Adaptive Collaborative Management (ACM) Model In Waste Management in Makassar City

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Abstract: **This study aims to analyze and to describe waste management in Makassar City from the ACM perspective, seen from the twelve dimensions of ACM, namely bridging organizations, conflict, enabling condition, incentives, knowledge, leadership, learning, networks, organizational interactions, strength empowerment, shared responsibility, and trust. The goal of this study is also to find an ACM model in waste management in Makassar City.This research used a qualitative approach applying a descriptive method. Sources of data are obtained from key informants who are directly related to waste management (primary), and from various literature, articles, journals.. Methods of data collection were observation, interviews and literature review. Data analysis techniques were carried out by (1) data condensation, (2) data display, and (3) conclusion overview/verification.The results showed that 1) five of twelve dimensions studied needed serious attention to be optimized since they have a major influence on the success of ACM, namely the dimensions of liaison organization, possible condition, knowledge, leadership, and learning. Meanwhile, the other dimensions had run even though it was not optimal. 2)The finding of the paper is the design of the ACM n approach model to be used in solving solid waste problems in Makassar City.**

Keywords: **ACM dimensions, ACM model approach**

I. INTRODUCTION

Makassar City is the center of development of various government, educational, and economic activities that produce goods and services. This city has become a magnet for residents from other regencies/cities in South Sulawesi and even from Eastern Indonesia as a place for trading, studying, and finding jobs. This condition causesthe number of people who have activities in Makassar City to be higher than the number of people who have Makassar Identity Card (KTP). The number of people who have a Makassar Identity Card is around 1,508,154 people (Makassar, 2019). As seen from the functional perspective of the city, Makassar is included in the category of a Metropolitan City since its population is more than 1 million.

Resource management, including the management and fulfillment of goods and services production, is carried out to improve the community welfare. Products are always packaged in safe, simple, and durable packaging. In general, the packaging of goods is made of synthetic materials such as plastic, rubber, cans, glass, which will become waste and are difficult to decompose naturally. The waste becomes a big problem for Makassar City until now.

Based on the observation, waste management in Makassar City is carried out using old and new paradigm. From around 394,359 tons/year or 7,900 m3 per day of waste produced by Makassar City (Makassar, 2018), about 5% is managed in a new paradigm, 86% uses an old paradigm, and the remaining 9% is unmanaged. Waste management using the old paradigm shows that almost all resources are organized by the government, for example, policymaking, provision of facilities and infrastructure, budgets, policy implementation and service delivery. The public and the private sector are mostly relative as objects, not subjects that can contribute actively.

From a public administration perspective, waste management using the old paradigm is the character of the Old Public Administration (OPA). It is characterized by a focus on the provision of services to the community by public administrators who are accountable and democratically responsible to public officials (elected official). The main basic values upheld OPA are efficiency and rationality as a closed system.

This is in contrast to the new paradigm. This method has involved various parties producing waste (sources of waste) to sort from sources according to the type of waste organic (waste originating from the remains of living things that are easily decomposed naturally without human intervention to decompose) and inorganic (waste that is no longer used and difficult to decompose). Waste that still has economic value will be handed over to the Garbage Bank or sold to garbage collectors. Waste management with this new paradigm aims to reduce waste through restrictions on waste reduction, reuse, and recycling (commonly known as 3R).

Waste management applying the new paradigm tends to involve all interested parties. This method is in line with the concept of New Public Services (NPS), which emphasizes the principles, such as 1) *serve citizen, not customers*, public interest; 2) *seek the public interest*, the centrality of public interest in government services; 3) *think strategically, act democratically*, policies and programs meet public needs through processes and collective collaborative efforts; 4) *recognize that accountability is not simple*, public servants must be more attractive; and 5) *value people, not just productivity*(Denhardt, 2002).

Based on the NPS concept, the involvement of all interested parties can be seen from the policies and strategies for waste management by Makassar City government as regulated in Makassar Mayor Regulation Number 36 of 2018 concerning Regional Strategic Policies in Waste Management,(Makassar, 2018). This strategy is a key to success and a source of problems, including institutional aspects, capacity building, coordination and cooperation, leadership, human resources (HR), information systems, community involvement, incentives and disincentives, and commitment of the business world.

