Master's Thesis

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Integration of the informal waste sector in the Indian city of Chennai: a case study

Application of the Institutional Network Analysis to a municipal waste management system

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1 Summary

India has experienced a significant increase in waste generation due to rapid industrialisation and higher demand of products. The **informal waste sector** plays a key role in managing consumer waste. Informal waste workers in India contribute to closing the loop by the collection, removal, disposal, identification of valuable recyclable materials and their extraction, processing, transport, and sale back to the industry. However, informal waste workers suffer negative social and economic conditions. The **integration** of the informal waste sector in the formal waste management systems remains an unsolved issue in the country.

Understanding **institutions** as strategies, norms and rules that guide the behaviour of actors, and acknowledging institutions are connected to one another, this research focuses on the waste management system of the Indian city Chennai. A qualitative case study assesses the institutional interdependencies of this system by answering the research question: *How does the structure of the institutional network of the waste system influence the integration of the informal waste sector?* To answer it, the Institutional Network Analysis method is applied to draw such network in the form of Institutional Network Diagrams (INDs).

The method of **Institutional Network Analysis** (INA) allows to assess institutional performance in a systematic manner, through four steps. It combines the theoretical work of the Institutional Grammar, proposed initially by Crawford & Ostrom (1995), and its ABDICO syntax, as well as the Institutional Analysis and Development framework (Ostrom, 2011). Through desk research and semi-structured interviews, data is gathered about the institutions present in Chennai's waste system. The institutions are formalised into institutional statements using the syntax, which are used to draw the Institutional Network Diagrams. The INDs allow to map the institutions in a comprehensive manner. Three analyses are carried out from the INDs, 1) study of institutional misalignments, 2) calculation of network metrics, and 3) assessment of the linkages between INDs.

The informal waste sector, and in particular waste pickers, is recognised legally since 2016 in India, in the national SWM Rules. These Rules mandate Municipalities to integrate the sector, hence being the ultimate responsible for this task. The main finding of this research is that the Municipality is the **major bottleneck** for the integration of waste pickers in Chennai, which is not taking place, given the centrality this actor has on the issue. What the local authority does or does not do is the ultimate determinant. Also, 7 of the 14 institutional issues are non-conformance instances of the SWM Rules 2016, in all cases issues of **rules-in-form** that are not put into practice, at the local and state level.

From the diagrams we see that the problem with the integration of waste pickers is not related to the lack of implementation of the rules or policy. It is not even considered or discussed during local policy making. If we look at the five stages of a policy cycle (e.g., agenda setting, policy formulation, decision making, policy implementation and policy evaluation) (Howlett & Giest, 2015), the institutional non-conformance happens at the

first two stages, **agenda setting and policy formulation**. The high conformance index of SWM Agenda II, supports this finding, and the non-conformance issues pinpoint that there is a big barrier in this institutional setting.

This non-compliance seems to be explained by a **lack of political will** to tackle the issue, given past experiences and collaboration of local NGOs with the Municipality. This inaction hints at the second main finding of the research: a **disagreement between high-level** or national policy makers **and low-level** or local policy makers and officials. The former agrees on the need for waste pickers' integration as reflected by the fact that they include WPs' legal recognition in SWM policy. On the other hand, the latter seems to not agree or at least not deem this issue a priority in the local agenda.

Based on these results, policy advice is given. The key **policy recommendations** for the integration of waste pickers are summarised below, divided by the level of policy making they address:

1) **National** policy makers, for the next amendment of the Rules 2016 should aim for
    a. Mandating waste pickers' integration as social inclusion.
    b. The enforcement of the local implementation of SWM Rules, or their incentivisation via Swachh Survekshan (also state policy makers).
2) **State** policy makers,
    a. Increase state minimum wage to the national recommendation (to improve working conditions if waste pickers are formalised).
    b. Invite waste pickers to SWM policy making.
3) **Local** policy makers in Chennai's Municipality,
    a. Immediate registration of waste pickers by issuing ID cards (so they can access basic government benefits and social security schemes).
    b. Include waste pickers' integration as a priority in local policy agenda.

It can be concluded that the issue of WPs' integration is not a priority in Chennai's local agenda, and therefore, it is not addressed in the formulation of the municipal bylaws. It was expected that the problem was related with the implementation of the policy, but it is apparent now that the institutional misalignment originates from the previous stages of policy making. It is a misalignment of rules-in-form not being in-use: the issue of waste pickers integration is not a priority in the local agenda, while it is mandated by national SWM policy. This misalignment hints at a deeper conflict: a conflict in values. There exists a big gap between high- and low-level policy makers, between the ones that create the policy and the ones that actually have to implement it. High-level or national policy makers agree with the need to achieve waste pickers' integration, while low-level or local policy makers seem to not agree with this need or its urgency.

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2 Introduction

Low- and middle-income countries, in general terms, have seen a rise in the average income per capita and with it, waste generation has increased significantly. The conventional linear economy that operates globally contributes to the depletion of finite natural resources and ever-growing waste generation (Calderón Márquez et al., 2021). Managing this generation has become an important challenge for these countries, whose waste management systems operate to low standards (Aparcana, 2017). This issue has led to the adoption of informal waste activities as alternative practices to manage and dispose of the waste. These activities are referred to as the 'informal waste sector'.

Informality is very high in developing economies. The informal sector can be defined as "characterised by small-scale, labour intensive, largely unregulated and unregistered, low-technology manufacturing or provision of services; in which workers do not pay taxes, have no trading license and are not included in social welfare or government insurance schemes" (Wilson et al., 2006). This is also the case for the informal waste sector. The recycling value chain, in the Global South, typically includes informal waste workers who are perceived to be a societal problem (Calderón Márquez et al., 2021). Worldwide, around 20 million people's livelihoods depend on collecting, sorting, selling and recycling waste (Zolnikov et al., 2021).

This is also the case for India, who has experienced rapid industrialisation, translated in higher income, higher demand of products and in turn increased generation of consumer waste (Nandy et al., 2015). Informal waste workers in India contribute to closing the loop by collecting waste door to door, extracting recyclables, and disposing the remaining waste at the dumps (Jai Singh Rathore, 2020; Nandy et al., 2015). It is estimated that 30-60% of paper and cardboard, 50-80% of plastic, and nearly 100% of glass bottles are recycled (Nandy et al., 2015). Several categories of informal waste workers can be distinguished in India: garbage collectors or waste pickers, waste dealers, small stores and itinerant merchants (Nandy et al., 2015).

To tackle the increasing waste generation, some national programmes have been implemented. Such is the case of the Clean India Mission, which aims to accomplish safe waste disposal and total sanitation. Nandy et al. (2015) argue that in order to meet this goal (the Mission), the informal sector is the most ponent ally of the Government because they intend to maximise daily earnings.

Therefore, the integration of the informal waste workers in the formal waste management systems across the country remains unsolved in the country. Assuming the behaviour of relevant actors in the decision making of waste policies is guided by rules, norms and strategies, in other words, by institutions (Mesdaghi et al., 2022); the goal of this research is to study how institutional dependencies influence the success of said integration in India.

2.1 Circular Economy

Lately, the momentum of the circular economy (CE) has been increasing. The CE rationale argues for a shift from the conventional linear economy in which products and materials eventually become waste, to the elimination of the 'end-of-life' notion by means of reducing, reusing, recycling and recovering materials in all processes involved in the

production, distribution and consumption of products. However, Desing et al. (2020) assert that usually the CE is used to provide a set of 'end-of-pipe' solutions; instead, it should look at the whole picture of production and consumption.

One of the major goals of the CE is to achieve sustainable development, since it aims to simultaneously bring environmental quality, economic prosperity, and social equity (Gall et al., 2020). In this manner, both concepts are related by the Sustainable Development Goal 12, which aims to accomplish sustainable production and consumption (UN Department of Economic and social affairs, n.d.). Bearing this in mind, the efforts towards transitioning to a circular economy made by LMICs should carefully take into account their socioeconomic settings; a key part of this transition will be facilitated by the informal waste sector (Gall et al., 2020).

2.2 Informal waste sector

In LMICs, the informal waste sector typically consists of individuals or family groups of low status, sometimes (micro-) enterprises; and is characterised by being unregulated, unorganised, non-recognised, low-paid, untaxed and labour-intensive (Zolnikov et al., 2021; Gunsilius et al., 2011; Wilson et al., 2006). This sector, its structure and functioning, is highly context and region-specific (Gall et al., 2020). Usually, the informal waste activity begins by collecting recyclable materials from dumpsites, streets, or from households; next, recyclables are sold to informal junk yard owners or other intermediate dealers. The value chain in which the waste is reintroduced in the economy, normally after being sorted, aggregated, cleaned, and processed, is "rather hierarchical and non-transparent" (Gall et al., 2020). Informally recycled materials are sold directly and introduced to the industrial value chain (Gunsilius et al., 2011).

The informal waste workers, typically referred to as waste pickers (WPs), take care of the extraction of recyclables from mixed waste, "undertaking the most labour-intensive and least rewarding" work (Gall et al., 2020). Their work provides both environmental and economic benefits, however WPs experience systematic marginalisation, e.g., asymmetric power relations, exploitation, volatile prices, and their work is stigmatised as 'dirty' and 'hazardous' (Gall et al., 2020; Jai Singh Rathore, 2020). Within the informal waste activities, Gunsilius et al. (2011) distinguish two sub-sectors, 1) the informal service sector, and 2) the informal valorisation sector. The former refers to activities such as waste removal, disposal, and other cleansing activities (e.g., street sweeping, drain cleaning), in other words, what is related to the removal of 'dirt'. The latter, in turn, includes the identification of valuable materials and their extraction, processing, transport, and sale. Valorisation is the extraction of value added from waste.

As highlighted by Calderón Márquez et al. (2021), evidence confirms the informal waste sector contributes to better social, economic and environmental indicators of solid waste management. For instance, they help municipal authorities reach waste management targets and save landfill space (Gunsilius et al., 2011). In fact, the informal sector diverts more waste from disposal (e.g., landfilling) than the formal sector (Gunsilius et al., 2011).

Nevertheless, several disadvantages or issues are associated with this sector and its workers. For example, they experience negative social and economic conditions, e.g., poverty, bad working conditions, exploitation, discrimination, child labour, social rejection and lack of education (Aparcana, 2017). Regarding their working conditions, it has been proved that informal waste management is linked to negative health outcomes, the most common hazards waste pickers are exposed to are physical (e.g., slips, trips, falls) and environmental-related (e.g., heat exposure); while the most common health effects are dermal (e.g., cuts, scrapes, wounds, lacerations) (Zolnikov et al., 2021).

2.2.1 Integration of the informal waste sector

To improve informal waste workers' conditions, some efforts have been made by policy and decision makers to recognise their duty and integrate them. Integration, as in Calderón Márquez et al. (2021), involves the design, implementation, monitoring and evaluation of public policies that aim the socioeconomic inclusion of these workers within the municipal waste management systems. Integration is used interchangeably with legislation, reconciliation, and formalisation. At the same time, these policies aim for the modernisation of the waste management sector to increase its efficiency and performance.

However, these policies need to take the informal sector into account, since it has been proven that setting up new formal waste management systems without doing so can be counterproductive (Wilson et al., 2006). It is often the case that negotiations for these policies leave out informal waste workers, who end up unevenly impacted by said policies, for instance by displacing waste units to the periphery of cities (Jai Singh Rathore, 2020); or even restricting their access to materials or eliminating the sector (Gunsilius et al., 2011).

Aparcana (2017) concludes there is no particular approach to formalisation[1] which is better than the others since its success depends highly on the context of the country and city. India is an example of those countries that have implemented formalisation policies but persisting barriers hamper real integration (Calderón Márquez et al., 2021). Nevertheless, the empowerment of the workers has been repeatedly confirmed to be a key factor in achieving successful integration (Aparcana, 2017).

2.3 Research gap

Although the scientific and societal discussion on the integration of the informal waste sector is old, it remains an unsolved and contemporary issue. Most studies found refer to global analyses, generalisations, different countries or to the whole of India (Aparcana, 2017; Calderón Márquez et al., 2021; Gall et al., 2020; Jai Singh Rathore, 2020; Nandy et al., 2015; Gunsilius et al., 2011.; Wilson et al., 2006; Zolnikov et al., 2021). Although, as pointed out by Aparcana (2017), the success of policies for the integration of the informal waste sector highly depends on the context of the city or region. Therefore, a

[1] Three approaches are studied: 1) informal waste workers organised in associations or cooperatives, 2) organised in Community Based Organisations (CBOs) or Small and Medium Enterprises (SMEs), and 3) contracted as individual workers by the formal waste sector

more detailed look into the waste system can help uncover new insights into the persisting barriers of this societal issue.

By means of a case study on the waste sector in Chennai, India, this research problem will be looked at from an institutional network perspective. It is assumed that actors behave guided by interdependencies between institutions (Mesdaghi et al., 2022). How institutions can determine the creation and evolution of policies for the integration of the informal waste sector has not yet been researched. Therefore, this thesis aims to fill this gap by providing insights from said perspective.

2.4 Research objective and relevance

The major goal of this thesis is to assess the institutional interdependencies of the waste sector in a case study in the Indian city of Chennai. Ultimately, it seeks to analyse comparatively top-level institutions (such as policies) to bottom-level institutions (e.g., people's or workers' behaviours). If these two levels are not aligned, no policy put in place will be effective in its purpose. Therefore, this research's aim is to identify potential issues between these levels so they can be tackled. From the institutional assessment, the study will provide information for decision making purposes in the form of implications and recommendations for policy, with the intent of contributing to the integration of the informal waste workers.

2.4.1 Relevance to the field of Industrial Ecology

The topic of this thesis focuses on waste management with the main objective of accelerating the integration of the informal waste workers in the city under study. This is intrinsically related to the concept of circular economy, given that this sector contributes to reducing the amount of waste that goes to landfill or gets incinerated. At the same time, the recyclates or materials they recover can be used again as raw materials, closing the loop and, hence, realising circularity. Industrial Ecology can be seen as a pillar of the concept of circular economy (Ogunmakinde et al., 2021); in any case, both concepts are closely related. In more general terms, the scientific contribution of this thesis aims to be the uncovering of the relations between institutions in a specific context that has not been studied, mapping them in a systematic manner (Mesdaghi et al., 2022).

2.4.2 Societal relevance

As aforementioned, the integration of the informal waste sector is a persisting issue in the Indian society. Although recovery rates are already quite good (Nandy et al., 2015), there is room for improvement. By tracking institutional interactions and dependencies, unsystematic efforts can be prevented (Mesdaghi et al., 2022). The societal relevance of this thesis is to provide, from the theory and the insights gained from the case study, the implications drawn for a better integration of the informal waste workers in Chennai. If applicable, recommendations could be provided for other cities in India.

2.5 Research questions and research approach

In order to achieve the research objective set, the main research question below is posed. The concept of structure of an institutional network below refers to the interconnections between several institutions.

How does the structure of the institutional network of the waste system influence the integration of the informal waste sector?

To answer the main question, various sub-questions are suggested:

1. What stakeholders are involved in the waste (management) sector in Chennai?
2. What are the formal institutions in the waste system?
3. What are the informal institutions in the waste system?
4. What is the relation between the formal and informal institutions identified?

The research approach that will be deployed for this thesis is chosen based on its objective. An explanatory approach will be taken by applying the Institutional Network Analysis method to a case study. This seems appropriate since it is the nature and nuances of the local institutional context what are desired to be found. Secondly, the nature of the study will be qualitative and through desk research and interviews the results and insights will be drawn. By doing this, the nuances and detailed institutional network above-mentioned can be uncovered.

