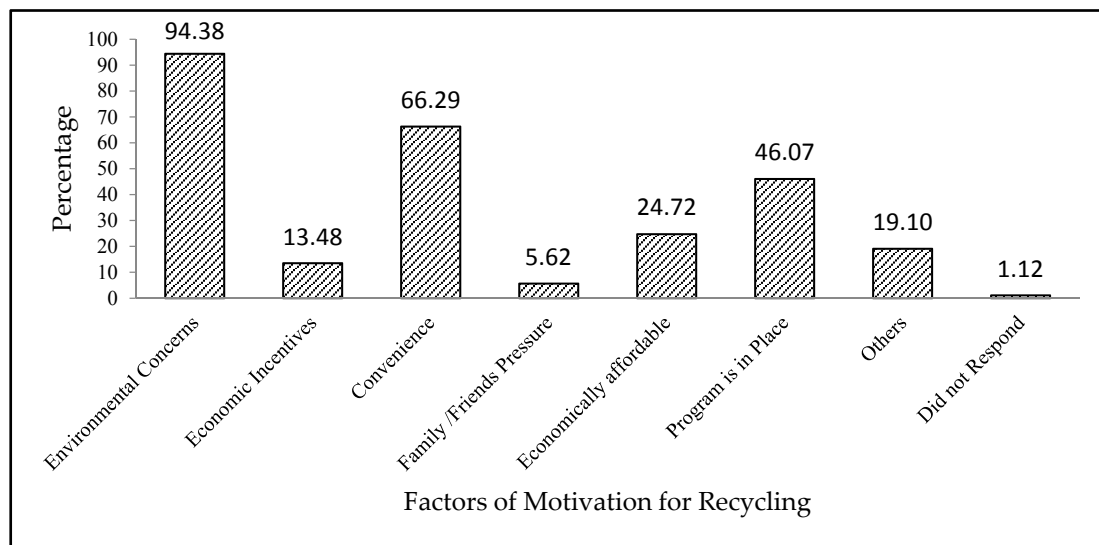
The results discussed above suggest that efforts to engage more citizens in the pre-implementation phase of the city's programs should be prioritized. Their engagement is also necessary to develop a program with a greater level of public consent, which should increase the likelihood of its success [41]. The active participation of citizens, especially during the pre-implementation of a program, also helps to build a consensus among policy-makers and the public to sketch out the possible ways to meet the program's goals and objectives in a desirable time-line [42].

#### 4.2. Understanding Recycling Behavior and Attitude

Many factors affect individual recycling behavior and attitude. The most important elements include motivations for recycling and level of satisfaction with such services [43]. In the context of Laramie, to understand the factors affecting individual behavior and attitude, respondents' motivation for recycling, and their cumulative recycling importance, recycling satisfaction, and recycling behavioral scores were determined.

##### 4.2.1. Motivations for Recycling

Motivation is one of the strong variables shaping recycling behavior [44]. Motivation is driven by environmental concerns, economic incentives, convenience, and the influence of family and friends [19]. In the case of Laramie, overwhelmingly, 84 out of 89 (94.38%) respondents expressed environmental concern (conserving natural resources and avoiding negative long-term impacts of landfill) as one of the most important factors motivating them to engage in recycling (Figure 7). This result may be because of residents' high level of concern for the environmental sustainability of the city (Personal Communication with City Solid Waste Manager, 5 April 2013).



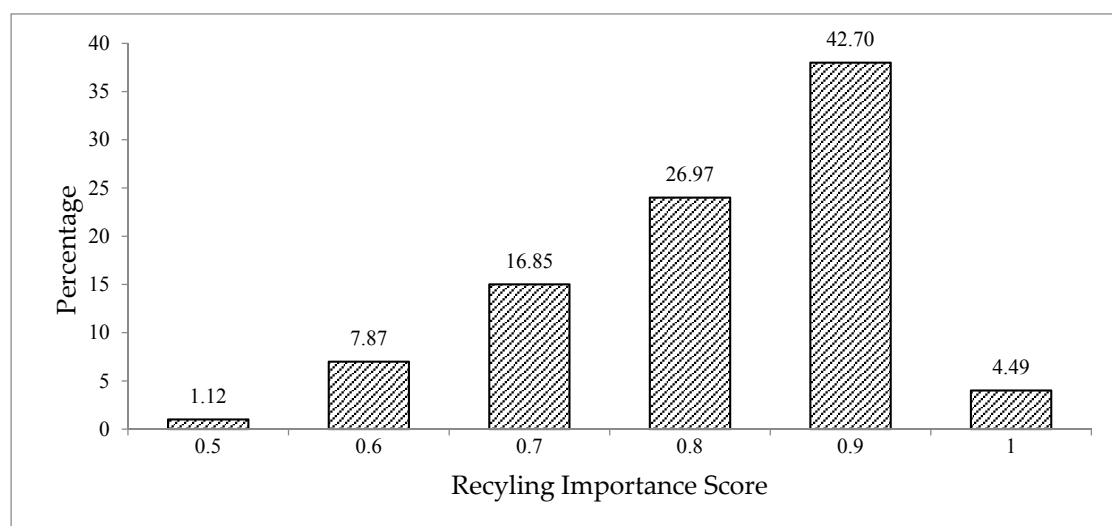
**Figure 7.** Motivations for Recycling.