Community involvement in waste management is only around 10-30%. This problem is caused by the weak commitment of the executive and legislative bodies of government in supervising waste management. Another problem is the lack of education about waste management in the community and the absence of suitable environmentally friendly technology. The policies and programs for waste resource management are still weak. Various programs that have been launched, such as Makassar-ta No Rantasa (MTR) in 2014 which try to invite residents to work together to create a waste-free Makassar, have not been effective and they seem incidental and unsustainable.

Based on a number of existing phenomena, the involvement of various stakeholders is very relevant to the ACM approach or model. In this model, several identified objects that serve as indicators or dimensions of ACM are an important part of attention in waste management in Makassar City. The objects in question will be adjusted to the opinion of scholars and practitioners who focus on the ACM model as well as have explored and examined various dimensions believed to be important components of the ACM process. Those dimensions are bridging organizations, conflict, enabling condition, incentives, knowledge, leadership, learning, networks, organizational interactions, strength empowerment, shared responsibility, and trust.

II. LITERATURE REVIEW

Adaptive Collaborative Management or Adaptive Co-Management (ACM), which is translated into Indonesian as **"***manajemen pengelolaan bersama yang adaptif*" is an advanced narrative from the perspective of collaborative management, where the trend towards this approach is a result of the limitation of understanding and bureaucratic control.ACM, according to Ruitenbeek and Cartier (2001, 8) in (Armitage & Doubleday, 2007), is defined as:

"a long-term management structure that permits stakeholders to share management responsibility within a specific system of natural resources, and to learn from their actors"

ACM combines adaptive and collaborative narratives in resource management to result in a different approach. ACM has been agreed upon as one of the promising approaches, according to (Berkes *et al.*, 2001)synthesized these similarities and differences in approaches/models that focus on relationship building, scope, and capacity building. ACM focuses on on-the-job learning, runs in the medium to long term through the learning and adaptation cycle, and concentrates on the relationships, requirements and capacities of managers. ACM establishes vertical institutional relationships, tending to produce short, medium term snapshots, linking local communities with government (both horizontal and vertical) to share roles between various actors. It is multi-scale and increases the capacity of all actors to manage their respective resources.

The main objective of ACM research is to develop theories that will help guide human-environmental interactions towards sustainable development in coordinated and complementary ways. ACM has received a lot of attention for its potential to provide a management system to address circumstances of complexity and uncertainty, as well as to improve compatibility with ecosystem dynamics (Folke *et al.*, 2005).

ACM generally seeks to encourage adaptive capacity, to encourage collaboration, and to bring about positive changes that are in line with socio-ecological resilience and sustainability ranging from relatively specific (i.e. knowledge integration and knowledge creation) to very broad ones (i.e. sustainability and resilience, Sensu Folke, 2006).

The greatest interests in terms of contribution to ACM are adaptive capacity, social learning, communication, sharing authority, and collective decision-making. Researchers focused on outcomes related to preconceptions of what ACM will achieve (e.g., adaptive capacity building, socio-ecological resilience, sustainable use of resources, increased management efficiency and effectiveness, improved livelihoods, and creative ideas for solving problems).

Based on the explanation of the research results, Armitege et.al, the list of items that were studied and often appeared in testing the application of ACM that contributed to the success of ACM are 12 dimensions, including bridging organizations, incentives, shared responsibility, leadership, conflict, enabling conditions, trust, shared power, organizational interactions, networks, knowledge, and learning as depicted in the image below(Plummer *et al.*, 2012).

Table 1: Important Dimensions of Adaptive Collaborative Management

No	Dimension	Review Dimension
1.	*Bridging Organizations*	Bridging organizations are intermediaries (not individuals), and the concern in this theme is in the roles played by these bodies. Attention is given to how they support each other among dimensions.
2.	*Conflict*	Conflict includes tensions that arise between individuals and organizations in the areas of conflict resolution, mechanisms for solving conflict, and opportunities related to conflict.
3.	*Enabling Conditions*	The enabling conditions include the central circumstances to develop and/or maintain the ACM process, which includes law or policy, the role of government, and funding.