There are some advantages to this approach. It will provide very specific knowledge to the city of Chennai since the implications or recommendations will be particularly specific of the city's context. Also, by carrying out interviews with stakeholders from Chennai the information obtained should be truer to the reality of the sector than any analysis limited to desk research. On the other hand, some limitations of the study may include: 1) ability to reach all relevant stakeholders for the study, 2) bias from the stakeholders can be translated/brought to the implications or results, 3) the specificness desired makes the results and conclusions highly restricted to the city under study and hardly generalisable.

2.6 Structure of the thesis

The next chapter aims to give a good overview of the waste system in India and especially in Chennai, explaining some elements that help understand the context of the case study. Chapter 4 covers the theoretical background of this thesis which sets the ground for institutional analysis. Next, chapter 5 consists of a detailed explanation of the Methods and the steps followed during the research. Chapter 6 presents the results of the institutional network analysis, while chapter 7 is the discussion and interpretation of the results. Lastly, chapter 8 gives the conclusion of the study as well as the limitations of the research and some recommendations for further investigation.

3 The Waste System in India and informality

3.1 The Informal Waste Sector in India

The IWS is a vital part of the recycling supply chain and contributes to the circular economy, as mentioned earlier. As a supply chain, it consists of several types of stakeholders or actors that have their own characteristics, that interact with each other selling and buying recyclables.

Citizens in India are used to keeping recyclables at home to sell it to, generally, waste aggregators and itinerant buyers. These two actors pay a certain amount of money to citizens, for their waste, being the first exchange of the supply chain. Other sources of recyclables in this chain are landfills, litter in the streets or roadside bins. The waste aggregation is a key aspect of the informal supply chain: it determines how much each actor (e.g., WPs, small aggregators) gets paid, e.g., the bigger the volume of waste aggregated, the better the price.

3.1.1 Stakeholders of the Waste System and classification of the IWS

Stakeholders of the Waste System

The waste system consists of both formal and informal stakeholders. Formal stakeholders are those that adhere to the rules of the system, while informal stakeholders are those that somehow act on the side of the formal system or "under the table". The main formal actors in the waste management system at the local level are the **municipal government** (in this case, the Municipality of Chennai), as the service provider; **private processors** or **waste companies** that take on the Solid Waste Management (SWM) duties when they are outsourced; **NGOs** working in SWM or directly with WP; **experts** that are in contact with the municipal government to provide advice; **waste workers** (also known as sanitation workers), hired by either the Municipality or the private company; and **citizens** as waste generators and receivers of the service.

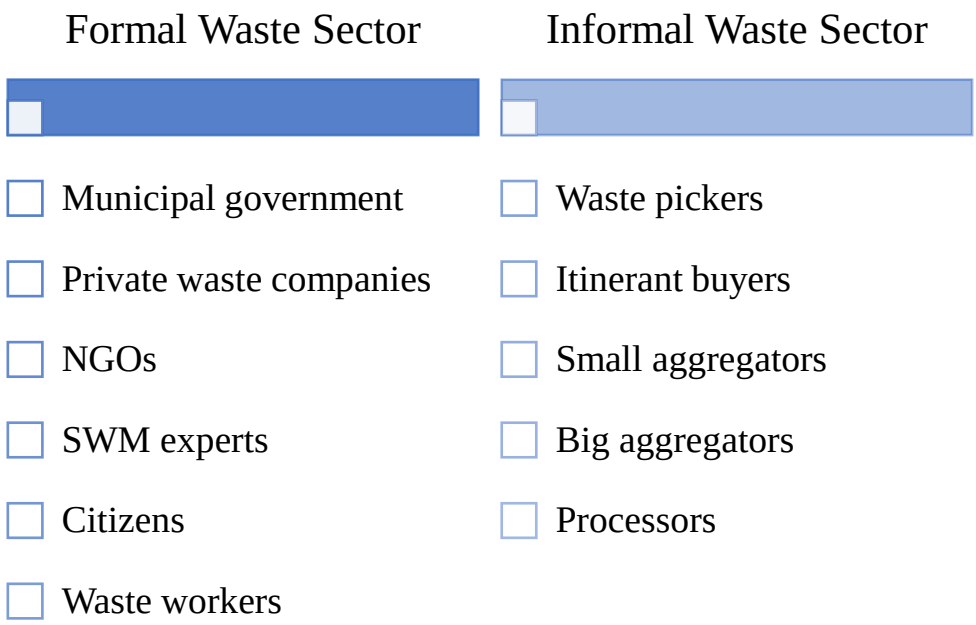

Figure 1. Main stakeholders of the local waste system, both formal and informal.

Classification of the IWS

The informal waste sector includes several categories of workers which are different parts of the waste supply chain. Starting from the collection of waste to the processing of materials: waste pickers (WP) and itinerant buyers, aggregators or scrap dealers, and processors (or recyclers) (see Figure 2).

- **Waste pickers**: WPs have no input cost or it is meagre, if e.g., they own a (motorised) tricycle; generally, they do not own any mode of transport. They extract recyclables from three different sources, in all cases **from mixed waste**: landfills or dumpsites, litter in the streets, and roadside bins. They sell what they collect to small aggregators (or small junk shops, as in Figure 2). They are the most vulnerable player of the entire supply chain, in terms of economic and social situation, as explained later in this chapter.
- **Itinerant buyers**: they own a vehicle to work. They go house to house, collecting and buying recyclables from citizens, **already segregated** (e.g., glass, cardboard and newspapers, hard plastics, metals). They sell what they collect daily to small or big aggregators. They do not have storage space.
- **Small aggregators**: they may buy several waste materials. They generally have some storage space to aggregate what they buy. They sell it, once they have gathered enough volume, to big aggregators. They are also known as scrap dealers. They usually do segregation by material type and some sort of cleaning.
- **Big aggregators**: they often specialise in one type of material (e.g., only plastics or only metals). They own a large storage space, which allows them to supply the materials when the conditions of the market demand it (CSE, 2021). They might do some processing of the material they buy, like shredding or further segregation. They are also known as middlemen, since they sell the materials they buy from small aggregators to processors.
- **Processors**: they process only one type of material. As the name indicates, they do the actual processing of waste into secondary raw materials or recycled material. They sell it back to the industry and manufacturers, closing the loop.

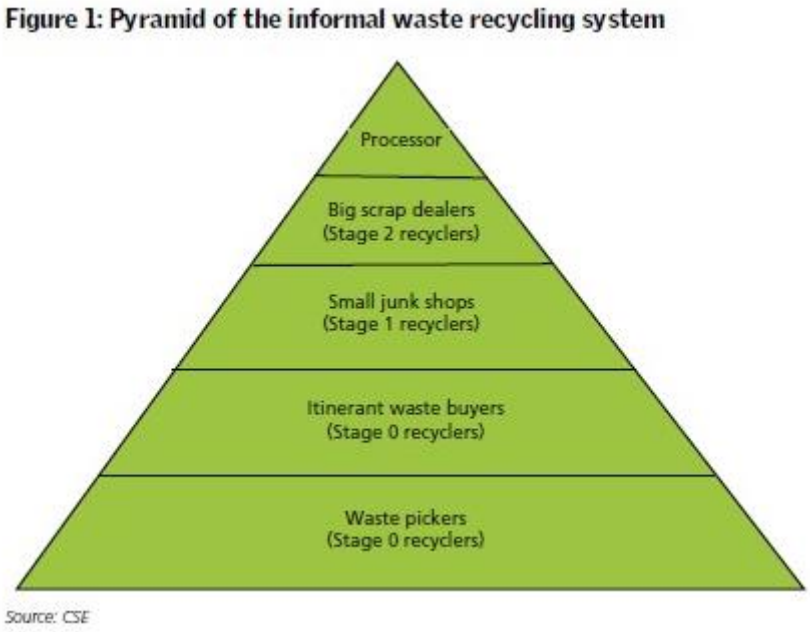

Figure 2. Classification of the informal waste sector. From CSE report on "Integration of the IWS".

3.1.2 Socio-economic status of the IWS

The socio-economic conditions of the various stakeholders in the IWS differ greatly. Big aggregators and processors are wealthy and are far from a situation of poverty. Small aggregators are not as vulnerable as waste pickers, but they could be considered to be out of the poverty threshold by a very small margin. On the other hand, waste pickers suffer from chronic poverty since they come from the lowest caste stratum, the Dalits, and are part of marginalised communities. They have to deal with the conditions below (CSE, 2021):

1. Poor living and working conditions
2. Occupational health hazards
3. Harassment
4. Social stigma
5. Child labour
6. Migrant workers
7. Exploitation by scrap dealers
8. Risk from privatisation of waste management services
9. Unstable income source

Waste pickers are perceived as dirty and are ignored by society, or even harassed. They work in a hazardous environment. At the same time, they lack access to health facilities and services. Since they are informal, they are not covered by the national labour legislation, being also prevented from accessing social security and health schemes.

3.2 Relevant policies

It is necessary to gain a better understanding of the applicable policies for Solid Waste Management and the IWS in India, both at the national and local level, as well as other strategies promoted by the central government. The operations of SWM are subject to the Solid Waste Management Rules of 2016. These Rules are an amendment of the Rules from 2000, which were the first Rules in the country to regulate waste management. In

the Rules 2016, improvements from the initial policy were introduced, such as source separation becoming mandatory. Additionally, there are rules specific for Plastic Waste and E-Waste.

These policies are part of the national law and are passed down to the state level. At the state level, each state government must adopt them and may make them stricter. In turn, they are incorporated into the municipal bylaws that govern the city. Again, they are the minimum requirements or policy that the Municipality must adapt to, but the municipal government may make them stricter.

On top of this, in 2014 the central government created the Clean India Mission (Swachh Bharat Mission, SBM) with the goal of achieving an open-defecation free India and garbage-free streets. It also supports solid and liquid waste management efforts. The first programme of SBM ended in 2019, and nowadays there is a second package in place. There are teams for every state in charge of implementing activities and projects in each state to achieve the objectives set in the mission.

In an effort to increase monitoring and enforcement of the Rules 2016 and SBM, there is a rating survey that serves as a competition among states and cities, Swachh Survekshan. In this survey, which takes place yearly, each municipality assesses their individual progress on SWM implementation (e.g., cleanliness levels, source separation, but also integration of WPs). An external and independent team goes to the field to do their own assessment of the cities' and states' progress. In this competition, the competitors (cities and states) earn more points the better their progress is; and the more points, the more funding they can receive to further improve the SWM implementation.

3.3 Solid Waste Management in Chennai

Solid Waste Management competencies or responsibilities fall under the department of Health and Hygiene. At the local level, the SWM Department is responsible for the "clearance and management of solid waste" in Chennai (Chennai Corporation, n.d.). For this they take care of the *primary collection*, which is from the source (waste generators, e.g., households, businesses, etc.) to transfer stations or Material Recovery Facilities; and the *secondary collection*, which is made with bigger vehicles from these stations or facilities to processing plants or to landfills. The Municipality is also responsible for waste disposal, which is the main fate of collected waste currently. Primary collection is done door-to-door, following national regulations. There are two main landfills in Chennai: Kodungaiyur and Perungudi, which are not scientifically managed.

The city is divided into so-called zones. Each zone, in turn, is divided into *wards*, which are smaller areas that have certain operational duties that are carried out in a decentralised way. To do so, there are zone offices as well as ward offices, where the duties are coordinated. The SWM services are outsourced in some of these zones; outsourcing or privatisation of these services is a trend that is observed in the rest of the country. A private company takes on the daily duties of waste collection (door-to-door), its transportation and disposal (and sometimes processing).

Source separation is mandatory for three waste streams: dry waste or recyclables, wet waste or biodegradable and hazardous waste. In order to reduce the waste sent to landfill, the municipality encourages source separation (Chennai Corporation, n.d.). However, it

remains a challenge to achieve full separation: it is encouraged in law but it is not practiced. Wet or biodegradable waste is processed in a decentralised manner in the so-called Micro-Composting Centres (MCC) through composting and bio-methanation.

The law distinguishes two types of waste generators: small and medium, such as households and small businesses; and bulk waste generators, such as big apartment complexes, industries or hotels. Depending on the category a waste generator belongs to, they have different obligations. Small and medium generators are expected to pay a user fee and hand over their waste to either municipal workers or private waste workers (if they generate waste in an outsourced part of the city). However, if a waste generator creates more than 100kg of waste a day is considered a bulk generator and must set up, in some cases, a facility to treat their own waste, in their premises.

Despite policy efforts, recycling or waste processing is not widely adopted and waste is mostly disposed of, unscientifically, in the two landfills of the city. Beside the scarce public participation in source separation, there is not an integrated waste system in place that can handle segregated waste, meaning that separate collection and/or transport is not guaranteed either.

3.4 Integration efforts in Chennai

The integration of the informal sector within waste management systems has long been studied in literature. Velis et al. (2012) claim this integration can be beneficial not only for the informal stakeholders but also for the formal system since it has the potential of increasing recycling rates and reducing cities' expenditure on waste management. For the informal workers, their integration would bring about more secure livelihoods and tackle health and occupational hazards they are exposed to otherwise.

There have been various efforts by different parties in the last few years in India. Nationally, the law (SWM Rules 2016) mandates municipalities to recognise waste pickers and to integrate them in the municipal SWM systems, ideally in waste collection or processing services. In this way, they would have a "dignified" job and would stop working at open landfills with mixed waste, with the associated risks. Then it is the decision of the Municipalities to choose when or how to do this task. In the 1990s, there was a movement created by a local NGO in Chennai that managed to integrate waste pickers in the municipal duties of SWM with the Municipality, that is door-to-door waste collection. After a few years, this collaboration stopped.

More recently, in 2015, a local citizen platform collaborated with the Municipality of Chennai in setting up the so-called "ID camps" at the city's landfills where they would register the waste pickers working there by giving them an ID card. In these camps, they also carried out a survey to better understand waste pickers' needs. However, nothing was done with this information and the registered WPs' integration was not continued. Currently, neither the Municipality nor the contractor (outsourced company) integrate informal WPs in their activities.

4 Theoretical background for institutional analysis

In order to understand the theoretical basis of this research, the key concepts of the institutional analysis approach taken need to be explained. This thesis relies on the academic work around institutional analysis as initially defined by Crawford & Ostrom (1995), using the Grammar of Institutions. This body of academic work seeks to analyse and/or design policies, under the assumption that a policy is effective when it considers and understands what guides human behaviour (Watkins & Westphal, 2016). Due to this advantage at identifying issues that prevent policies from being effective, this method is chosen. Because the issue under study can be understood as conflicting formal and informal practices that are not captured by policies, an institutional analysis can shed light on the factors or barriers that limit the effectiveness of these policies.

As defined by Crawford & Ostrom (1995), institutions are "enduring regularities of human action in situations structured by rules, norms and shared strategies, as well as by the physical world". These rules, norms and shared strategies are created and shaped by human interaction in "frequently occurring or repetitive situations" (Crawford & Ostrom, 1995), and in turn they influence the choices of individuals; they make up the entirety of institutional statements (Watkins & Westphal, 2016). To study any institutional statement, both formal and informal, the ADICO syntax of the grammar of institutions, as proposed by Crawford & Ostrom (1995), provides a promising framework to assess institutions in a structural manner. In order to provide useful recommendations for institutional reform, one needs to conduct systematic, comparative institutional assessments (Ostrom, 2011).