The above-mentioned results also agree with other research [17] which found a strong correlation between environmental concerns and motivations for recycling. These results also agree with the survey conducted by Custom Research North America (CRN) in 2011, in which 75% of the respondents expressed environmental concerns as their main motivation for recycling [45]. However, motivation for recycling as a function of environmental concern may vary in relation to the education level of the people living in a community. Usually, persons with low levels of education and a lack of awareness are influenced by their friends and neighbors rather than environmental concern [46].

The second most noticeable reason for joining recycling programs for 59 out of 89 (66.29%) respondents was the convenience of city's curbside recycling program (Figure 7). Here, the convenience includes the ease of managing household waste. The third most important motivation for engaging in recycling, which was expressed by 41 respondents (46.07%), was to support the city's initiative since the program was in place. Economic affordability was important for 22 (24.72%) respondents. Only five (5.62%) respondents reported they were influenced by family and friends to participate in recycling. This number is low compared to the results of the survey done by Custom Research North America in 2011, in which 26% of the respondents were motivated by family, friends, and neighbors to join recycling efforts in their communities [45]. Seventeen respondents (19.10%) stated that other reasons, such as a mandatory fee in their utility bill and the charitable nature of non-profits, motivated them to join recycling (Figure 7).

#### 4.2.2. Recycling Attitude: Recycling Importance Score

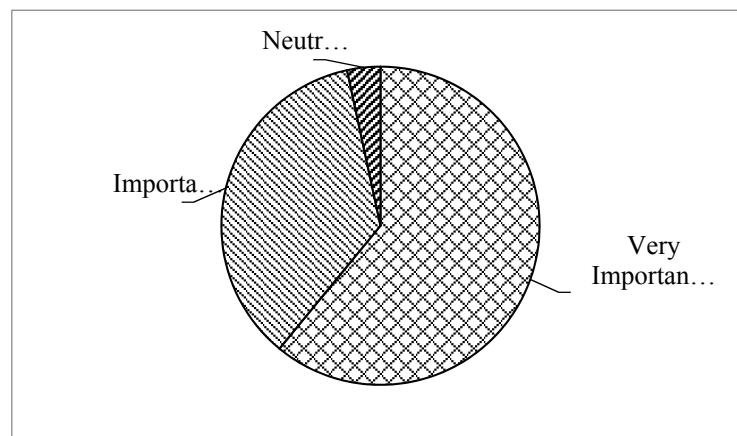
Residents' perception of recycling has an important role in determining their behavior and attitude towards its practice. In order to determine an individual's behavior, it is necessary to understand their beliefs, intentions, and the level of importance they give to recycling [14]. Participants of the survey were asked two major questions to identify the level of importance and level of knowledge they had pertaining to recycling methods and procedures: (a) *How important is recycling to you?* and (b) *What is your level of knowledge about recycling methods and procedures?* The responses to the first question were quantified with Very important = 5, Important = 4, Neutral = 3, Less important = 2, and Don't Know = 1. Likewise, the responses to the second question were quantified as Very knowledgeable = 5, Knowledgeable = 4, Neutral = 3, Less knowledgeable = 2, and Don't Know = 1. A cumulative recycling importance score for each respondent was calculated by summing the ordinal values corresponding to their responses and dividing by the maximum value of 10. The score results ranged between 0.5 and 1 (Figure 8).