4.	*Incentives*	Incentives include those that inhibit, maintain, or eliminate ACM. The general idea of incentives is identified as a catalyst for both monetary and non-monetary, which focuses on punishment and rewards that depend on certain achievements/behaviors.
5	*Knowledge*	Information/skills/expertise/experience/world view brought by individuals and organizations to ACM, which includes a combination of knowledge, types of knowledge, forms and functions of information, communication of knowledge, control of knowledge, and knowledge in relation to other dimensions.
6	*Leadership*	This is the act of leading or giving guidance (by individuals or organizations) as a leadership theme. The presence or absence of leadership is usually associated with ACM success or failure and the discussed key related characteristics.
7	*Learning*	Learning concerns on how knowledge is acquired and used in relation to ACM. Attention is also given to the influence of the learning process on ACM and its interactions with other dimensions. Social learning comes with considerable strengths: experiential learning, monitoring and evaluation, and transformative learning.
8	*Networks*	Networks include connections (structurally and functionally) between and within entities, including network features (e.g. cross-scale, multi-level), network types (e.g. formal, informal), and relationships with other dimensions (e.g. social capital, learning, knowledge).
9	*Organizational Interactions*	Organizational interactions take into account the relationships between and within organizations (formal and informal), the nature of these links (horizontal and vertical), the extent to which they cross scales and levels, their suitability to the ecosystem, and their consequences (e.g. increased compatibility)
10	*Shared Power*	Shared power is the basic premise of ACM and is often considered a structural element. This theme is often used in a general sense to convey the collective ability to influence or exert authority. Sub themes include empowerment, devolution power (decentralization), and an emphasis on property rights.
11	*Shared Responsibility*	Shared responsibility refers to the shared obligation for resource or environmental considerations. Including rights and transferring responsibilities are common considerations.
12	*Trust*	Trust focuses on the relationship between human and institutions. Trust is considered the main influence on the success or failure of ACM. These are examined in the case studies and highlighted as important links in building cross-scale and cross-level relationships.

Source: Plummer, R., B. Crona, D. R. Armitage, P. Olsson, M. Tengö, and O. Yudina. (2012) in Adaptive Co-management: a Systematic Review and Analysis. Ecology and Society

The twelve dimensions explained by ACM researchers, driven by Plummer, DR Armitage, P. Olsson, et al. (2012) in the journal of research results on ACM regarding ecological and community systematic review and analysis, will be used as a basis for photographing waste management models in Makassar City.

ACM and Public Policy

ACM is not the answer to all policy management challenges, but a useful way in dealing with complexity, when there is desirable decentralization or need to legitimize decision making in conflict resolution and problem solving at least some of the functions that are the urgency of this concept include:

1. *Dealing with complexity*

ACM is useful in dealing with complex multi-scale as well as level systems and with problems where the need to link different types and levels or organizations is required through partnerships.

2. *Decentralization of management*

ACM has also generally been associated with decentralization of management of communal natural resources, landscapes or small-scale resources such as urban ecosystems(Bulkeley and Betsill, 2005), where local knowledge is required; or when the rights to resource distribution are different. The regulation of centralized authority should be directed to an appropriate level, congruent with the scale of the ecosystem being managed (Bohensky *et al.*, 2010).

3. *Legitimization of decision making*

Government agencies can also use ACM to legitimize decision making, to delegate functions that are too difficult to manage, or to allocate tasks where a vision of labor across levels and capacities can increase efficiency; for example, when a group of local producers gains access to new markets through scaling up economics, (Carlsson and Berkes, 2005).

4. *Conflict resolution and problem solving*

Dimensions and ACM Measurement

As an outcome that emerges from collaborative management narratives and ACM, ACM can represent an important innovation in resource management under conditions of change, uncertainty, and complexity. A working definition of ACM is provided by a number of experts, such as (Olsson, Folke and Hahn, 2004; Kaharuddin, et al., 2020; Hasyim et al., 2020) noting that one key feature of ACM is the combination of the iterative learning dimension of adaptive management and the relationship dimension of collaborative management in which rights and responsibilities are shared.

The consensus among experts is that in order for ACM to work optimally, the following essential elements have different degrees:

1. *Systems perspective*

As a starting point, key actors need conceptual and adaptive co-management approaches as complex adaptive processes or complex problems. Complex problems have no clear end-points and require collaboration between agencies and local people at the center of the process(Patterson *et al.*, 2013). Ideally, the system should have a well-defined shared resource system in which ownership rights to these resources are clear(Dietz, 2003) and an identifiable social group or entity can help facilitate collaboration.