The method of Institutional Network Analysis is based on the theoretical blocks of the Institutional Grammar, and the Institutional Analysis and Development framework, as well as on the principles of Social Network Analysis. INA has been applied to studies of institutional compliance of various fields, such as flood risk management and climate adaptation (Ghorbani et al., 2022; Mesdaghi et al., 2022). It seems relevant to apply it to the case of the integration of the Informal Waste Sector in Chennai, given the national mandates explained for said integration and the seemingly lack of progress in this regard in the city.

4.1 The Grammar of Institutions

The Grammar of Institutions or Institutional Grammar (IG) was proposed by Crawford & Ostrom (1995) as a theoretical structure to analyse institutions and their elements, as well as the potential impact they might have on human behaviour, through a systematic coding process (Bushouse et al., 2021). This theoretical structure is a tool that has proven useful to provide a common framework for synthetising and understanding the content of institutional statements (Crawford & Ostrom, 1995; Basurto et al., 2010; McGinnis, 2011).

An institutional statement is a "shared linguistic constraint or opportunity that prescribes, permits or advises actions or outcomes for actors"; said constraints and opportunities are either spoken, written or tacitly understood by the actors in a given empirical setting (Crawford & Ostrom, 1995). In the IG, institutional statements are expressed as sets of 5 components, which are the unitary elements of the ADICO syntax (Crawford & Ostrom,

1995; Watkins & Westphal, 2016). The syntax identifies these components that are common to every institutional statement (Crawford & Ostrom, 1995; Bushouse et al., 2021): **A**ttribute, **D**eontic, a**I**m, **C**onditions, and **O**r else (ADICO).

A: *attribute*, actor (individual or corporate) to whom the institutional statement applies.

D: *deontic*, prescriptive operator that specifies if an action *may, must or must not, should or should not* be undertaken by the relevant actor.

I: *aim*, denotes the action of the institutional statement.

C: *conditions* under which the statement is deemed appropriate or relevant for application.

O: o*r else*, denotes the sanction to be applied if the statement is not complied with.

The deontic (D) adds information for individuals about what they expect of other individuals' behaviour and adjust their response accordingly (Crawford & Ostrom, 1995). More recently, the syntax incorporated an additional component, the *object* (B), becoming ABDICO (Siddiki, Weible, Basurto and Calanni, 2011). The object receives the action of the institutional statement; it is also understood as the outcome of the statement. The advantage of introducing the object in the grammar is that it clarifies who conducts the statement (attribute) and who it affects (object) (Watkins & Westphal, 2016). The syntax proves useful since any institutional statement can be expressed in these 6 basic components, no matter how they were expressed in natural language, which allows for comparison, analysis and synthesis advantages (Crawford & Ostrom, 1995) for understanding complex policy issues (Basurto et al., 2010).

4.2 Institutions: definition and types

Institutions are "human-constructed constraints or opportunities within which individual choices take place and which shape the consequences of their choices" (McGinnis, 2011). Roggero et al. (2018) define institutions as shared practices that individuals use to address mutual interdependencies and in doing so, they shape individual behaviour; they take various shapes, such as "laws, regulations, habits, customs, standard practices, professional codes, protocols, agreements, conventions, traditions". Institutions can be classified as formal and informal. They are **formal** when they are in statutes, regulations or bylaws; they are **informal** when they are spoken or tacitly understood as social norms or cultural practices (Watkins & Westphal, 2016).

So far in this chapter, the terms institutions and institutional statements have been used interchangeably, but a difference exist between them. Institutional statements are linguistic elements, they are either spoken or written; while institutions are rather an abstract or conceptual definition with no linguistic components (Basurto et al., 2010). Institutional statements can be classified in three types:

Rules: institutional statements that contain all the components of the ABDICO syntax. It differs with the other types in having a tangible or explicit sanction (the "Or else").

Norms: contains the components ABDIC. Watkins & Westphal (2016) state that norms are "strong motivational and guiding forces of human behaviour". Even though they do not contain a tangible sanction, they involve some kind of social pressure or expectation that influences individual behaviour.

Shared strategies: contains only ABIC. They do not involve any social expectation, unlike norms and rules. They represent average or usual behaviours or habits.

4.3 The Institutional Analysis and Development (IAD) framework

The framework for Institutional Analysis and Development was proposed by Ostrom (2011), with the purpose of creating a "systematic, comparative institutional assessment" to avoid giving naïve policy recommendations for reform about "good" or "bad" institutions, but rather assessing the performance of said institutions. This framework originates from systems approach applied to policy processes (McGinnis, 2011).

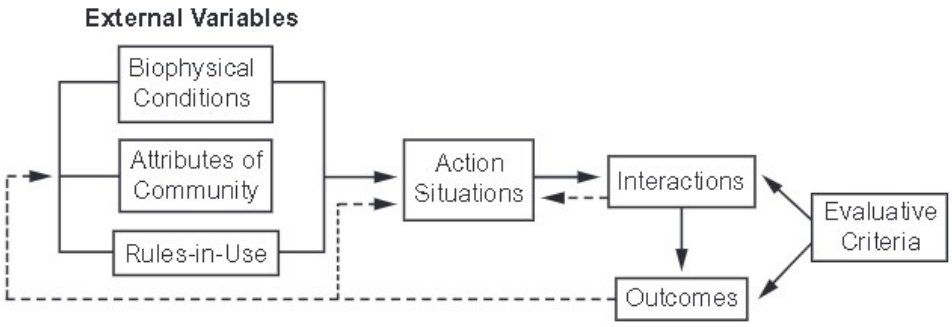

Figure 3. The IAD framework. From Ostrom (2011).

The IAD framework introduces the concept of **action situation**, central to institutional analysis. This concept can be used to explain behaviour in a given institutional arrangement (Ostrom, 2011). An action situation is "where actors (individual or corporation) observe information, select actions, engage in patterns of interaction, and realise outcomes from their interaction" (McGinnis, 2011). The definition of action situations helps in the design of the research and data collection as well as in clarifying the representation of results and their interpretation.

Rules can be further distinguished or classified as **rules-in-form** and **rules-in-use**. Rules-in-form are written rules, in policy for example; while rules-in-use are rules that society follows, that are *in use* by individuals. Rules can be in-form but might be not practiced or incorporated by society, therefore being not in-use. This distinction is particularly interesting for studying cases where written rules and policies are not practiced or complied with by individuals. Analysing the misalignments between the two types of rules can help identify dysfunctionalities in a given institutional configuration or setting. The IAD framework has been widely used for diagnosis purposes, particularly for the identification of these dysfunctionalities due to missing institutions (McGinnis, 2011).

5 Methods

In this chapter, the steps that were undertaken during the research are explained in detail. These are the four steps of the method INA (see Figure 4). The chapter is divided in 5 sub-sections where it is shown what was done for each step, an extra sub-section is included to show how the drawing of the diagrams was done. The method of Institutional Network Analysis, as proposed in Ghorbani et al. (2020), studies institutional dependencies and configurations. It sheds light on how actors are connected by institutions in decision making processes, helping understand power positions, responsibilities and dependencies (Mesdaghi et al., 2022). In this context, it is assumed that actors' behaviour is guided or influenced by institutions. This method is based on the Grammar of Institutions, which develops a syntax for institutions, understood as shared strategies, rules and norms (Crawford & Ostrom, 1995).

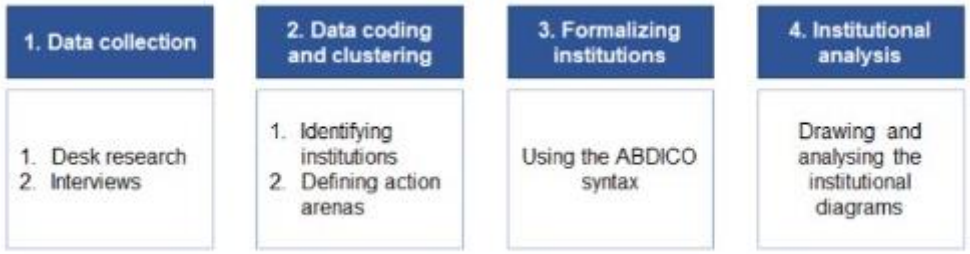

Figure 4. Steps of the method Institutional Network Analysis (INA). From Mesdaghi et al. (2022).

5.1 Data collection

In order to acquire a good understanding of the context of Chennai and the IWS in the city, knowledge was gathered through desk research, mainly reviewing grey literature (news articles on SWM and IWS, reports, official websites…). This was also useful to map the relevant stakeholders that play a part in the system. For the actual data collection, official documents (reports) were studied as well as legislation related to SWM and IWS integration (SWM Rules 2016, Chennai Bylaws). From there, several rules that are applicable to the issue under study were extracted, as well as additional and contextual information.

Identifying the relevant stakeholders is the first step before carrying out interviews. From a preliminary list with broad categories of the stakeholders, further research was done into specific organisations and individuals that could be interviewed. Respondents were selected based on whether they are knowledgeable about the IWS, they are part of a decision making body or government, or if involved directly with IWS. Most candidates were reached out via email and a few via phone call, whose personal details were found on the organisations' public websites and social media. In the email, the goal of the study was explained as well as why their participation was important, and how they could participate (joining a videocall on Teams preferably, or via phone call), as well as the expected duration of interview.

Some of the candidates that were reached out redirected me to a colleague of theirs. Since the research is conducted from the Netherlands, and the case study is on Chennai, the interviews were conducted online using Microsoft Team or Zoom. Given the transcription features of these programmes, they were preferred. Four interviews were done via phone

call due to the respondent's preference or availability. See Table 1 for the main stakeholder categories and the organisations interviewed.

Table 1. Stakeholder categories and organisations interviewed.

Relevant actors	
Government bodies	Greater Corporation of Chennai, SBM implementation team in Tamil Nadu, CHEEO (policy making body)
Experts	IIT-Madras, Centre for Science and Environment (CSE), Kabadiwalla Connect, Anna University
Private sector	Waste processor
NGOs	CAG, Exnora, HHI, NOF
WP organisation	SWaCH, Alliance of Indian Waste pickers (AIW)

A total of 16 interviews (including 4 phone calls) were conducted, with a length between 25 minutes and 1 hour. The interviews were semi-structured, with a list of key questions to be asked and topics to be covered, also used to guide the interview. Conducting semi-structured interviews helps ensure there is freedom and flexibility to "divert" if something else comes up in the conversation. The topics were identified during the desk research phase. The questions were crafted in a way that they could cover these main topics or issues, while also inquiring about institutional information and ambiguities. The questions were carefully arranged in order, from less sensitive topics to more sensitive so that the respondent felt comfortable sharing their knowledge and opinions. The list of topics with example questions is shown in Table 2. Find the full list of interview questions in Appendix B: list of interview topics and questions.

Table 2. List of covered topics during the interviewing stage and some example questions.

Main topics	Example questions
Persisting barriers for the integration of the IWS	-What are persistent barriers for the real integration of IWS?
Potential measures that can be implemented	-What measures and/or policies do you think could be implemented to achieve real integration of the informal sector?
Rules and guidelines that apply to the sector and, in particular, to the integration of IWS	-Can you give a general overview of what the Rules 2016 meant for SWM and the IS?
Interaction between stakeholders: IWS-FWS, IWS-Municipality, IWS-society, and within IWS	-What is the social perception of the IWS? -Can you elaborate on what are typical situations where WP or IWS might suffer harassment from the authorities or other?
Common problems/issues between informal stakeholders (especially, WPs and aggregators)	-Can you elaborate on what are typical situations where WP or IWS might suffer harassment from the authorities or other?
Views on (integration of) the IWS	-What is the priority for Organisation X when it comes to the integration of IWS?
Information asymmetry regarding price among informal stakeholders	-How do you think it can be ensured that informal workers (WPs) get a fair price?
Implementation status (actual integration efforts)	-What is the current situation of the IWS in Chennai? What has been done?

Decision-making processes at the local level (regarding IWS)	-Are there any conflicts in what parties or stakeholders consider a successful IWS integration?

Despite carefully arranging the questions in order, in the moment of the interviews the questions varied, as well as their order depending on the interviewee and their expertise, openness and time availability. Emphasis was placed on trying to fill the knowledge gaps I had about the system.

While working on the interview questions, a consent form was created and emailed to the selected organisations and respondents about whether they agreed to participate in the research under the conditions given (e.g., recording of the interview). The respondents that participated agreed in written form to the consent. The interviews were recorded and transcribed, using the specific software or programme. The transcripts are the starting point for the next steps of the method.

5.2 Data coding and clustering

Identifying institutions

From the interview transcripts, institutions were identified. The transcripts needed double-checking (listening to the recordings again) since the jargon, and other elements, were not picked up by the software. A first read of each transcript was useful to understand the content of each interview and identify where in the transcript was the most important content, which was highlighted in bold. In a second read of the transcript, more in detail, every piece of information (e.g., sentence or paragraph) that had the potential to be an institution was highlighted (in a different colour) in the transcript for the next step to be translated into the ABDICO syntax.

Defining action situations

Ideally the action situations are defined before designing the interview questions (to serve as a guide and inspiration). Initially, the AS were defined using the stages of waste management processes, e.g. waste generation and collection, waste transportation, waste processing and waste disposal. This choice was made due to a lack of a standardised or established process for the integration of the IWS.

Unfortunately, this choice was not appropriate and did not reflect the system properly. There were other aspects that are related to the integration process that were not shown in these stages of waste management processes. Therefore, the action situations were redefined after the interviewing phase once the data was analysed; I had to resort to backtracking to define the new AS.

Once all the transcripts were processed and patterns were apparent, data was clustered around the main topics (e.g., interaction between the IWS and the FWS, interaction between the IWS and society, or dynamics of IWS). To do so, visual tools e.g., a mind map, were used to aid the synthetising process given the amount of information gathered from the interviews. The redefined AS were used to cluster the identified institutions and data under them. Also, subtopics, within the action situations, were identified. For instance, within the AS Interaction between the Informal and the Formal Waste Sectors, grouping institutions about interaction with the Municipality and in a separate sub-group

interaction with the private contractors. This helped sort the institutional statements in the Action Situations as well as to distribute them in the diagrams. It is easier to find a relationship or dependency between 2 sub-groups (or within a sub-group) than connections between every possible institutional statement. These Action Situations served to define and create the different Institutional Network Diagrams.

5.3 Formalising institutions

From the institutions identified in the pieces of text from the transcripts and from the written documents analysed, it is necessary to process them to convert them into institutional statements using the ABDICO syntax. An institutional statement is a "shared linguistic constraint or opportunity that prescribes, permits or advises actions or outcomes of actors […] they are spoken, written or tacitly understood in form intelligible to actors in an empirical setting" (Crawford & Ostrom, 1995). Given that the research analysed both written sources and interviews for institution identification, it is necessary to consider how to do it for each type of source differently.

On the one hand, to extract institutions from written documents Basurto et al. (2010) was followed; they propose a series of steps for documents such as laws and policies. On the other hand, there is not a stablished set of steps or procedure for extracting institutions from interview transcripts.

Identifying the components of institutional statements

Institutional statements consist of six components, as per the ABDICO syntaxis.

- Attribute [**A**], the actor who carries out the institution or to which the institution applies.
- Object [**B**], the receiver of the institution.
- Deontic [**D**], it expresses obligation, permission, or prohibition (must, must not, may, should, should not).
- Aim [**I**], the "what" or the action of the institutional statement.
- Conditions [**C**], they express under which conditions (where, when, how) the institution occurs.
- Or else [**O**], sanction that is to be applied if the institution is not followed.