**Figure 8.** Distribution of Recycling Importance Score.

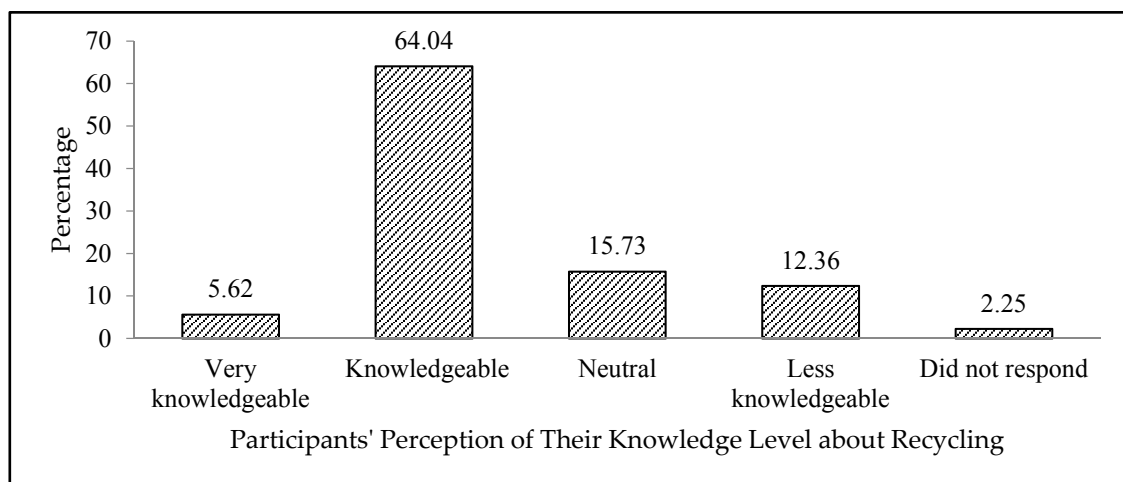
The results of the analysis showed that more than 74.16% of the respondents received high scores of 0.8 and above (Figure 8). Most of the respondents gave high-recycling importance scores, as indicated by the fact that 86 out of 89 (97%) expressed recycling as an important method to waste management, and only three residents (3%) had a neutral opinion to it (Figure 9). Scott [19] observed similar results in Ontario, Canada, where residents perceived recycling as an important method to address the issue of solid waste management in their community.





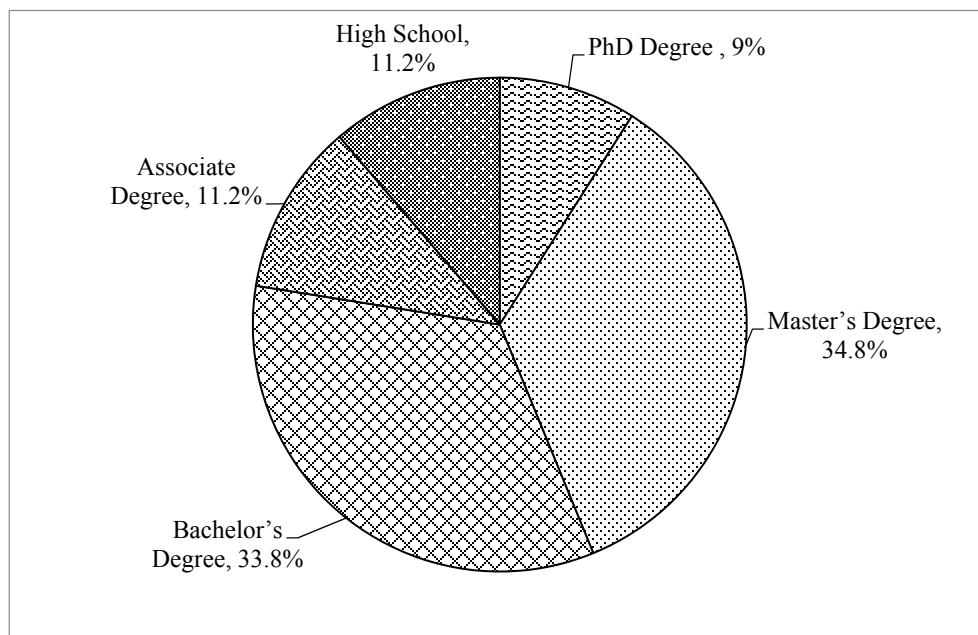
**Figure 9.** Respondents' Level of Importance to Recycling.

Another reason for high-recycling importance scores is shown by 62 respondents (69.66%) indicating they were knowledgeable or very knowledgeable about recycling methods and procedures (Figure 10). Thus, the evidence suggests that most respondents in Laramie care about recycling and are motivated to be engaged in recycling.