2. *Interdependence*

Interdependence among stakeholders is also an enhancing factor. If stakeholders or actors are connected through interdependence, and understand that, in order to achieve their goals, they need buying and commitment from other shareholders, the likelihood of sustainable adaptive co-management increases (Logsdon, 1991).

3. *Enabling environments*

Enabling environments that encourage multi-level collaboration and experiential trials are the key to adaptive co-management. The legal and policy environment needs to allow flexibility so that innovative management can take place and, without a clearly defined place-based entity involved in co-management of resources adaptive co-management becomes impossible. Having access to a range of adaptable management actions can enhance learning and experimentation,(Armitage *et al.*, 2009).

4. *Network sand linkages*

Resilient ACM requires a set of management attributes that encourage participation through social networks and management with functioning vertical and horizontal relationships. These attributes include polycentric institutions with multiple layers of authority and well-connected decision-making to enable a variety of government financial responses adjusted to the scale of the resources being managed and the context (Lebel, Garden and Imamura, 2005).

5. *Incentives*

Incentives for participation can be motivating, which arises as a result of a crisis or policy changes. Incentives for participation are also related to shared visions, cultural factors, ethics, and values (Olsson, et al., 2004)

6. *Capacity*

Capacity is a multi-aspect element of adaptive management and can involve skills and expertise, time, sense of place, freedom, and even commitment. Anyone with these aspects can promote or inhibit participation or result in marginalization of stakeholders. Two factors of "agency" are "the capacity of individuals to act independently and to make their own choice".

7. *Structure*,

Structure includes factors outside the individual such as social class, religion, gender, ethnicity, customs, etc. They are the main determinants of the capacity of individuals and communities to make decisions and action (Berkes and Ross, 2013).

8. *Leadership*

Key leaders are needed to lead the process and to develop the capacity of stakeholders at various levels, aiming to empower them to participate. However, it is unlikely that all stakeholders (local, regional and national) will have all the skills and expertise required for meaningful participation. Technical knowledge, local knowledge and expert knowledge often need to be combined to manage complex systems (Armitage *et al.*, 2009).

9. *Sense of place*

Collaboration can be inhibited when stakeholders do not have a sense of place or connection to the system. However, the sense of place can be a double-edged sword, which results in group thinking and a reluctance to innovate or engage newcomers.

10. *Time*

Allocating time to allow all the needed steps in the process can increase collaboration and learning. Adaptive co-management processes do not happen in a short time or in a simple way. This involves building relationships, networks, and trust, that is time-consuming(Roussos and Fawcett, 2000).

11. *Commitment*

The commitment of stakeholders can be an important determinant of the success of adaptive co-management. Stakeholders need to commit to support long-term, inclusive, and collaborative institutional development processes and this is where incentives for participation works(Armitage *et al.*, 2009).

12. *Power balances*

Lack of capacity (Murdock et al. 2005), lack of national infrastructure organization without civil society groups, status (Rogers et al. 1993, Buanes et al., 2004), or agency (Yaffee and Wondolleck 2003) can deter some stakeholders' interest to collaborate fully and effectively, which results in distrust of power imbalances and lack of commitment (Ansell and Gash, 2007).

III. RESULTS AND DISCUSSION

1. The Implementation of ACM in Waste Management in Makassar City

a. Bridging Organizations

Institution that has the function of connecting users or managers of waste resources, the government, and other stakeholders is BSU (waste bank unit). There are 757 units of BSU Institutions in Makassar City, and around 489 (64.6%) units are active. This agency has direct contact with the community as a source of waste and the number of people (household heads) who participate or become active customers is around 10-30% and they are generally in the middle to lower economic class. In addition to BSU, there are individual (non-institution) roles that have a bridging function and play an important and significant role in turning waste into a resource, namely scavengers and collectors. Individual scavengers and collectors collect inorganic waste that still has economic value not directly from the community, but from the TPS (waste temporary landfill) and TPA (landfill final wastewaste final processing. Viewed from the source of collection, its role can accommodate around 70 - 90% of the community or family who do not participate in sorting waste.