As explained in chapter 4, *Theoretical background for institutional analysis*, rules are institutional statements that contain the 6 components. Norms consist of 5 of them, ABDIC; and shared strategies of 4, ABIC. For rules, the sanction when the statement is not complied with is explicit or tangible. When formalising institutions, institutional statements were considered rules when they had explicit sanctions or when they were extracted from official or legal documents (laws, tender contracts or policies). For norms, when the statement expressed obligation, permission or prohibition but there was no sanction associated. A statement was coded as a shared strategy when it did not contain any deontic, nor sanction.

It is important to note that there are usually two types of objects implicit in institutions: animate and inanimate. For instance, "Municipality must provide waste pickers with ID cards if waste pickers are not registered". In this case, both waste pickers and ID cards can be considered objects of the institutional statement. Waste pickers would be the animate object, while ID cards the inanimate object. For the sake of the method and the

networks, the animate objects are coded as part of the aim [I] for the syntax and its representation in the diagrams. In this case, the aim would be: “provide waste pickers with”, and the object: “ID cards”.

5.3.1 Identifying institutional statements from documents

To identify statements from written documents, the steps proposed by Basurto et al. (2010) were followed. They advise the following 6 steps:

1. Identify and disregard all definitions, titles, preambles, and headings.
2. Identify sections and sub-sections of the policy as initial units of observation. They may be subdivided into smaller units when they contain more than one institutional statement.
3. Divide each unit sentence by sentence.
4. Code each unit of observation using the ABDICO syntax.
5. Once they are expressed in ABDICO form, classify the statements in rules, norms or shared strategies.
6. For the units of observation containing more than one rule, norm or strategy, separate them and code them using the syntax and classify as rules, norms or shared strategies.

5.3.2 Identifying institutional statements from interviews

As aforementioned, there is no established set of steps in literature that can be followed to identify institutional statements from interview transcripts. Watkins & Westphal (2016) give recommendations on how to approach this task based on their experience. These recommendations are merely advice rather than clear steps to follow.

The highlighted pieces of information in each interview, from step 2, were put in a separate document to process the information more clearly (excel, each unit of observation would be one row). Similarly to Basurto et al. (2010), they were divided into units of observation and the aims (verbs) were highlighted in bold. After this, the attribute was identified for each unit. In the next stage (in a different tab), the object and conditions were coded. After this, the deontic was identified where applicable. Lastly, for those statements that were rules the sanction was coded. Once all the components are coded, the statements can be classified into rules, norms or shared strategies. Below there is an example of how an institutional statement is extracted from a piece of interview transcript:

“They [WP] may be transient, look at a scrap shop and say I'll get you material and that guy [aggregator] has no trust in them and gives them really bad pricing.”

[A] Small aggregators [I] give WP [B] bad pricing [C] if transient WP (Shared strategy).

5.4 Institutional Network Diagrams

From the full list with the coded institutional statements, the statements were sorted in the different action situations. After sorting out all the statements, they were put in diagram form (following the conventions of the INA method, see Figure *5*-Figure *13*). Institutional Network Diagrams are a graphical representation of the networks of institutional statements in an action situation. The attribute of a statement (see Figure *5*) is connected to the condition with an arrow, which is in turn connected to the object with another arrow. The latter arrow represents the aim and the former may contain the deontic if it is a norm or a rule.

To make the diagram more understandable visually, a colour code is applied to distinguish the three types of statements: shared strategies are blue, norms are orange and rules are green (see Figure 6). Note that the components of Attributes, Conditions and Objects remain black and only the arrows and the text accompanying them is coloured differently.

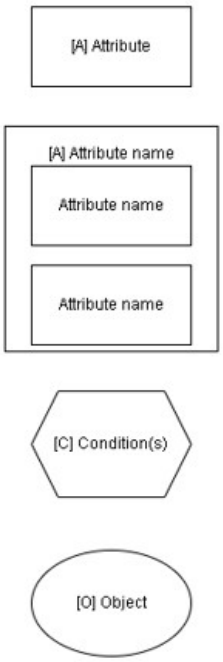

Figure 5. The components of the ABDICO syntax, except the aim [I] and deontic [D].

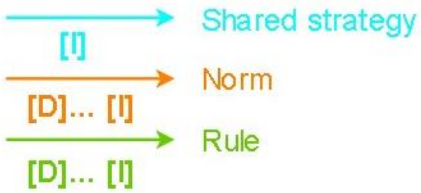

Figure 6. Depending on the type of institutional statement, the arrows (aim and deontic) take one of these three colours.

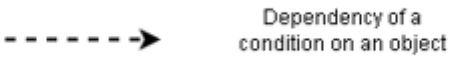

Figure 7. A dashed line is used to connect different institutional statements.

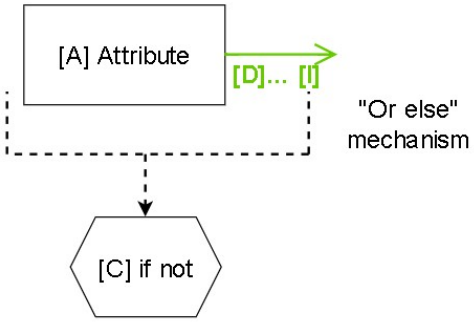

Figure 8. The "Or else" or sanction takes this representation.

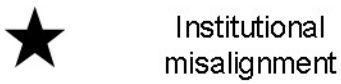

Figure 9. Institutional misalignments are represented as black stars.

Once all the conventions of the representations are explained, Figure 10 shows an example of the visualisation of an institutional statement, and how different elements are combined and linked. Note that PPE means personal protective equipment, and WPs waste pickers.

[A] WPs [D] must [I] use [B] PPE [C] when PPE is made available.

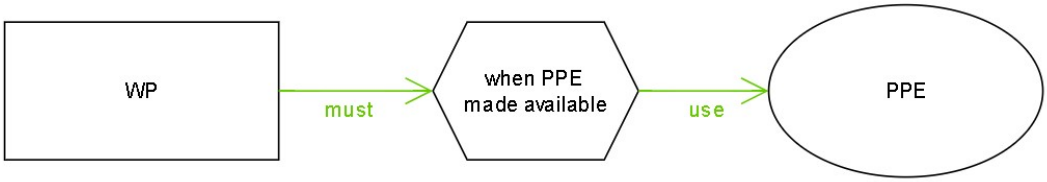

Figure 10. Visualisation of an example of institutional statement.

After all institutional statements are drawn, it is necessary to find the connections between all of them and relate them to each other; specifically, how one institution activates another one. This activation occurs from the object of the first one, to the condition of the second one (see Figure 13). This means that the attribute of the first institutional statement influences the behaviour of the attribute of the second institutional statement. The second statement can only take place when the first one occurs, so when the aggregated waste is sold to the processor.

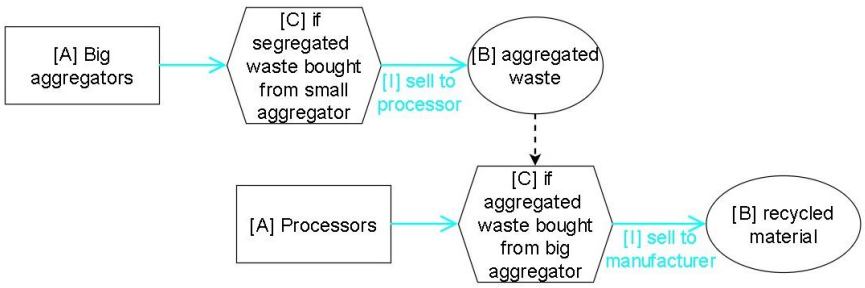

Figure 11. Example of how two institutional statements can be connected, always from the object to the condition(s) of the next.

Institutional misalignments or issues represent dysfunctionalities between formal and informal institutions. There are different types or degrees of misalignment. The most apparent occurs when two institutional statements share all the syntax components except one, the aim or the object (see Figure 12). This means that, for the case of different aims, one attribute is supposed to do a certain action but does something else or the opposite. In the example below, the Municipality must ensure WP's job recognition, but in practice, they do not ensure it. This type of institutional issue was referred to as institutional conflicts or non-conformance in previous works using the INA method (Ghorbani et al., 2022; Mesdaghi et al., 2022).

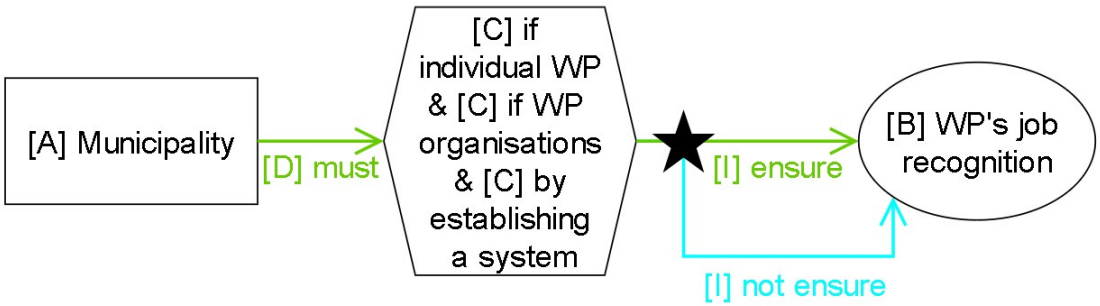

Figure 12. Example of institutional misalignment between two institutional statements differing only on the aim.

In other cases of misalignment, two statements might share the attribute, at least one condition and the object or the aim, as shown in Figure 13. In other words, institutional statements that, apart from differing on the aim or the object, also differed in one condition, while sharing the other one(s). This type of misalignment is less apparent, indicating in any case some malfunctioning of the system. For example, waste pickers must not lend the money from the (government) loan to other people when they are given the loan; however, some waste pickers may misbehave and do so to profit from it and hence not complying with the formal statement.

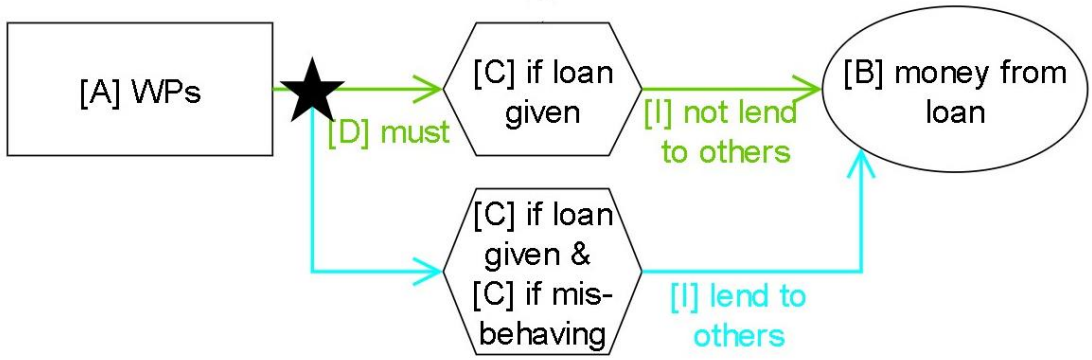

Figure 13. Example of an institutional misalignment when two institutional statements differ also on the condition(s).

5.5 Institutional Network Analysis

Once all the diagrams are constructed, the actual analysis of the institutional networks can be done. There are three possible types of analysis, that are complementary: 1) assessing the institutional misalignments that come up from the diagrams, 2) calculating the network metrics, and 3) studying the interconnections between diagrams. The institutional misalignments pinpoint issues between formal and informal institutions. The second form adds a quantitative dimension to the analysis. For the third type, the connections between diagrams happen when an institutional statement (or object) is present in more than one diagram.

The network metrics that are calculated include: 1) **centrality** of attributes in each Action Situation or diagram, 2) **embeddedness** of objects for each diagram, 3) **Institutional Dependency Rate** (IDR) or density of the network (how linked the institutional statements are), and 4) **Conformance Index** (CI) between formal and informal institutions. The figure below explains how each metric is calculated.

Metric	Calculation	Range
Centrality	Number of links per attribute connecting them to conditions, divided by the average number of links per attribute connecting them to conditions.	Range: [0, ∞] A high value for an attribute implies an important position in carrying out institutions.
Embeddedness	Number of links directed out of the object, divided by the total number of links (in-degree + outdegree) per object. Note that these links are counted across all diagrams per object if the object is repeated in more than one diagram.	Range: [0, 1] A high value for an object implies that a large number of institutions are dependent on this object for their execution.
Institutional dependency rate (IDR)	Number of outdegree links from all objects divided by all possible outdegree links. This means every institutions (i.e. object) being connected to all other institutions. Since this is only possible through conditions and there is only one condition per institutions, counting conditions is the same: All possible connections = 0.5 *conditions * (conditions – 1) Note, while counting outdegree links of objects, all diagrams should be considered if the objects are repeated across diagrams.	Range: [0,1] A high value for a diagram implies that a large number of institutions rely on the execution of other institutions to execute.
Conformance index	Total number of links connecting conditions to objects divided by total number of conditions (i.e. institutions).	Range: [1, ∞] Value 1 implies no conformance issue, while the higher the number, the more institutions that face conformance issues.

Figure 14. Table explaining how the network metrics are calculated. Taken from Ghorbani et al. (2020).

6 Results of the Institutional Network Analysis

This chapter presents the results of the INA applied to this case study. Firstly, the system and its scope are defined, together with the action situations and assumptions that need to be noted. Then, the Institutional Network Diagrams (INDs) and the uncovered institutional misalignments are presented and described. The analysis of the results takes three forms: 1) the institutional misalignments that come from the INDs, 2) the network metrics calculated for each action situation, and 3) the linkages between INDs.

6.1 Defining the system under study

It is important to be aware of what is considered part of the system and what is not studied. In this case, the system is the informal waste sector in the city of Chennai. It concerns municipal solid waste and all the actors that participate in the management of said waste, both formal and informal. In fact, only the so-called dry waste, or recyclable waste, is considered; even though biodegradable waste makes up almost half of the entire waste generation. However, it is only the recyclable waste that the Informal Waste Sector deals with, since it is this waste that they can sell and has value in the market. Recyclable waste is usually metals, hard plastics, glass, paper, cardboard…

6.1.1 Definition of the Action Situations (AS)

In order to make sense of the collected data and cluster it in a logical manner, Action Situations (AS) need to be defined. Since there is no established system or framework with defined steps for the integration of the IWS, the AS were chosen in an attempt to represent the system as comprehensively as possible. That is, the interaction of the IWS with the other parts or aspects of the system. The AS selected for this study are seven: 1) Informal waste supply chain (IWSC), 2) Market and the informal waste supply chain, 3) Interaction between IWS and Formal Waste Sector (FWS), 4) Interaction between IWS and society, 5 and 6) Solid Waste Management Agenda I & II, and 7) Municipal integration obligations.

Table 3. Definition of the chosen Action Situations.