**Figure 10.** Level of Knowledge on Recycling Methods and Procedures.

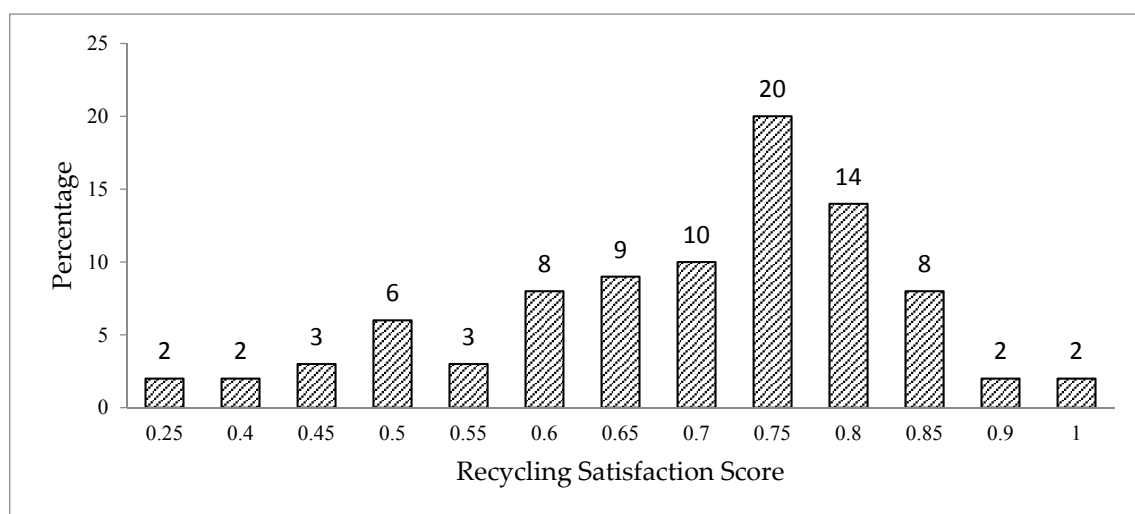
Another contributing factor to high-recycling importance score results can be further tied to respondents' level of education. In this study, 77.6% of the respondents have earned a Bachelor's Degree level of education and above (Figure 11). Studies suggest that people with high levels of education tend to know more about the benefits of recycling methods and the procedures of a program, and thus give high importance to it [47].



**Figure 11.** Respondents' Educational Level.

#### 4.2.3. Recycling Satisfaction: Recycling Satisfaction Score

Customer satisfaction is the top priority for many recycling service providers, and is one of the driving forces for their success [48]. In the case of Laramie, survey participants were asked the following questions to seek their levels of satisfaction towards city services and facilities: (i) *Are you satisfied with the frequency of recyclable collection service?* (ii) *Are you satisfied with the size of the bin provided by the city?* (iii) *What is your level of satisfaction towards number of recycling outreach educational programs?* (iv) *What is your level of satisfaction towards public engagement in decision in relation to recycling planning process in the city?* The responses to these questions were quantified with a five-point Likert scale of Very Satisfied = 5, Satisfied = 4, Neutral = 3, Unsatisfied = 2, and Very unsatisfied = 1. A cumulative recycling satisfaction score for each respondent was calculated by adding up ordinal values corresponding to their responses, and dividing it by the maximum value of 20. The scores results of 89 respondents ranged between 0.25 and 1.00 (Figure 12).



**Figure 12.** Distribution of Recycling Satisfaction Score.

The results of the analysis of the recycling satisfaction score (RSS) showed that 56 (62.92%) of the respondents scored 0.65 or higher for recycling satisfaction (Figure 12). This result indicates that respondents were satisfied with the city's current waste collection services and the size of the bin provided for curbside recycling. However, they were not satisfied with public engagement in the recycling planning process, since 69 respondents (70%) indicated their neutrality or low levels of dissatisfaction towards it (Figure 13). This data suggest that the city needs to engage more people in its town-hall meetings for planning to receive feedback and to implement what most of the people expect from the city's recycling program.



Figure 13. Level of Satisfaction with Recycling Planning Process.

#### 4.2.4. Recycling Behavior: Recycling Behavior Score

A recycling behavior score was determined to understand how frequently the respondents participated in recycling activities. This included their engagement in sorting recyclables at home and buying recycled materials from the market. To understand this issue, respondents were asked two questions: (a) *How often do you recycle?* (b) *How often do you buy recycled products?* The responses to these questions were quantified with a five-point Likert-scale: Every opportunity = 5, Weekly = 4, Monthly = 2, and Never = 1. A cumulative recycling satisfaction score for each respondent was calculated by adding up the ordinal values corresponding to their responses, and dividing it by the maximum value of 10. The results of 89 respondents ranged between 0.40 and 1.00 (Figure 14).