b. Conflicts

Conflicts are grouped into individual and institutional perspectives. In an individual perspective, conflicts occur incidentally between individuals fighting over waste in the same location, but can be resolved with a persuasive and administrative approach. Institutional conflicts that arise are only complaints from BSU regarding the low selling value of waste. The BSP institution, which has the obligation to buy waste from BSU, has set a price set by the government, which is not affected by changes in market prices. The solution offered is to allow BSU to sell or to market to collectors or collectors who buy at a higher price, by still requiring them to report to the BSP regarding the type and weight of waste being sold for data collection (administration) of managed waste.

c. Enabling Conditions

Enabling conditions, related to the regulation of waste resource management, are available and quite complete, starting from the highest regulations (Laws, Government Regulations, Presidential Regulations, Ministerial Regulations, Regional Regulations, and Mayor Regulations) to policies, programs, and activities.

d. Incentives

The government has given incentives or rewards to BSU that has been active in guiding, sorting, and collecting waste from the community. Incentives are given based on the level or category of silver, gold, and platinum. The silver category is given to BSU that has 25 active heads of household (KK), the gold category consists a maximum of 100 heads of household (KK), and platinum category consist of customers over 100 heads of household (KK). Awards are given in the form of certificates and trophies as well as money from sponsors. In addition, another form of incentive is to facilitate the managers of BSU as well as RT-RW and PKK to visit other areas to see first-hand management activities of waste resource. This incentive aims to encourage the role of BSU, as a catalyst, and to be more proactive in showing the community the benefits of managing waste for the economy and environment around them. Penalties (disincentives) have not been applied to people who violate local regulations, such as littering anywhere. This also affects the people's reluctance to manage their waste.

e. Knowledge

Knowledge and skills regarding waste resource management are provided by the government and NGOs as well as the private sector (pawnshops and waste mall) and universities. This combination of knowledge and skills has been accepted by all Makassar City civil servants, the heads of RT and RW, the Garbage Bank Management, community leaders, PKK, and market trader organizations. As a follow up, it has been practiced by BSU and some people. However, the practice of managing waste into a resource is only carried out by the middle to lower economic class, around 10-30%.

f. Leadership

The City Government's policy of making waste bank saving books for civil servants an administrative prerequisite for any activities at the mayor's office and the efforts of some RW and RT heads that require their citizens to have a waste saving book as a prerequisite for getting a cover letter to the urban village and also for poor rice recipients, become the evidence of the pioneering work of the government and RW-RT in fostering community members, even though they are compulsory, not because of the awareness of the knowledge and guidance obtained from the government, BSU, and NGOs. From an ACM perspective, leaders should take action to embody certain values that serve as standards for others, to facilitate innovation, not limited in giving orders, and to use their authority to empower others.

g. Learning

Learning about waste resource management is routinely carried out to BSU administrators, and part of the community uses the regional budget. Learning is intended to increase knowledge and skills of actors so that the economic value of waste management can be higher, and it is carried out in the form of socialization, mentoring, training, waste bank jamboree activities, communication, and information through the waste bank WhatsApp group social media. However, it does not reach the community as a whole within the scope of the BSU or RW area and other stakeholders such as scavengers and collectors.

h. Networks

Cooperation has been formed vertically and formally between the government (UPT BSP) and BSU through a waste marketing cooperation agreement. BSU is free to determine the market for its waste, in addition to BSP, as long as they are obliged to report the type and weight of waste marketed used for government data collection at the UPT BSP. In addition, other collaborations have also been carried out by the government functionally and formally with the NGO *Yayasan Peduli Negeri* in terms of the community assistance in managing waste into resources, and with the private sector (Octopus and MallSampah) in terms of marketing (buying and selling) inorganic waste, through application system.

i. Organizational Interactions

Formal and vertical organizational interactions can be seen from the collaboration between BSP and BSU as well as BSU and Pegadaian in terms of waste marketing. Informally and horizontally, the interaction is intensively established between BSU in one sub-district as well as between BSU and collectors (vendors), between individuals and the private sector (octofus and waste mall) and vendors through WhatsApp, email and Instagram.