AS 1: Informal waste supply chain (IWSC)
This AS includes the relations between the different informal stakeholders around their business interactions, buy-sell relationships, that conform the supply chain. It starts from the extraction of recyclables from the WP and sale to small aggregators, until the material reaches processors, and it is converted into recycled or secondary raw material. It also includes the nature of their relationships, which is informal in itself, but involves mutual expectations and a certain degree of loyalty or trust.
AS 2: Market and the informal waste supply chain (IWSC)
Intrinsically related with the previous AS, this one exclusively describes how the market sets the price and influences the entire supply chain and its pricing mechanisms. In slightly more detail, the power relations related to price between small aggregators and waste pickers are included and potential issues about waste pickers receiving a fair price.
AS 3: Interaction between IWS and FWS

This AS entails how the Informal Waste Sector behaves with the formal part of the waste system. That is, the processes that would take place and institutions that would exist if waste pickers were hired by either the Municipality or by a private contractor for SWM services.
AS 4: Interaction between IWS and society
In order to cover the issues of social perception and stigma that affect the IWS and particularly WPs, this AS was deemed necessary. It includes the current perception that society has of this sector, as well as the influence of caste in this phenomenon and how caste shapes the informal waste supply chain.
AS 5 & 6: SWM Agenda I & II
The Solid Waste Management Agenda describes the processes and hierarchies of policy making and how the national policy is passed down to the local sphere. Also, the priorities that are set by the different levels of policy making in the SWM Agendas. It is divided into two diagrams for the sake of readability: the SWM Agenda I covers the national level, and the SWM Agenda II addresses the state and local level.
AS 7: Municipal integration obligations
In this AS, the obligations that the Municipality has regarding the integration of the IWS are mapped. These obligations are set nationally, by the national SWM Rules 2016, and need to be complied with and implemented at the local level. The obligations include ensuring waste pickers have access to recyclables so their source of livelihood is not threatened, as well as promoting their integration in the formal waste system by means of their participation in the municipal SWM services, among others. Most WPs do not have identification or identity proof (e.g., ID cards) that recognise them as citizens of India. Therefore, one of the obligations is to promote the registration of WPs via ID cards by the Municipality.

6.1.2 Case study's assumptions

This research relies on some assumptions. In terms of data coding, it is assumed that institutional statements with deontic but without tangible or formal sanction (ABDIC) are considered rules when they represent formal responsibilities or when they are extracted from official documents, such as laws and regulations, policies or contracts. Otherwise, they are classified as norms, following the rules of the IG (Institutional Grammar). Regarding the definition of the Action Situations and drawing of the INDs, it is assumed that the AS are independent and separate from each other. The AS do not follow any particular order since they do not represent steps or phases of a process, as aforementioned; but they aim to cover the entirety of the system. However, in reality they are related to each other because they are parts of the same system. Therefore, the INDs represent a more fragmented and static view than reality.

6.2 Institutional patterns and conformance

This sub-section contains the results of the first two types of analysis of the method: the institutional misalignments, and the network metrics. Both are described together with the insights brought by the diagrams themselves. The results are given for each action situation or diagram separately. For the full diagrams and the calculated metrics in detail for every IND, see Appendix C: Institutional Network Diagrams and Appendix D: Institutional Network Metrics, respectively.

6.2.1 Institutional patterns and conformance in the IWSC

This action situation contains the relationships between the informal actors that conform the waste supply chain through their transactions, as shown in Figure 15. Once WPs gather enough volume of recyclables, they go to small aggregators' shops to sell it. Small aggregators also buy recyclables from private houses, who are incentivised to keep this waste by the money they get in exchange. The small aggregators sort the recyclables and might clean the material; they aggregate bigger volumes to sell to the next level of the supply chain, big aggregators. The big aggregators own large storage spaces so they can store enough volume of segregated material to sell to processors. Processors convert the waste into recycled or secondary raw materials, which are sold back to the manufacturing industry.

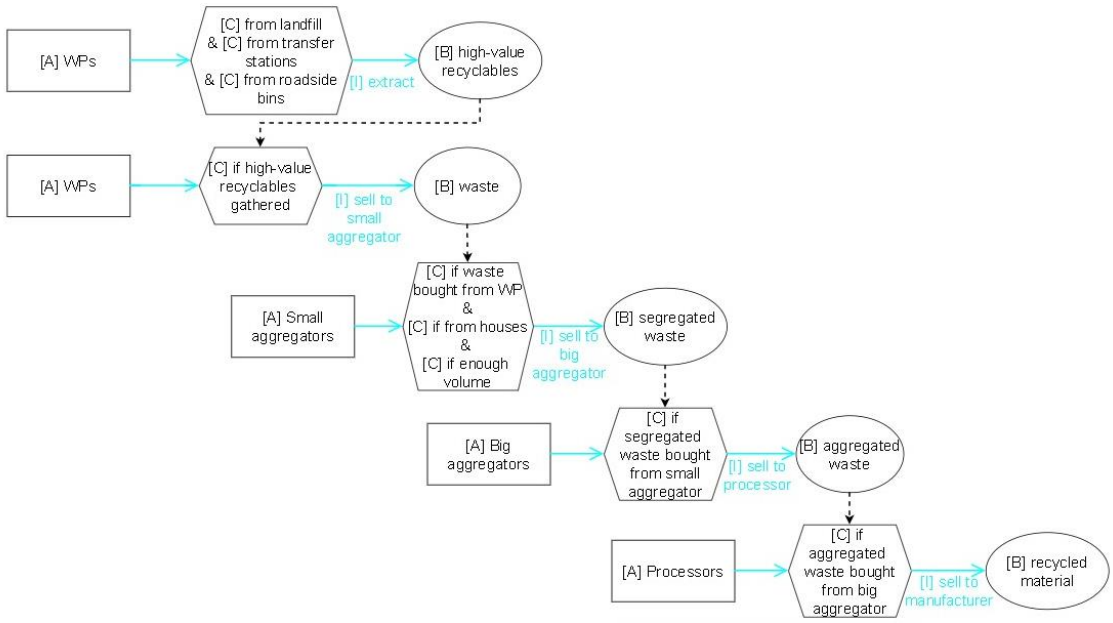

Figure 15. Excerpt from the IND: Informal Waste Supply Chain, showing the key actors that conform it and their commercial exchanges.

Small aggregators are the most central actor (C=1,75) in this diagram due to their relative position in their interaction with waste pickers. This interaction is in nature informal, but it is based on mutual loyalty and expectations. In fact, "WP loyalty" is the most embedded object of the network (E=0,75). An example of this is the fact that small aggregators make verbal contracts with waste pickers, when a waste picker brings them recyclables on a regular basis. When small aggregators count on regular waste pickers, they do better business. If a contract is made, the waste picker must comply with the conditions set, which usually involve waste quality standards, the volume they need to gather and by when waste pickers should bring the aggregators this volume.

The conformance index of this network is low (CI=1,13) since the network contains only two institutional misalignments (see Figure *22*). This makes sense given the fact that institutional issues normally occur between formal and informal practices, and this diagram covers mostly informal behaviours. The issues are: 1) There is a law prohibiting citizens from living in an area of 500 meters around the landfill as a buffer zone with the aim of avoiding health and pollution issues from living next to the dumped waste. However, when WPs work at landfills, they usually live in the surroundings, being

exposed to said health risks. And 2) Processors remain informal because it is more profitable for them (that is, by avoiding taxation). However, this impacts the workers that processors have under them. In the case of an accident at the workplace, formal processors must pay a compensation to the worker. If the processor is informal, this obligation does not exist, and the worker does not receive said compensation. In both cases, the misalignments pinpoint an issue of rules-in-form not being in-use or practiced by society.

Table 4. Institutional misalignments in IND 1.

#	Institutional statement	Type of misalignment
1	(R) Waste pickers must **not live** in landfill buffer zone if working at landfill & in 500m radius.	Rule-in-form not rule-in-use
	(SS) Waste pickers **live** in landfill buffer zone if working at landfill & in 500m radius.	
2	(R) Processors must **pay** worker compensation if accident & if formal.	Rule-in-form not rule-in-use
	(SS) Processors do **not pay** worker compensation if accident & if informal.	

6.2.2 Institutional patterns and conformance in the Market and IWSC

The network about the market entails the pricing mechanisms and information of the supply chain, and how the latter is passed down by the actors. The price is set by market mechanisms, that is supply and demand. Processors give a lower price for recycled materials than that of virgin materials in order to be competitive and sell their products. If the price of virgin materials change, processors change their price accordingly. In the event of a price change, processors pass down the information to big aggregators, who pass it down in turn to small aggregators. There is an expectation that each actor passes down the price change information (norm). When the price change is beneficial for processors, they might keep this information to themselves and profit from it (see Table *5*), not complying with what is expected of them.

Table 5. Institutional misalignments in IND 2.

#	Institutional statement	Type of misalignment
1	(N) Processors must **inform** big aggregator of price for aggregated waste, if recycled materials' price change.	Norm and routine
	(SS) Processors do **not inform** big aggregator of price for aggregated waste, if recycled materials' price change & if favourable.	

Similar to the previous diagram, the most central actor are small aggregators (C=1,45). In this case, waste pickers are as central as small aggregators. This is explained by the presence of institutional statements that show in more detail the relation between small aggregators, waste pickers and price (explained below); which is confirmed by the fact that the most embedded objects are "price for segregated waste" and "price" (E=0,67). Since the network is about price and pricing mechanisms of the market, this result is not surprising.

Small aggregators have to adjust the price they offer to WPs and households, when the big aggregators inform them of a price change. However, if this change is drastic, they will absorb the change in order to remain competitive so they can offer a good price to WPs and households for their waste. This shows that, despite being a central actor in the diagram, they are not central in the supply chain hierarchy but rather subject to what other actors decide.

Interestingly, unlike the bargaining culture present in India, small aggregators offer fixed price for recyclables and do not expect WPs to bargain. Therefore, WPs generally accept the price as given by the scrap shop. It is possible that small aggregators act as money lenders for WPs if the WP has a sudden need. If the WP borrows the money from the loan, he or she will accept a lower price (if the aggregator gives it to him/her) because they owe money to the scrap shop. This reflects an unequal power relationship when it comes to fair pricing. Because these players are informal, there is no redressing mechanism that WPs can resort to when small aggregators abuse their power and give lower pricing. At most, what WPs can do is change the scrap shop they work with.

6.2.3 Institutional patterns and conformance between IWS and FWS

This Action Situation shows the institutions that are present when WPs are hired by the formal system, either by the Municipality or by the private contractor. However, according to some interviewees, the hiring of informal waste pickers by formal actors does not take place (see Figure 16). Therefore, the information in the diagram applies to the workers of these parties, being or not waste pickers (e.g., salary, working conditions).

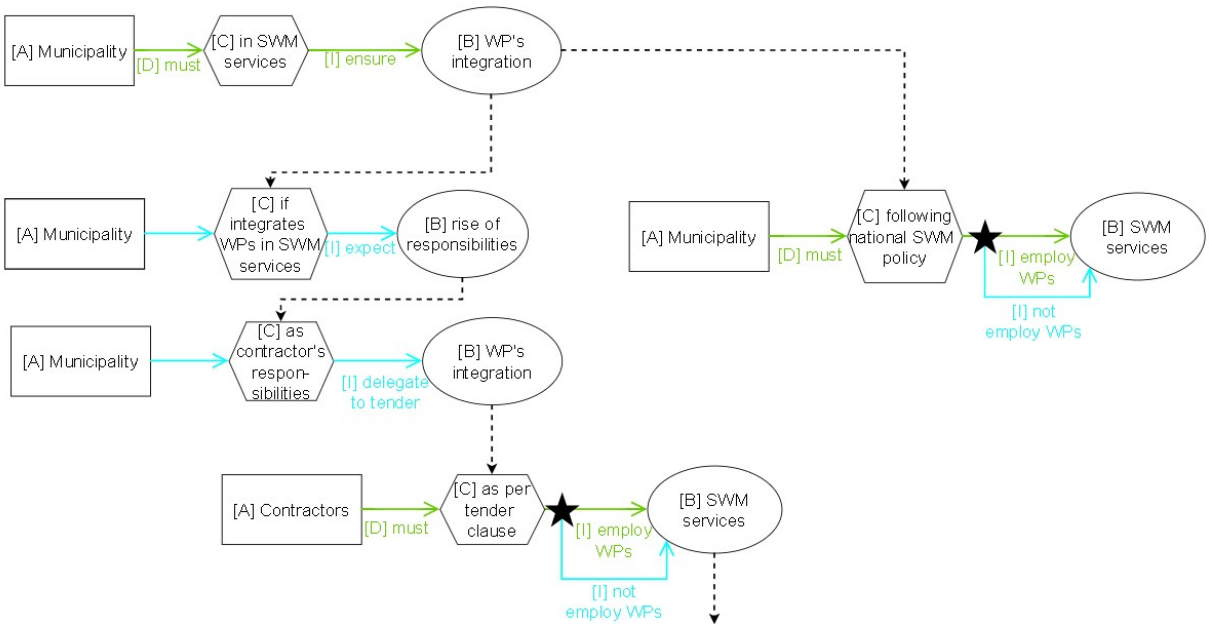

Figure 16. Excerpt from IND 3: interaction IWS-FWS, showing the non-compliance by both Municipality and the private contractor when it comes to employing waste pickers in their activities.

The most central actors of this network are the Municipality and waste pickers equally (C=1,60). As mentioned in the previous paragraph, apparently waste pickers are not hired formally so it is rather waste workers that would be the central actor. It does make sense the Municipality is one of the most central actors given that they must ensure the integration of waste pickers in SWM services (either publicly or privately), as stated in

the SWM Rules 2016. As can be expected, the integration of waste pickers is the most embedded object (E=0,60), followed closely by "SWM services" (E=0,56).

The institutional dependency rate is low, as in the previous two diagrams, meaning the density of the network is low (IDR=0,12). The conformance index shows a certain conformance issue, there are three misalignments in the network. The index is slightly higher than for the previous two networks (CI=1,20), which were only about informal practices. Here, the interaction between formal and informal actors and their clashes are captured.

However, the Municipality is not employing waste pickers for SWM services. One of the reasons is that they expect more responsibilities if they engage with informal WPs for SWM services. Since in some areas of the city, SWM operations are outsourced to a private company, the Municipality delegates this obligation or responsibility to the company through the conditions of the tender contract. The private contractor, in turn, does not incorporate waste pickers in their staff either.

When hired by the contractor, waste pickers must follow the company's rules or otherwise they get fired. There are cases where waste workers have to do an overload of work when contracted privately that workers do to avoid being fired. In these situations, the Municipality does not have any mechanisms to control or avoid this exploitation by the contractor.

When hired by the Municipality, they must do door-to-door waste collection. Interestingly, unlike the case with the contractor, waste workers cannot be fired because it is a public job. In this case, workers might take for granted their jobs and underperform. They receive the minimum wage (also when hired privately). This minimum wage is in most cases lower than what waste pickers earn informally. It is set by the state government and must be updated to the recommended national minimum wage, much higher. But the state government does not update it, remaining very low (see Table *6*).

Table 6. Institutional misalignments in IND 3.

#	Institutional statement	Type of misalignment
1	(R) Contractors must **employ WPs** in SWM services as per tender clause.	Rule-in-form not rule-in-use
	(SS) Contractors do **not employ WPs** in SWM services as per tender clause.	
2	(R) Municipality must **employ WPs** in SWM services following national SWM policy.	Rule-in-form not rule-in-use
	(SS) Municipality does **not employ WPs** in SWM services following national SWM policy.	
3	(R) State government must **update** state minimum wage with national wage.	Rule-in-form not rule-in-use
	(SS) State government does **not update** state minimum wage with national waste.	

6.2.4 Institutional patterns and conformance between the IWS and society

Despite the big influence caste has on this issue, caste stigmatisation is not talked about explicitly. NGOs, for instance, do not address caste stigmatisation in their awareness

programmes, deliberatively or not. This might be due to the fact that many NGOs are run by high-caste people. NGOs' awareness programmes seek to change citizens' perception on waste pickers so that citizens respect them. When citizens look down on waste pickers, citizens might disrespect WPs or ignore they exist. Together with caste stigmatisation, xenophobia and islamophobia are also present in society, worsening waste pickers' vulnerability to discrimination. Waste pickers are quite often transient or migrants and, in most cases, Muslims. These behaviours of discrimination are dependent on citizens' awareness, which is the most embedded object (E=0,75); meaning that unless the awareness programs work, most likely discrimination towards waste pickers will not end.