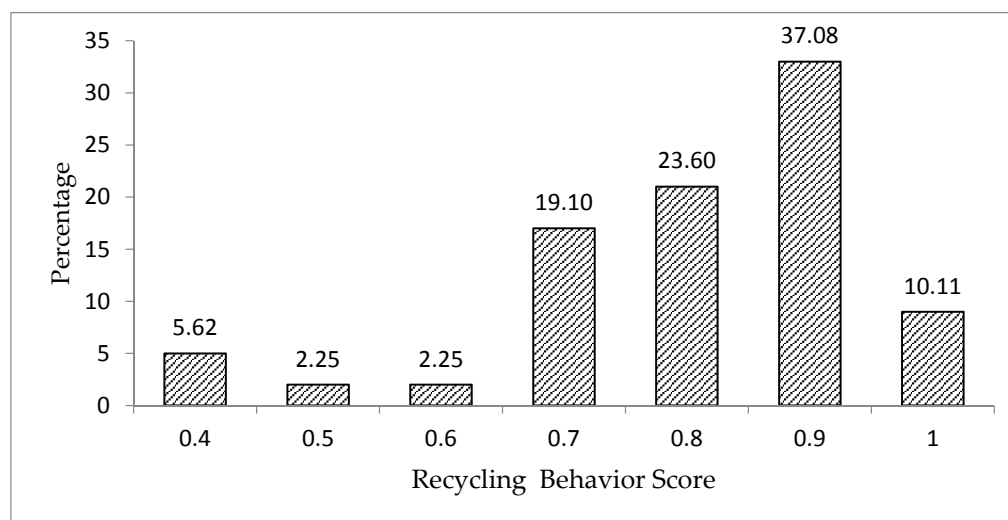
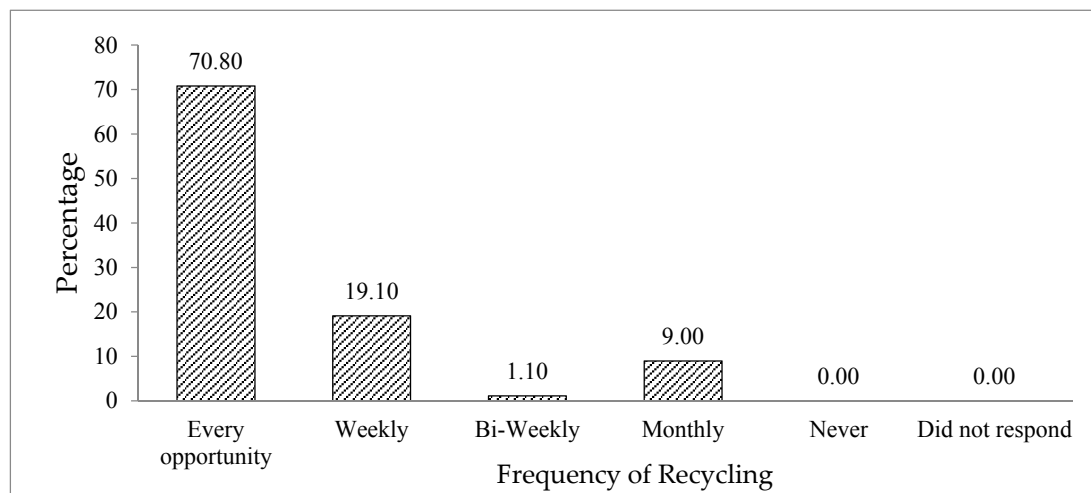


Figure 14. Distribution of Recycling Behavior Score.

Analysis of the recycling behavior scores showed that about 90% of the respondents obtained the score of 0.7 or higher (Figure 14). This finding is supported by the fact that overwhelmingly 71% of the respondents were engaged in recycling activities at every opportunity and 19.1% expressed they were involved once a week (Figure 15).



**Figure 15.** Frequency of Participants in Recycling Activities.

#### 4.3. Recycling Efforts in Laramie: Key Informant Interviews

One of the primary reasons to conduct key informant interviews was to gain an in-depth understanding of the current recycling landscape of Laramie through the efforts of the key stakeholders. These included the City of Laramie Solid Waste Division, the University of Wyoming (UW), and Ark Regional Services. Their current recycling status and efforts are described below.