j. Shared Power

Strength empowerment in terms of resource sharing can be seen from the assistance of PT. Pegadaian in the form of facilities and infrastructure for the implementation of waste management as a resource. In addition, PT. Pegadaian helps BSU as a pawnshop agent, of which job is to help its customers to convert them to gold. Vendors also empower the garbage collectors by providing business capital without interest in the hope that the vendor's needs for waste resources will still be provided by garbage collectors and the waste is not marketed to other vendors.

k. Shared Responsibility

In fact, the waste resource management agency has responsibilities, such as the government serves the collection and transportation of waste that has been sorted from households to TPS / TPST, transferdepo, transferstation, and TPA. UPTD BSP, as part of DLH, is responsible for providing services for receiving waste from BSU, noting the weight and type of managed waste. The community is responsible for sorting out the waste in their homes. Private sector facilitates waste marketing manually and through an android-based application system. These responsibilities, in concept and regulation, have partly been carried out, but some have not. From the perspective of the NPS, sharing responsibility is the way of achieving goals to generate shared interest and responsibility in society, not only to find quick solutions through individual choices and preferences.

l. Trust

Institutionally, the working relationship between government agencies (District Head, Village Head, and BSP) and BSU and private institutions is well-established and greatly affects the activeness of waste resource management in the community. Personally and institutionally, the working relationship between scavengers, garbage collectors and vendors is well established and takes place on the basis of dependence on waste resources and trust without a written cooperation agreement. However, the personal and institutional relationships between scavengers and garbage collectors with the government are not well established.Scavengers and collectors do not receive guidance, and they do not get involved or collaborate with the government or NGOs in managing waste resources.

2. ACM Model Approach in Waste Management in Makassar City

Based on the results of research and discussion, in order to achieve the objectives of waste management as a resource and to improve public health and environmental quality, it is necessary to have collaboration among stakeholders in managing waste resources by adopting the Adaptive Collaborative Management (ACM) Model approach in waste resource management as follows (figure 1).

IV. CONCLUSION

1. The Implementation of ACM in Waste Management in Makassar City

a. The community-based resource management, as carried out in waste resource management in Makassar City, has not been running optimally. However, its activities have indicated that it is in the direction of the ACM model approach.
b. Six of twelve dimensions studied need serious attention, namely:

1. Bridging Organizations

Institutions that have the function of connecting users or managers of waste resources, the government and other stakeholders are BSU and individual parties (non-institutional), namely scavengers and collectors.

2. Enabling Conditions

Regulations and other policies cannot be fully applied without implementation in the form of programs, activities, and budget support, so that public participation can increase above average (10-30%).

3. Knowledge

The provision of knowledge and skills has not been implemented in an adaptive manner throughout society. Thus, the percentage of changes in habits and

community participation in managing waste resources is still limited to the middle to lower economic class.

4. *Leadership*

   Leadership has not been fully implemented in a collaborative manner, generally providing direction and using authority to empower communities in managing waste resources.

5. *Learning*

   Learning about waste resource management is routinely carried out by BSU administrators and part of the community using the regional budget, but does not reach the community as a whole including scavengers and garbage collectors.

6. *Shared Responsibility*

   People are not yet responsible for sorting waste in their homes, especially the upper middle economy class.

   a. There are individuals (non-institutions) who have significant role in contributing to the management of waste resources, namely scavengers and garbage collectors. The waste that is not segregated from the source is 70-90% done manually by scavengers and garbage collectors even though the government's attention is not maximized. Moreover, the interaction between them individually and the government institutions does not run functionally and structurally.
   b. The role of scavengers and garbage collectors in the perspective of the twelve dimensions of ACM is not accommodated. Thus, it is a new thing to develop this model, especially in the management of waste resources. This individual and institutional interaction is called individual-institutions interaction.

   This dimension is very influencing.

2. *The design of the Adaptive Collaborative Management (ACM) approach to Solid Waste Management in Makassar City* (figure 1 attached) is very suitable and relevant to be used in solving solid waste problems in Makassar City. This is an innovation as an element of novelty in this research.