All this influences the way the informal waste supply chain is built. For example, citizens will not sell their recyclables to WPs if they do not respect them; in fact, these citizens will not tolerate that WPs go to their houses or doors. Therefore, generally WPs do not source recyclables from private houses. However, small aggregators or itinerant buyers are allowed to go house to house buying recyclables from citizens. Citizens treat differently these two actors of the informal sector, due to their caste. Citizens are the most central actor in the network (C=2,00) given their big role in shaping the supply chain and their perception of and attitude towards waste pickers.

Caste determines the occupations a person may or may not do in the Indian society to this day. Only low-caste citizens may engage in waste picking, while a citizen from another caste must not do so (social norm) or they would be frown upon. For example, a small aggregator (when he is not coming from low caste) would never do waste picking even if he goes bankrupted, he will resort to other ways of getting out of that situation (loans, help from relatives…).

Due to the role that caste plays in Indian society, there exists a law that states citizens must not disrespect waste pickers (or any person) when they are from low caste. However, some people do not comply with this rule and disrespect them (see Table 7).

Table 7. Institutional misalignments in IND 4.

#	Institutional statement	Type of misalignment
1	(R) Citizens must **give WPs** respect if (citizens) are not aware, if WP is low-caste, and if WP is transient or Muslim.	Rule-in-form not rule-in-use
	(SS) Citizens do **not give** respect if (citizens) are not aware, if WP is low-caste, and if WP is transient or Muslim.	

6.2.5 Institutional patterns and conformance in the SWM Agenda I

This Action Situation reflects the agenda setting for SWM matters at the national level. The most central actor (C=1,80), National policy makers, are responsible for setting said agenda and the priorities for SWM policy. This research has found that, nationally, policy makers agree on the need to integrate the informal waste sector, resulting in the inclusion of this task in the Rules. However, they prioritise achieving Sustainable Solid Waste Management (e.g., scientific landfilling, source separation, investing in waste-to-energy).

As Figure 17 shows, for the integration of the informal waste sector, policy makers include the legal recognition of their work in the Rules 2016. This recognition was intended as the legal recognition of waste pickers only. Scrap shops, aggregators and processors are not devised in these Rules because they are considered to be "integrated in the recycling chain" by policy makers, not needing the "protection" of the law. On the contrary, policy makers deem necessary the protection of waste pickers and their source of livelihood. The latter might be threatened by SWM plans (closing transfer stations, ending with littering, closing up landfills...).

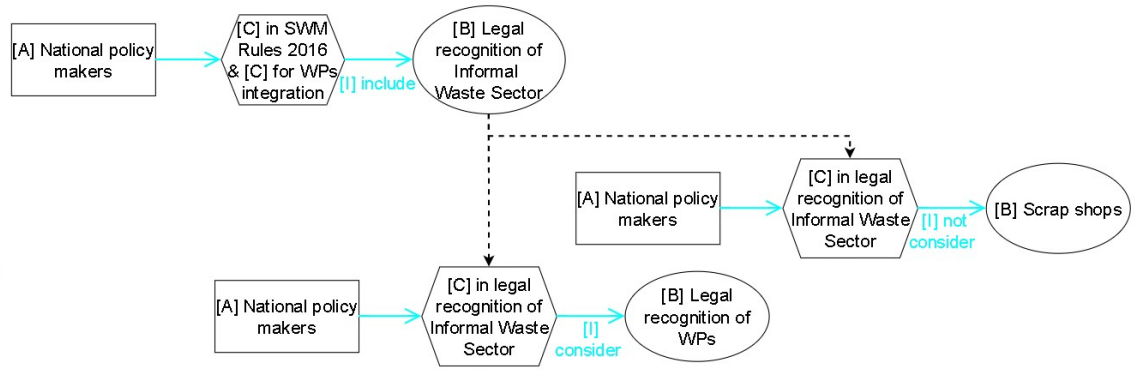

Figure 17. Excerpt from IND: SWM Agenda I, showing the finding that Rules 2016 concern only waste pickers' legal recognition, and not the entirety of the informal sector.

The Ministry of Environment, Forest and Climate Change in duty must mandate waste pickers' integration following Rules 2016. However, if the Ministry has a different policy agenda for SWM, they might be reluctant to act on it. Instead, they might prioritise Sustainable SWM solutions and simply ignore the issue.

Table 8. Institutional misalignments in IND 5. MoEFCC stands for Ministry of Environment, Forest and Climate Change.

#	Institutional statement	Type of misalignment
1	(R) MoEFCC must **mandate** WPs integration following national SWM policy agenda.	Rule-in-form not rule-in-use
	(SS) MoEFCC **be reluctant about** WPs integration if different SWM policy agenda.	

6.2.6 Institutional patterns and conformance in the SWM Agenda II

This Action Situation reflects what follows from the agenda setting at the national level for SWM matters at the state and local stage. From the national policy, State policy makers formulate SWM rules for state application. In this policy making process, the interests of waste pickers are represented by policy makers, experts and NGOs at best (see Figure 18). Waste pickers are not invited to policy making to voice their own needs.

Next, state SWM policy is passed down to the local level in the municipal bylaws that are formulated to incorporate the Rules 2016. During this formulation, the Municipality must establish the integration of waste pickers however they deem appropriate. Figure 18 shows how the Municipality, instead, does not even discuss the issue during the bylaws formulation. To tackle this non-compliance, the state government should monitor

municipal progress on the Rules implementation; monitoring that does not take place either (see Table 9).

At the local level, the Municipality must treat the integration of waste pickers as another one of their priorities and duties. However, when it comes to SWM, the Municipality prioritises solutions that ease their job such as privatisation of SWM services and capital-intensive solutions (e.g., waste-to-energy). No efforts are put into the integration of waste pickers by the local government.

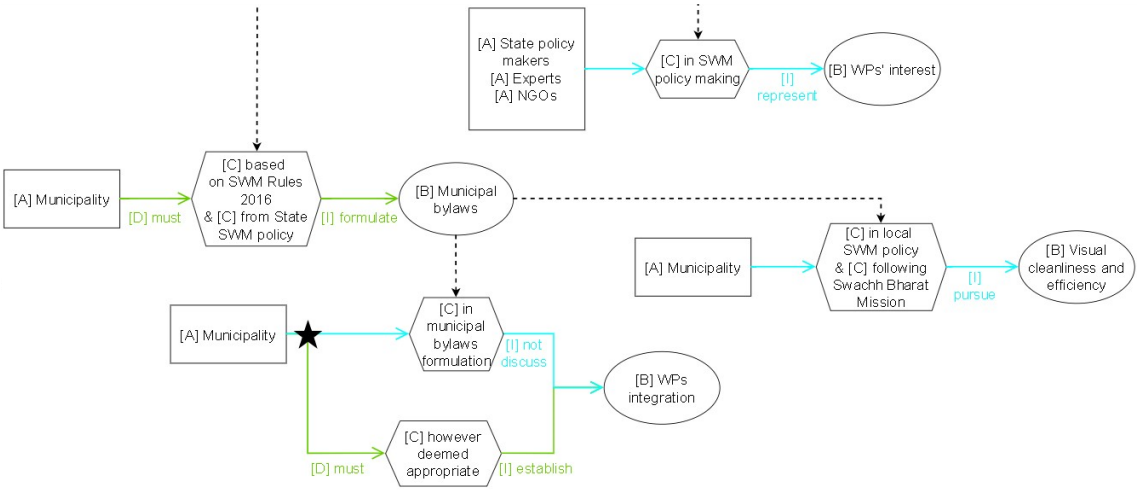

Figure 18. Excerpt from IND: SWM Agenda II.

There are significant issues of conformance, being the conformance index the highest of all networks (CI=1,5). The most central actor is again the Municipality (C=2,00), given their responsibility in local policy formulation and implementation. The State SWM policy is the most embedded object (E=0,75) since the rest of the process of implementation is dependent on it. The density of the network, or dependency rate, is similar to the other networks' and low in any case (IDR=0,11).

Table 9. Institutional misalignment in IND 6.

#	Institutional statement	Type of misalignment
1	(R) Municipality must **establish** WPs integration however deemed appropriate.	Rule-in-form not rule-in-use
	(SS) Municipality does **not discuss** WPs integration in municipal bylaws formulation.	
2	(R) State government must **monitor** Municipality's SWM rules implementation for WPs integration.	Rule-in-form not rule-in-use
	(SS) State government does **not monitor** Municipality's SWM rules implementation for WPs integration.	
3	(R) Municipality must prioritise **WPs integration** with other municipal duties, and as mandated by national policy.	Rule-in-form not rule-in-use
	(SS) Municipality prioritises **privatisation of SWM services** if different agenda, and if deal with private company.	

	(SS) Municipality prioritises **capital-intensive SWM solutions** (e.g. waste-to-energy) over WPs integration.	

6.2.7 Institutional patterns and conformance in Municipal Integration obligations

As previously mentioned, municipalities in India must comply with the national legislation for SWM (Rules 2016). This legislation mandates certain "duties" for the integration of the informal waste pickers. Firstly, the Municipality must establish a system for waste pickers' job recognition to ensure waste pickers' integration. Secondly, the Municipality must ensure waste pickers have access to waste, so their source of livelihood is not threatened (see Figure 19). Besides, in the event of integrating waste pickers in the SWM services, the Municipality must provide a training on SWM. This training is devised to provide waste pickers with knowledge about collection and segregation of all waste types, since they only deal with and have knowledge about recyclables. An interesting insight that appears in this diagram is that waste pickers mistrust awareness programs or trainings (for personal protective equipment, formalisation…) when these are given by the Municipality or NGOs.

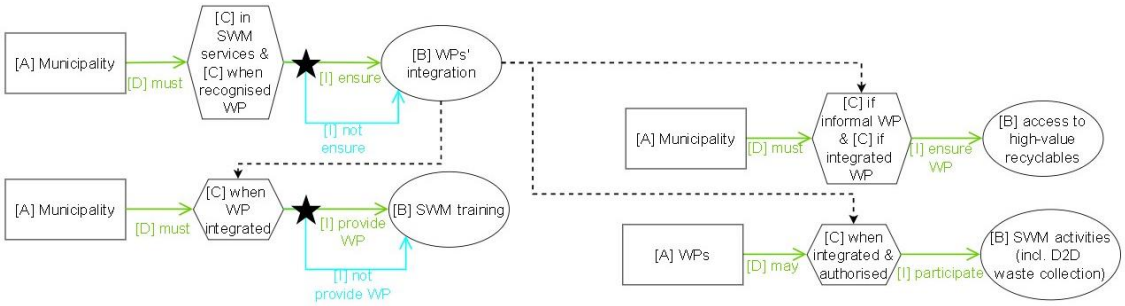

Figure 19. Excerpt from IND: Municipal Integration obligations.

The Municipality must register WPs by giving them ID cards, since most WPs do not even have an identity proof, but the Municipality is not registering WPs nowadays. With this, the integration process is completely blocked, or directly not started. One of the reasons why the Municipality is not providing ID cards to WPs is because WPs might use them for the wrong purposes, according to the Municipality.

As can be seen in Figure 20, ID cards turns out to be quite an embedded object (in fact, it is one of the two most embedded objects, E=0,60). Receiving an ID card activates various institutions. Firstly, waste pickers gain social recognition when they are given an ID card. When they do not have ID cards, they are more exposed to vulnerabilities because they do not have any rights or protection (technically, they do not have identity). Obtaining an ID card allows WPs to access several government benefits and social security schemes, such as health services, primary education for their children, or a ration or daily meal. These would allow them to acquire some social and economic protection. WPs may also receive a loan from the government when they possess an identity proof. This loan must be used for business purposes; however, some WPs misuse it by lending money to others and profiting from doing so.

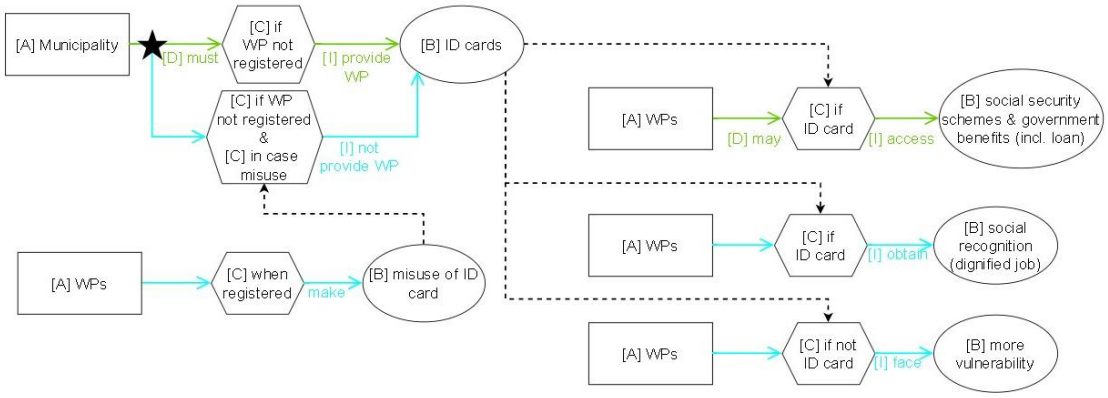

Figure 20. Second excerpt from IND: Municipal Integration obligations, about the identification of waste pickers.

Contrary to what was anticipated, the most central actor are waste pickers. This could be explained because the process of integration activates several institutions they would carry out. However, since it is the Municipality's responsibility, it was anticipated that the local authority would be the most central actor. This diagram's dependency rate is relatively low too. Regarding the diagram's conformance, there are some issues because various rules are not followed, the municipal obligations (see Table *10*). The conformance index is in fact the second highest of all diagrams (CI=1,38).

Table 10. Institutional misalignments in IND 7.

#	Institutional statement	Type of misalignment
1	(R) Municipality must **ensure** WP's job recognition, if individual or organisations of WPs and by establishing a system.	Rule-in-form not rule-in-use
	(SS) Municipality does **not ensure** WP's job recognition, if individual or organisations of WPs and by establishing a system.	
2	(R) Municipality must **ensure** WPs' integration in SWM services, and when recognised waste pickers.	Rule-in-form not rule-in-use
	(SS) Municipality does **not ensure** WPs' integration in SWM services, and when recognised waste pickers.	
3	(R) Municipality must **provide WPs** with SWM training when WP integrated.	Rule-in-form not rule-in-use
	(SS) Municipality does **not provide WPs** with SWM training when WP integrated.	
4	(R) Municipality must **provide WPs** with ID cards if WP is not registered.	Rule-in-form not rule-in-use
	(SS) Municipality does **not provide WPs** with ID cards if WP is not registered, and in case of misuse of ID cards.	
5	(R) Waste pickers must **not lend** to others money from loan if they are given the loan.	Rule-in-form not rule-in-use
	(SS) Waste pickers **lend** to others money from loan if they are given the loan and if misbehaving.	

6.3 Linkages between Action Situations

Table 11 shows how the 7 diagrams are connected to each other through the objects present in each diagram. Only the objects that are present in more than one diagram are included in the table. There are 6 objects that link the diagrams.

Table 11. Linkages (objects) between INDs.