##### 4.3.1. City of Laramie Solid Waste Division

The city recycling service involves picking up single-stream recycling every other week, on the same day as trash day. Once the materials are taken to the landfill, recyclable materials are dumped inside a building, then compacted and finally put into a container. Once the container is full, it is hauled to Denver, Colorado, two times a week. The service fee for residents is \$4.30 per bin per month, the fee being mainly appropriated for transportation and management. The volume of recycling materials collected in the City of Laramie has increased since the establishment of curbside recycling in September of 2011. It increased from 414 tons in 2011 to 1358.78 tons in 2012, a 228.21% increase in the first year. The city is now averaging approximately 90 tons a month (1080 tons per year) of single-stream recycling. This trend shows that Laramie's recycling rate is gradually increasing, but it has a long way to go to achieve its goal of a 40% diversion rate by 2030. The most common materials the city receives are paper products, fiber, cardboard, and newspaper. With respect to its immediate plan, the city solid waste manager mentioned that the city is investing approximately \$7.0 million for a new landfill project with a bale facility building to bale trash and store higher volumes of recyclables (Personal Communication with City Solid Waste Manager on 5 April 2013).

The City Solid Waste Manager feels that an educational policy is most effective for increasing recycling rates in Laramie. To meet this objective, he mentioned that the city is already working with elementary schools in a grassroots approach. He further recommended a pay-as-you-throw policy to be implemented in the city that may motivate people to recycle more with higher economic incentives (Personal Communication with City Solid Manager, Laramie on 5 April 2013). This policy provides a direct economic incentive to residents in their waste disposal fee, which motivates them to recycle more and produce less waste for dumping [8].

#### 4.3.2. The University of Wyoming Recycling Center

The University of Wyoming (UW) has been engaged in recycling for more than a decade with a recycling center established on premises. There are approximately 50 recyclable collection bins placed at different locations across the campus. The quantity of recyclables increased from 396 tons in 2011 to 433.5 tons in 2012. Most of the recyclables included paper, plastic bottles, aluminum cans, cardboards, brown glass, clear glass, newspapers, office junk mail, shred paper, steel cans, and white paper. The university's recycling is currently supported by the revenue obtained from the sale of commodities, the student fee, and a contract with Pepsi, the sole provider of beverages on campus (Personal Communication with UW Recycling Manager on 9 April 2013). Besides regular trash collection, the University also takes part in a nationwide recycling competition known as "Recyclomania". In 2013, the results of the competition placed UW in 130th place among 411 schools, in which the participants of UW collected approximately 72 tons of recyclables from school premises during the four-month duration of the competition [21].

Immediate plans to improve recycling on campus include a warehouse building to create more space for storage. This new facility will double the size of the current facility in the future. Next, the University of Wyoming plans to work very closely with the City to make recycling more convenient. With regards to new policy adoption, the UW Recycling Manager recommended mandatory recycling for all communities in Laramie. This includes all multi-family units and commercial establishments across the city, in addition to single-family units (Personal Communication with UW Recycling Manager on 9 April 2013).

#### 4.3.3. Ark Regional Services

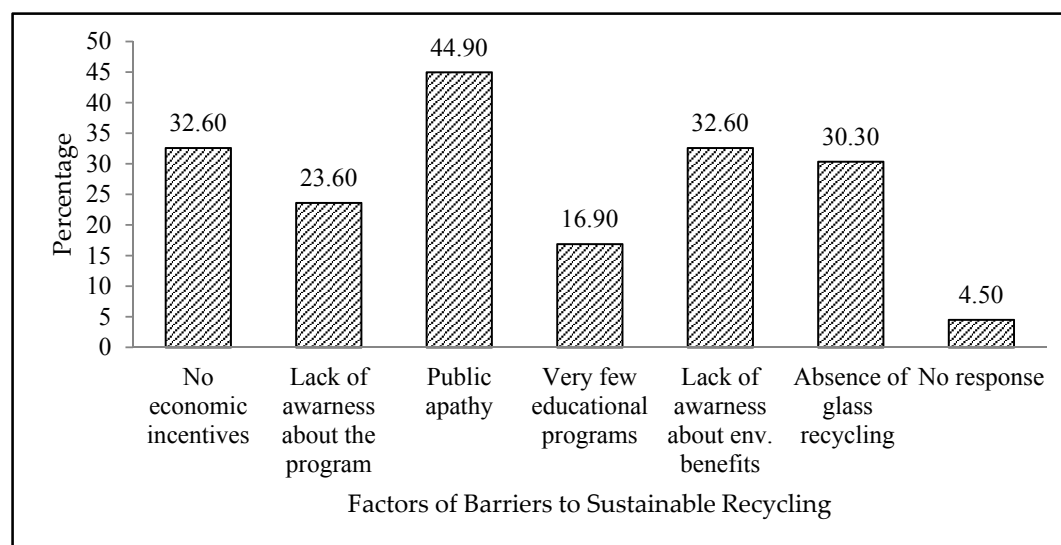
Another major stakeholder involved in recycling in Laramie was Ark Regional Services. It was a non-profit organization engaged in recycling for more than two decades, whose main objective was to create job opportunities for people with disabilities. In 2011, Ark collected approximately 4000 tons and that amount increased to 4500 tons in 2012. The composition of recyclables Ark collected in 2012 was 50% newspaper/magazines, 25% corrugated cardboard, and 25% everything else (glass, plastic, steel, and aluminum cans). The newspaper and magazines were sold to Idaho and Utah, where companies made insulation out of those materials. The recyclable cardboard (1000 tons per year) was shipped to China. The revenue from these sales was approximately \$100,000 per year. In addition to this, Ark also received funding from the state and federal agencies to support its recycling management (Personal Communication with Director of Ark Regional Services on 18 April 2013).