V. SUGGESTIONS

1. It is recommended that the Makassar City Government be able to do a waste management approach by applying the Adaptive Collaborative Management Model in waste resource management to increase participation and collaboration among stakeholders in waste resource management.
2. The Makassar City Government, along with other stakeholders, is expected to continue to encourage the community and to provide intense awareness and assistance to BSU, scavengers, and garbage collectors in order to keep managing waste resources.
3. The government needs to involve scavengers and garbage collectors in every waste management activity, considering that they have significant contribution in making waste a resource with economic value.
4. Building understanding, transferring knowledge, and practicing waste resource management should be carried out and familiarized with the household, not only in the middle to lower economic groups but also in the middle and upper economic groups.
5. Digital technology, to perform waste buying and selling services, can be used as another medium in managing waste resources, especially for millennial people, as well as middle and upper economic groups so that they can also be actively involved, and this can be used as a development for another dimension of the ACM model.

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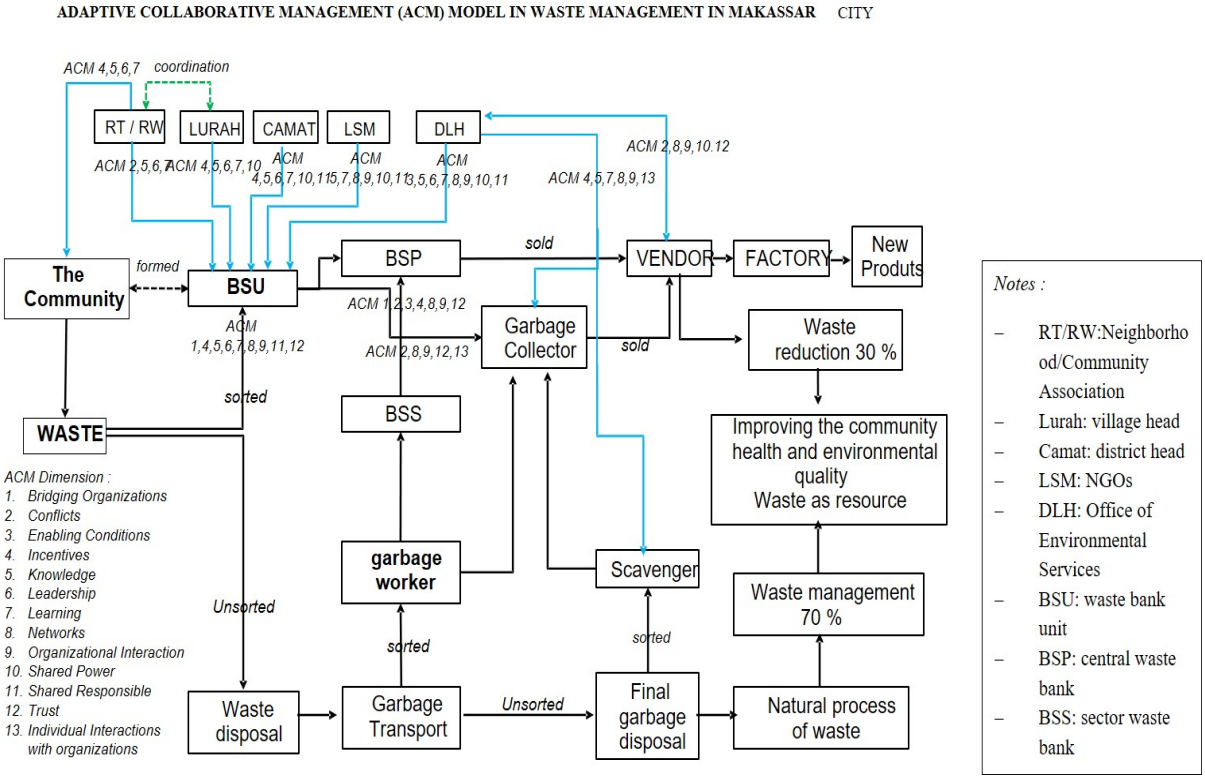
Figure 1: Adaptive Collaborative Management (ACM) Model in Waste Management in Makassar City



Notes :

– RT/RW:Neighborhood/Community Association
– Lurah: village head
– Camat: district head
– LSM: NGOs
– DLH: Office of Environmental Services
– BSU: waste bank unit
– BSP: central waste bank
– BSS: sector waste bank