IWSC	**Market and IWSC**	**IWS-FWS**	**IWS-society**	**SWM Agenda I**	**SWM Agenda II**	**Municipal Integration obligations**
High-value recyclables			High-value recyclables			High-value recyclables (*access to*)
	Scrap shops			Scrap shops		
Contract (*verbal*)		Contract (*WP's*)				
		WPs integration		WPs integration	WPs integration	WPs integration
			Awareness (*about WPs*)			Awareness (*activities and trainings*)
		SWM services			SWM services (*Privatisation of*)	SWM services

WPs integration is present in both SWM Agendas and the Municipal Integration obligations, as well as interaction with formal waste sector. In the other institutional settings, this object does not appear maybe due to the informality that characterises said settings.

The object "high-value recyclables" is not present in the AS Interaction IWS-FWS because the formal system deals with all types of waste. At the same time, the object "SWM services" are not present in the diagrams of informal supply chain nor in market, for the opposite reason: the informal supply chain is not about servicing and only deals with waste that has value in the market and has the potential to be recycled.

Also, in the diagram of Integration obligations, no scrap shop is mentioned which highlights the finding that the SWM policy aim to protect or to integrate the WPs and not the whole IWS. The linkages between diagrams do not seem to add further insights to the results.

7 Discussion

The findings from this research, presented in Chapter 6, are interpreted below; followed by policy recommendations for the integration of waste pickers based on the findings.

The main finding of this research is that the Municipality is the major bottleneck for the integration of waste pickers in Chennai. Both the network metrics and the fact that the Municipality has the highest number of misalignments associated (7 of 14), highlight the centrality this actor has on the issue. What the local authority does or does not do is the ultimate determinant. Also, 7 of the 14 institutional issues are non-conformance instances of the SWM Rules 2016, in all cases issues of rules-in-form that are not put into practice, at the local and state level. The table below shows all the formal institutions that are not complied with.

Table 12. All formal institutions that are not followed.

#	Non-complied formal institution	In Rules 2016?
1	Waste pickers must not live in landfill buffer zone.	
2	Contractors must employ waste pickers in outsourced SWM services as per tender clause.	
3	**Municipality** must employ waste pickers in SWM services following national SWM policy.	
4	State government must update state minimum wage to national recommendations.	
5	Citizens must respect waste pickers, regardless of caste, origin or religion.	
6	MoEFCC must mandate waste pickers' integration following national SWM policy agenda.	
7	**Municipality** must establish waste pickers integration however they deem appropriate.	
8	State government must monitor Municipality's implementation of SWM rules 2016 (also for WPs integration).	
9	**Municipality** must prioritise waste pickers integration together with other municipal duties, as mandated by national policy.	
10	**Municipality** must ensure waste picker's job recognition and establishing a system for their integration, for both individual WP and organisations of WPs.	
11	**Municipality** must ensure (recognised) waste pickers' integration in SWM services.	
12	**Municipality** must provide waste pickers with SWM training when they are integrated.	
13	**Municipality** must provide waste pickers with ID cards when waste pickers are not registered.	
14	Waste pickers must not lend other people money from the government loan.	

Lack of capacity or lack of political will

The non-compliance from the Municipality could be explained by two reasons. Firstly, the lack of capacity of the local authority to deal with all the duties, as some interviewees pointed out. On the other hand, it could as well be due to a lack of political will to tackle the issue of waste pickers' integration. The diagram about the interaction between the informal and formal waste sectors contains one institutional statement about the Municipality expecting more responsibilities if they hired waste pickers. It could be one reason that working on their integration would bring difficulties and other types of issues to the Municipality.

From the diagrams about SWM Agenda, we see that the problem with the integration of waste pickers not taking place is not about the rules or policy not being implemented, but rather that it is not even considered or discussed during local policy making. If we look at the five stages of a policy cycle, as in Howlett & Giest (2015), (e.g., agenda setting, policy formulation, decision making, policy implementation and policy evaluation), the institutional non-conformance happens at the stages of agenda setting and policy formulation. The high conformance index of SWM Agenda II, supports this finding, and the non-conformance issues pinpoint that there is a big barrier in this institutional setting.

It is worth noting that a local NGO collaborated with the Municipality for the registration of WPs and their integration in the late 2010s. After calling for registration camps in the main landfills of the city and gather information about WPs' needs via survey, the Municipality stopped this collaboration and the entire integration process. From the more than 900 WPs registered, only 30-40 received an ID card. Since then, no efforts have been made from the local body towards waste pickers' integration. The NGO suggests the cause for the cease on the collaboration might be due to the influence of actors within the Municipality that did not like the project and/or have different interests.

A key institutional issue is Municipality's non-conformance with their obligation of issuing ID cards for the unregistered WPs (who are the majority). This would be the first step to take if WPs integration was taken seriously. Regardless of which cause for the Municipality's inaction, it affects waste pickers' chance for social inclusion. Without a proper ID card, waste pickers are prevented from accessing basic social security schemes and benefits and remain socially excluded.

This inaction hints at a deeper issue: disagreement between high-level or national policy makers and low-level or local policy makers and officials. The former agrees on the need for waste pickers' integration as reflected by the fact that they include WPs' legal recognition in SWM policy. On the other hand, the latter seems to not agree or at least not deem this issue as a priority in the local agenda. Therefore, at least historically, the cause for the inaction of the local government body seems to be the lack of political will. This leads to another issue worth discussing, which might be the cause of this first finding: the trend of privatisation in India.

Trend of services' privatisation

The lack of political will from the Municipality suggests and opens a different debate. As aforementioned, there is a trend of privatisation of municipal services in India, particularly for Solid Waste Management. By outsourcing SWM duties and services, the Municipality delegates responsibilities to the tender. However, the rules of the game

change significantly for the integration of waste pickers: the private contractor will only hire waste pickers if it is cheaper than hiring regular waste workers.

This trend of might reflect a change in values that could explain the misalignments between the rules-in-form and rules-in-use. It comes down to the government body's priorities and agenda, and hence their values: if policy makers prioritise profit over social protection in their agendas, they will not comply with the institutions that are not in line with their agendas if they can; which may cause and lead to the inaction discussed above.

It could explain why, in order to deal with this trend, high-level policy makers opt for a utilitarian approach for the integration of waste pickers. That is, trying to convey the message to local governments that waste pickers, if integrated, will be useful and profitable for Municipalities. Narrative that is common in most NGOs and governments awareness campaigns for WPs integration. In doing so, municipal governments could choose to integrate this community not for their social and economic inclusion per se, but for the benefits that their integration can bring about.

In all levels of government, cleanliness and efficiency is pursued for SWM efforts. In general, Sustainable SWM receives the largest efforts by authorities, policies and strategies such as the Clean India Mission (Swachh Bharat Mission). SWM departments focus on increasing source segregation, building large processing plants (including waste-to-energy) which are capital-intensive solutions, and they aim to achieve scientific landfilling. All these efforts and plans are prioritised over waste pickers' integration, despite the latter sometimes scoring better in waste hierarchy (for instance, compared to incineration). Also, some sustainable SWM solutions threaten and reduce waste pickers' access to waste (e.g., closing of landfills, increasing formal waste processing).

Informality, integration and social inclusion

On a different note, it is worth reflecting on what informality means. Coletto & Bisschop (2017) state there are three perspectives on informality: 1) the informal sector consists of "marginalised people that 'fail' to get a job in the formal system"; 2) jobs that are excluded for being harmful or illegal; and 3) informal sector for purposes of avoiding bureaucracy and taxation. The first perspective fits the profile of waste pickers, while the third one fits aggregators and processors.

This distinction in the meaning of informality that accompanies the different actors matches other differentiations observed in the research. It fits the differentiation found in the SWM Rules 2016, by which they are envisaged for the protection of waste pickers (by means of their integration) but do not involve aggregators and processors. In turn, the decision of only including waste pickers in the Rules comes from another distinction: policy makers perceive aggregators' and processors' informality to be acceptable, "they are already integrated in the recycling chain", while informality for waste pickers is perceived as a problem (due to waste pickers' vulnerability). Thirdly, in the broader society and due to caste stigma, this distinction is present too. Waste pickers are not allowed to buy recyclables from private houses, but aggregators are. This is another indication that waste pickers suffer discrimination, not because of their informal condition, but due to caste stigmatisation.

"Belonging" to these different types of informality has wider consequences. For example, waste pickers endure the disadvantages of remaining informal, which is usually not a choice for them, while higher actors in the informal waste chain *decide* to stay informal because this decision is beneficial for them. In contrast, these actors' workers might be affected by the informality of their employers: e.g., if there is an accident, the workers do not receive compensation. The informal processor profits from being informal (less taxes) but the workers suffer the precariousness. Another example relates to pricing, due to the informality of the sector there are no official prices for waste materials. Aggregators and processors can profit from the actor in the level below them in the chain; while it harms waste pickers given their relative position with aggregators. Waste pickers accept the price given by aggregators because there are no official prices they can claim.

Similarly, what does integration mean? As taken from the Indian policy, integration refers to the formalisation and participation of waste pickers in the municipal SWM system. However, as the results show, this formalisation might not bring waste pickers improvements in their economic and social conditions (e.g., very low minimum wage). This suggests that waste pickers need, instead, an integration in society, in other words, social inclusion, rather than the integration in the SWM system. Limiting the policy to the latter would keep many waste pickers from giving up waste picking and starting other occupations, which may be more desirable for them.

Short- versus long-term thinking

From the side of the waste pickers themselves, there are some factors limiting their integration too. As it is the case of other cities (e.g., Pune, Bangalore), waste pickers have self-organised in unions, cooperatives or Community-Based Organisations (CBOs). This has successfully led to collaborations with Municipalities about SWM activities, by which waste pickers are formalised. For instance, the cooperative SWaCH, based in Pune, currently takes care of 75% of the city's SWM duties. In Chennai, a local NGO has suggested the idea of forming a union to waste pickers several times, so they could increase their collective voice and agency. Surprisingly, waste pickers themselves are not interested in starting a union.

Given their socio-economic situation, or due to other reasons unknown to this research, waste pickers seem to prefer shorter-term gratification over long-term stability. This might explain their view on the union and self-organisation. Even though it is beneficial for them in the long term, day to day, they are concern with other worries (e.g., earning enough money and finding food for the day). Another example is the fact that they (in cities where formalisation has happened) go back to informality if their informal earnings are higher; even though they could access social security schemes, if working formally.

7.1 Policy recommendations for the integration of waste pickers

Given the complexity of the issue under study and its dependency on policy making, the policy recommendations are structured in five blocks, the stages of a policy cycle (Howlett & Giest, 2015). Doing this will hopefully bring clarity to the policy suggestions. In Figure 21, the main recommendations are outlined.

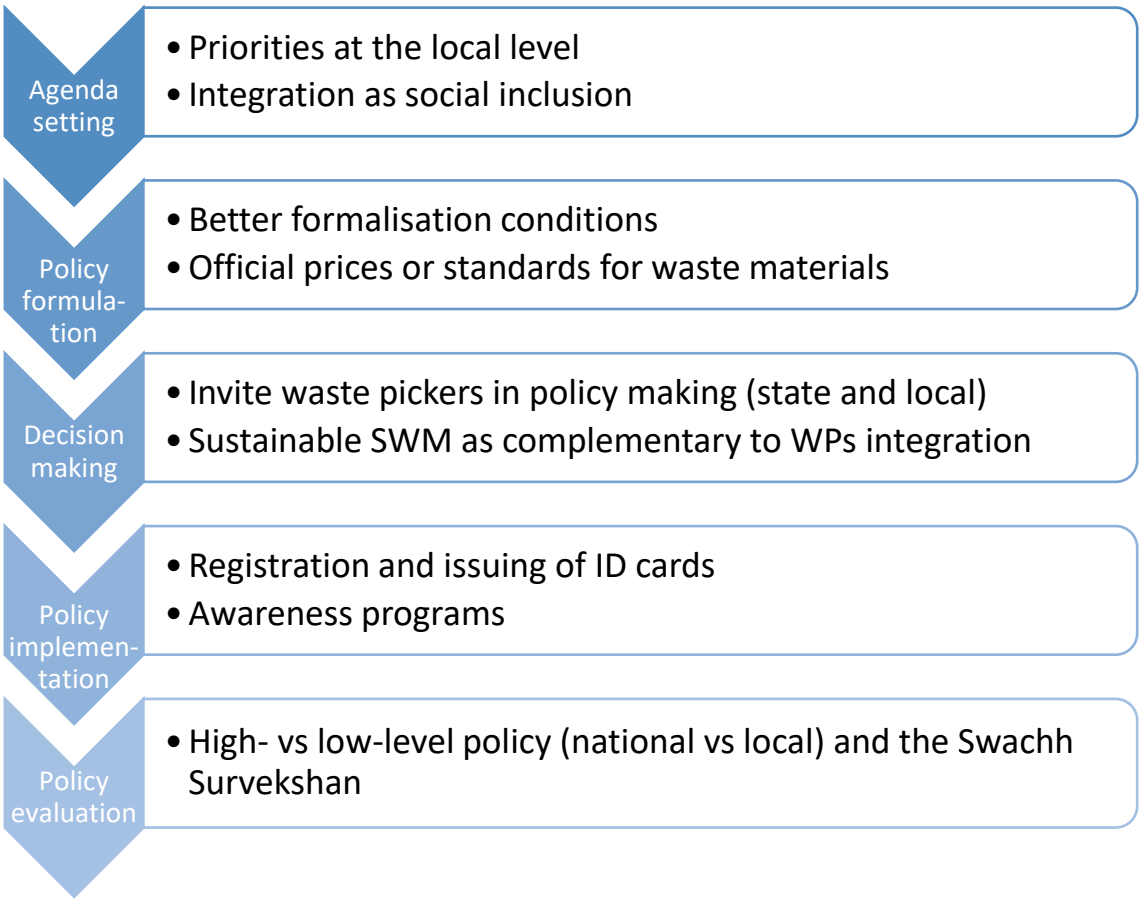

Figure 21. Outlined policy recommendations based on the research findings.

1. Agenda setting

Priorities at the local level

Despite the main finding of this research (the barrier is at the stages of agenda setting and policy formulation especially at the local level caused by lack of political will), an open debate should take place about Municipality's priorities, including the participation of citizens. Regardless of Municipality's priorities, the local government must follow national SWM policy and at the moment they are not doing so. The Municipality should be held accountable for this non-compliance, both by state authorities and the public. Local NGOs could mobilise the public to exert pressure on the local government to take the necessary measures.

Integration as social inclusion

When setting the agenda for SWM matters, a wider approach for waste pickers integration should be taken. Rather than limiting it to their integration in the municipal SWM system, their social inclusion should be promoted and facilitated. Hence, broader social policies should be coupled with SWM Rules in the next amendment. As the results show, even if WPs participate in the formal system, they remain in a vulnerable position, socially and economically speaking. Therefore, their participation in the formal SWM system is not enough.

2. Policy formulation

Better formalisation conditions

In line with the previous recommendation, the conditions when waste pickers become part of the formal SWM systems are not much better than those of informal waste picking. As we have seen, they receive a very low minimum wage, they need to work longer hours than when working informally and have less flexibility. Acknowledging they do gain some benefits when formalised (ID card, protection and some social recognition), the formal working conditions should be improved. The State government should raise the minimum wage to the national standards.