The immediate plan of Ark was to work with a statewide organization known as the Wyoming Solid Waste and Recycling Association (WSWRA) to standardize recycling target rates in the state. The Director of Ark mentioned that WSWRA and Ark along with other non-profit organizations were trying to establish statewide policies to increase the recycling rate in Wyoming. In this respect, the director of Ark Regional Services recommended a statewide Bottle Bill [49], which he thought would increase the recycling rates of containerized beverages (Personal Communication with the Director of Ark Regional Services on 18 April 2013). Unfortunately, Ark Regional Services ceased to provide its recycling services in Laramie since 2014.

#### 4.4. Barriers to Recycling in Laramie

Though there is demand for new and renewed recycling efforts, there are also several barriers to such programs that must be considered. Usually, barriers to recycling include cost and the absence of economic incentives, a lack of knowledge about programs, as well as negligence and a lack of awareness about the environmental benefits of recycling [50]. In the context of Laramie, 40 respondents (44.9%) participating in the survey expressed public apathy as the key barrier to recycling (Figure 16). This result is consistent with a general sentiment that the city has many wide-open spaces where

residents can simply bury their waste (Personal Communication with the Director of Ark Regional Service on 18 April 2013).



**Figure 16.** Barriers to Sustainable Recycling in Laramie.

Another barrier to recycling in Laramie expressed by 29 respondents (32.6%) was the absence of attractive economic incentives for residents to recycle. This result is meaningful, since there are no incentive policies like pay-as-you-throw, and no state-wide Bottle Bill to reward recycling. The only economic incentive received by residents is the subsidized disposal fee established by the city and Ark Regional Services (Personal Communication with the City Solid Waste Manager on 5 April 2013). If we look at the situation in Boulder, Colorado, one of the reasons for their growing recycling rates is the establishment of a pay-as-you-throw policy. In this policy, residents pay less for garbage service by generating less waste to dump and more to recycle [51]. This example indicates that residents will increase their recycling if it will save them money on their disposal fee.

A third important barrier to recycling identified by the respondents was the lack of awareness about the environmental benefits of recycling. Twenty-nine respondents (32.6%) indicated increased knowledge regarding the environmental benefits of recycling would encourage more people to participate. Remaining problems include public idleness and the absence of glass recycling, the lack of awareness and information about the program, and very few educational programs in the city (Figure 13).

While there are number of issues posing challenges to a successful recycling program, in addition to above mentioned barriers, the key informant interviews indicated that economic constraints were one of the most important barriers to recycling in Laramie. All of the three key major stakeholders expressed the opinion that funding was the major problem inhibiting program effectiveness and sustainability. For example, the City Solid Waste Manager mentioned during the Glass Recycling Forum that the cost of transportation for collecting recyclables within the city and transporting them to a recycling facility in Denver was very high, and that the revenue obtained from the collection fee was just enough to support the cost of transportation. For this reason, the city was not able to carry out extensive door-to-door recycling campaigns or educational programs. With a similar perspective, the Manager at the University of Wyoming Recycling Centre and the Director of Ark Regional Services felt that they did not have funding to conduct more events for recycling outreach and education (Personal Communication on 9 April and 18 April 2013, respectively).

Another barrier to recycling in Laramie expressed by the key informants was the citizens' attitude towards recycling and a general reluctance to change their attitude. Supporting this statement, the City Solid Waste Manager expressed his opinion that it was very difficult to persuade people to change



their attitude and behavior in relation to effective recycling practice (Personal Communication on 5 April 2013). To add to this, the University of Wyoming Recycling Manager indicated that Wyoming culture was such that residents often did not like to be told what to do (Personal Communication on 9 April 2013).

## 5. Recommendations

Based on the findings and discussion of the study, the following policies and strategies are recommended to the City of Laramie to increase its recycling rates to meet its 40% diversion rate by 2030 goal.

### 5.1. Establishment of an Educational Policy

The City of Laramie should adopt an educational policy to educate residents about the importance of recycling, its methods, and its procedures. This can be done in several ways; for example, through door-to-door campaigns, distributing pamphlets and posters during community meetings and events, increasing access to educational seminars for community members, creating special training packages for elementary and high school teachers, including recycling contests among students and collaborating with the local newspaper to produce articles and advertisements. The city can also work more closely with the University of Wyoming to mobilize students and faculty in their educational outreach campaigns, and to increase the number of green events on and off campus.

### 5.2. Adoption of Recycling Ordinances and Incentive Policies

The city should consider mandating recycling for businesses and multi-family housings. Additionally, the city can adopt a construction and demolition ordinance to divert such waste from the landfill, and create a special events ordinance requiring organizers and participants of events to separate recyclables and non-recyclables. Finally, if feasible, the study recommends the City of Laramie to adopt a pay-as-you-throw policy, and work with state legislators to create a statewide Bottle Bill to increase the recycling rates of containerized beverages by providing rebates and incentives to participants. However, it is to be noted that the state legislature of Wyoming has already rejected the Bottle Bill three times.

### 5.3. Adopt Strategies to Increase Public Participation in the City's Planning Process

Referring to participants' low civic engagement scores and low level of satisfaction towards city's planning process, this study strongly recommends engaging a greater number of residents in the recycling planning process. Increased community engagement may lead to increased overall participation as well as to increased levels of satisfaction by creating a strong consensus among policy-makers and the public during the planning phase. Keeping these things in mind, public participation can be increased by conducting frequent public meetings and hearings, informing people via newspaper advertisements, radio announcements, social media, and online programs, and conducting door-to-door outreach campaigns when possible.

### 5.4. Strategies to Reinstate Glass Recycling

In order to resume glass recycling in Laramie, this study recommends considering the ideas and suggestions discussed in the Glass Recycling Forum to generate funds. A key recommendation at the forum was increasing the recycling fee to cover the cost of transporting glass to the nearest recycling facility in Colorado. Another potential source of funds for the city could be creating opportunities for private sponsorship to place their advertisements on recycling bins. In conjunction with the above, a voluntary fee on the utility bill could also be used to help reinstate glass recycling in the city.

### 5.5. Developing a Master Plan

Based on priorities identified in the key informant interviews, the study highly recommends that the city partner with statewide agencies, non-profits, and environmental groups to develop a Master Plan to create minimum annual recycling targets for each city in Wyoming, including Laramie, based on their population. This plan would eventually increase the state's overall recycling rate. In addition, the Master Plan should also focus on reducing and reusing paper products, which comprise around 77% of total recyclables in Laramie.

## 6. Conclusions

Although changes cannot occur overnight, the results of this study show that there are many options that the City of Laramie can take to increase its recycling rates. Citizen involvement is fundamental to this process. By fostering a sense of community purpose among Laramie residents, their views and attitudes about recycling can be focused toward sustainable community development and environmental conservation. Recycling, in its essence, is about old things becoming new. It is about possibilities to reuse materials and it is about safeguarding the environment. When community residents and government officials see the potential returns on investment in recycling, people tend to respond positively to the benefits both to themselves and their communities. By actively increasing and promoting its recycling program, the City of Laramie can reap many benefits recycling can provide.

Given the results of this study, the next task for the city is to develop creative ways to engage its residents in the recycling program. This process can be aided by working with local community groups, artists, businesses, school programs, and youth groups to integrate recycling themes into their events, and to gather feedback directly about recycling initiatives in Laramie. Being a university town, Laramie has a great potential to expand its educational efforts across the city. These efforts should be used to remind people of how recycling benefits them and their communities, and as such helping them become more knowledgeable about recycling methods and procedures. Consequently, people will better be able to see the positive results of their actions, and will be more likely to continue those actions. Keeping people inspired, motivated, educated, and informed is essential to a successful long-term recycling program [8]. After evaluating the three major policy evaluation criteria (i.e., administrative feasibility, political feasibility, and economic feasibility), it can be concluded that Laramie needs to be deliberate in generating additional funds for implementing the proposed educational and incentive policies to meet its long-term recycling goals to reach a 40% diversion rate by 2030. The study can further be implicated to all of the growing university towns, where recycling can become more effective and efficient through public outreach and education.

Solid waste recycling can be a resource for income generation [52], energy production [53,54], and the construction of recreational objects [55] through an integrated recycling program. The future direction of this kind of program should be considered by small towns and cities in local policy and planning through recycling education, public awareness and participation, and the sustainable, environmentally friendly developmental goals of reduce, reuse, and recycle (the 3Rs) [56].

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