Official prices or standards for waste materials

A recommendation to set official prices or standards for the waste market should be included in the national policy. Even though there is market competition, which theoretically, ensures a fair price, some irregularities take place in the informal waste chain as the results show. If official prices were given to waste materials, this would bring about more reliability to the given prices by the different actors. It would provide, in particular for waste pickers, an official reference of the price they should get for their work. Therefore, national policy makers should study this intervention to include it in national SWM policy.

3. Decision making

Invite waste pickers for policy making (state and local)

As the finding from the diagram SWM Agenda II shows, waste pickers' interests are represented by other actors during state policy making. In the local level, their integration is not even discussed in the bylaws formulation. A serious procedure should be started to comply with national mandates on waste pickers' integration. Waste pickers should be invited to policy making, state and local. Otherwise, in order to represent their needs more accurately, waste pickers should be approached and asked (e.g., via survey).

Sustainable SWM as complementary to WPs integration

If wider integration efforts were made, waste pickers would have opportunities to do other occupations and give up waste picking. In a long-term perspective, if they are helped in their social inclusion, the number of waste pickers will be reduced, and hence, will not clash with current sustainable SWM plans (e.g., current plans threaten waste pickers' access to waste). Instead, these two approaches would be complementary to achieve a formal and sustainable waste management system and at the same time, the welfare of waste pickers (either doing waste work in better conditions, or doing other occupations).

4. Policy implementation

Registration and issuing of ID cards

In contrast with the previous recommendation, about longer-term plans, short-term measures must be taken. The registration of waste pickers is the most urgent measure, as repeatedly mentioned. Even if no further integration efforts are made, their identification provides waste pickers with eligibility to access basic social security benefits and

schemes. Given waste pickers' socio-economic situation, a policy recommendation for the Municipality is to issue ID cards for informal waste pickers immediately.

Awareness programs

Linking back to the finding of waste pickers' short- term gratification versus long-term thinking, a measure that can be taken is the design of awareness programs to tackle this behaviour. They can be educated to recognise long-term benefits when faced with more urgent, short-term needs. For this, and following the finding about waste pickers' mistrust of NGOs and Municipality, the programs should take into account this mistrust. Instead, the programs can be provided through a trusted figure by the waste pickers (usually their equals or representatives, e.g., leader of WPs groupings).

5. Policy evaluation

High- versus low-level policy (national versus local) and the Swachh Survekshan

The issue between high- and low-level policy makers, that became apparent in the research, is significant and influences the lack of progress in waste pickers integration. Even though, this integration is deemed desirable at the high level, it is completely disregarded at the local level. Since it is due to different priorities and values, the local policy makers should be incentivised to work on waste pickers integration.

In order to tackle this 'gap' between the two levels of policy making, the Swachh Survekshan (national rating survey, explained in Chapter 3, The Waste System in India and informality) has proved successful in incentivising other SWM matters. However, this research has discovered that waste pickers' integration is not a central part of the Survekshan, it is in fact not given much importance. From the national team in charge of the Survekshan, this should be changed and waste pickers' integration should be made a central aspect in the national competition.

8 Conclusion

This chapter sums up the findings and interpretation of results by answering the research questions (section 8.1). Next, the limitations of this study and recommendations for further research are given (section 8.2).

8.1 Contribution to the study of institutional dependencies in the integration of waste pickers

The goal of this research was to understand the institutional setting that surrounds and influences the integration of informal waste pickers in the formal waste system. Below, the sub-questions set to study this research problem are answered, followed by the main research question.

1. What stakeholders are involved in the waste (management) sector in Chennai?

The waste management sector or the waste system consists of both formal and informal stakeholders or actors. The informal sector involves stakeholders that interact creating a supply chain for recyclables, while the formal actors do not interact through transactions necessarily. In the case of Chennai, the **municipal government** is the Municipality or Corporation of Chennai, who is in charge of providing the service for SWM. In some areas of the city, the service is outsourced to a private contractor, a **private waste company**, that takes on this duty. Other waste companies that are part of the system are waste processors operating in the city. Also, **NGOs** are active in Chennai with programmes about sustainable waste management but also about WPs and the informal sector. **Experts** on SWM act as advisors in policy making for the government and decision makers by providing technical input; often they are more knowledgeable about SWM than about the integration of IWS. **Citizens** are part of the waste system too, as waste generators and recipients of the SWM services.

The IWS, on the other hand, is clearly a supply chain, the main actors being:

- **Waste pickers**: They extract recyclables from three different sources, in all cases from mixed waste: landfills or dumpsites, litter in the streets, and roadside bins. They sell what they collect to small aggregators. They are the most vulnerable player of the entire supply chain, in terms of economic and social situation.
- **Itinerant buyers**: They go house to house, using a vehicle, collecting and buying segregated recyclables from citizens (e.g., glass, cardboard and newspapers, hard plastics, metals). They sell what they collect daily to small or big aggregators. They do not have storage space.
- **Small aggregators**: They may buy different waste materials and generally have some storage space to aggregate what they buy. They sell, once they have gathered enough volume, to big aggregators. They usually do segregation by material type and some sort of cleaning.
- **Big aggregators**: Unlike small aggregators, they often specialise in one type of material (e.g., only plastics or only metals). They own a large storage space, which allows them to supply the materials when the conditions of the market demand it. They might do some processing of the material they buy, like shredding or further segregation.

- **Processors**: they process one type of material only. As the name indicates, they do the actual processing of waste into secondary raw materials or recycled material. They sell it back to the industry and manufacturers, closing the loop.

2. What are the formal institutions in the waste system?

The formal institutions that govern Chennai's waste system are present in the national Solid Waste Management Rules 2016 (see

Appendix A: SWM Rules 2016 and tender terms), which are translated into the municipal bylaws for local implementation. Besides, the strategy of Clean India Mission (Swachh Bharat Mission) from the central government of India encourages the practical implementation of the Rules 2016. Lastly, the formal responsibilities stated in the tender contract by the Municipality for the outsourcing of SWM services.

In the SWM Rules 2016, and in the bylaws, it is stated that the local government must ensure the integration of the IWS, meaning integration of waste pickers, in the municipal SWM system. This refers both in the public SWM services and the private or outsourced. In this way, the private contractor is mandated to hire waste pickers by the terms of the tender contract. Among the formal institutions that relate to WPs' integration, the local government must register the informal waste pickers by issuing ID cards.

3. What are the informal institutions in the waste system?

Given that we are talking about the informal waste sector, it is not a surprise that the number of informal institutions is higher than the formal ones. The practices that make up the informal supply chain are informal institutions, the routines and commercial transactions as well as the relationships among actors based on loyalty and trust. Also, the market and pricing mechanisms of this supply chain are informal institutions by which the actors interact with each other.

There are informal institutions around the issue of caste stigma, present in the Indian society. There are social norms and culture that are still ingrained with this stigma. For instance, because of caste discrimination, waste pickers must not ask for recyclables at private houses because they mostly belong to the lowest caste, the Dalits.

Other informal institutions surround the policy making environment. At the state level, the state government does not monitor local implementation of the SWM Rules 2016, nor follows the recommendation by the national government of updating and increasing the state minimum salary. At the local level, the Municipality does not address the issue of waste pickers integration in local policy making. The local government neither registers waste pickers nor incorporates them in the formal SWM system.

4. What is the relation between the formal and informal institutions identified?

The informal institutions are misaligned with the formal institutions when there are issues of non-conformance with the formal institutional setting. Largely, the non-conformance is associated with the Municipality and its obligations regarding waste pickers' integration set by the national Rules 2016. In most cases, it is an issue between rules-in-form and rules-in-use. That is, the formal institutions state certain behaviours or actions, that in practice are not complied with by society. And, instead, the informal institutions carry out different behaviours or actions. For example, as mandated by law, citizens must respect waste pickers, and any citizen regardless of caste, religion and origin (formal institution). However, some citizens disrespect and discriminate waste pickers because of their caste, religion or origin (informal institution).

The table below outlines the formal rules that are not complied with in the institutional setting. From the 14 misalignments, 7 are non-compliance of the SWM Rules 2016.

Table 13. All formal institutions that are not followed.

#	Non-complied formal institution	In Rules 2016?
1	Waste pickers must not live in landfill buffer zone.	
2	Contractors must employ waste pickers in outsourced SWM services as per tender clause.	
3	**Municipality** must employ waste pickers in SWM services following national SWM policy.	
4	State government must update state minimum wage to national recommendations.	
5	Citizens must respect waste pickers, regardless of caste, origin or religion.	
6	Ministry of Environment, Forest and Climate Change must mandate waste pickers' integration following national SWM policy agenda.	
7	**Municipality** must establish waste pickers integration however they deem appropriate.	
8	State government must monitor Municipality's implementation of SWM rules 2016 (also for WPs integration).	
9	**Municipality** must prioritise waste pickers integration together with other municipal duties, as mandated by national policy.	
10	**Municipality** must ensure waste picker's job recognition and establishing a system for their integration, for both individual WP and organisations of WPs.	
11	**Municipality** must ensure (recognised) waste pickers' integration in SWM services.	
12	**Municipality** must provide waste pickers with SWM training when they are integrated.	
13	**Municipality** must provide waste pickers with ID cards when waste pickers are not registered.	
14	Waste pickers must not lend other people money from the government loan.	

Now that the sub-questions are covered, the main research question can be answered:

How does the structure of the institutional network of the waste system influence the integration of the informal waste sector?

The formal institutions pursue the integration of waste pickers in national SWM policy, considering that aggregators and processors are already integrated in the recycling chain. Given the uncovered interdependencies and misalignments between institutions, the main bottleneck for the integration of waste pickers seems to be the Municipality (high centrality and number of misalignments associated).

The main finding of the research identifies that the barrier(s) for the realisation of said integration are at the stages of agenda setting and policy formulation in local policy making. The issue of WPs' integration is not a priority in the local agenda, and therefore, it is not addressed in the formulation of the municipal bylaws. It was expected that the problem was related with the implementation of the policy, but it is apparent now that the institutional misalignment originates from the previous stages of policy making.

It is a misalignment of rules-in-form not being in-use: the issue of waste pickers integration is not a priority in the local agenda, while it is mandated by national SWM policy. This misalignment hints at a deeper conflict: a conflict in values. There exists a big gap between high- and low-level policy makers, between the ones that create the policy and the ones that actually have to implement it. High-level or national policy makers agree with the need to achieve waste pickers' integration, while low-level or local policy makers seem to not agree with this need or its urgency. Therefore, policy makers from each level might differ in their values and priorities (e.g., social protection versus profit).

8.2 Limitations and recommendations for further research

First, I reflect on some limitations of the research and give some recommendations for further research. Secondly, I reflect on the suitability of the method for this case study

8.2.1 Limitations of the research

The limitations of the research below are divided by each step of the INA method. Regarding the data collection stage, the key limitations are:

1. *A better representation of actors that were interviewed*. More emphasis on contacting certain stakeholders should have been put, particularly more respondents from the Municipality would have improved the representation given the central role they have (both from different departments and hierarchical levels). However, these actors are very busy with their jobs and is difficult to get in touch with them. Also, given the sensitivity of the topic, people are not that keen on talking about it.
2. *Lack of norms*. Either due to failing to enquire about norms, or because there are not many norms in the system. Another explanation could be that I failed to interpret and extract them from the transcripts. I expected a larger number of norms given the big role caste and social conventions have and surround this issue.

For the steps of data coding and clustering and formalisation of institutions:

1. *Disconnection with the context*. This research was done with an important cultural difference, as well as physical distance of the location under study. Sometimes, my lack of knowledge of certain things about the culture or the context was beneficial since I was able to ask naïve questions. On the other hand, it is possible I missed some important contextual factors for the outcome of the research.
2. *Only one pair of eyes formalising institutions*. Given how dependent on one's interpretation this research is, the results would be more reliable or robust against individual bias if the institutions had been extracted by more than one analyst (Watkins & Westphal, 2016).
3. *IG cannot eliminate all ambiguity*. As stated by Crawford & Ostrom (1995) the institutional grammar cannot tackle all ambiguity from the research problem, despite the goal of using this theory is to get rid of ambiguities and voids in actors' responsibilities. The INDs still show some level of ambiguity or inconsistencies about the system, which can be due to an inability to solve some of the knowledge gaps during the interviewing phase.

Lastly, for the phases of drawing the diagrams and the analysis of the networks:

1. *Unconnected institutional statements*. Some statements were left out of the diagrams because they were not connected to other statements. However, it is possible that some of the information in these statements is relevant.

8.2.2 Recommendations for further research

In hindsight, the research problem is strongly related to and dependent on policy making processes, which raises the question of the appropriateness of the chosen Action Situations. At the same time, it is anticipated that there is a significant barrier in the interface between national and local policy making, as the results show. A more in-depth look into the policy cycle and/or this interface may shed light into persisting barriers and institutional dependencies for waste pickers' integration.

Additionally, the cause for the inaction of Municipality when it comes to the integration of the IWS was not uncovered. This should be looked into in future research to uncover the root cause of the problem. Moreover, in SWM Rules 2016, various terms are used in a rather unclear way: registration, recognition, authorisation, integration. They are not defined separately which leads to ambiguity and confusion when studying the policy. Further research should take this into account.

8.2.3 Reflections on the use of the INA method

The INA method provides a static view of the research problem, it brings a snapshot of reality. This helps understand and identify persisting barriers that hinder waste pickers' integration. However, it would be equally interesting to take a dynamic approach on the research issue. Modelling certain parameters or actors' behaviours might bring additional insights. It would be insightful to do a longitudinal study too, given the past experiences and attempts to integrate waste pickers in Chennai (in 1990s and 2010s).

Given the high number of institutional misalignments that are a clash between rules-in-use and rules-in-form, an evolutionary take on the institutional analysis could be interesting for some of the issues that came up from the research (e.g., caste stigma,

Municipality's political priorities); how or when rules-in-form are incorporated, in-use by society.

It might be interesting to explore how different stakeholders perceive informality and waste pickers' integration means for them. For this purpose, the method of comparative cognitive mapping (CCM) could be useful since it helps map the perceptions of the different stakeholders and the similarities to find conflicting but also shared goals or means.

References

Aparcana, S. (2017). Approaches to formalization of the informal waste sector into municipal solid waste management systems in low- and middle-income countries: Review of barriers and success factors. In *Waste Management* (Vol. 61, pp. 593–607). Elsevier Ltd. https://doi.org/10.1016/j.wasman.2016.12.028

Basurto, X., Kingsley, G., McQueen, K., Smith, M., Weible, C. M. (2010). A systematic approach to institutional analysis: Applying Crawford and Ostrom's grammar. *Political Research Quarterly, 63 (3),* 523–537. https://doi.org/10.1177/1065912909334430

Bushouse, B. K., Schweik, C. M., Siddiki, S., Rice, D., & Wolfson, I. (2021). The Institutional Grammar: A Method for Coding Institutions and its Potential for Advancing Third Sector Research. *Voluntas*. https://doi.org/10.1007/s11266-021-00423-w

Coletto, D., & Bisschop, L. (2017). Waste pickers in the informal economy of the Global South: included or excluded? *International Journal of Sociology and Social Policy*, *37*(5–6), 280–294. https://doi.org/10.1108/IJSSP-01-2016-0006

Calderón Márquez, A. J., Silva de Souza Lima Cano, N., & Rutkowski, E. W. (2021). Inclusion of Waste Pickers Into Municipal Waste Management Systems: A Comparison Between Colombia and Brazil. *Journal of Environment and Development*, *30*(4), 395–425. https://doi.org/10.1177/10704965211053425

Crawford, S. E. S., & Ostrom, E. (1995). A GRAMMAR OF INSTITUTIONS. In *American Political Science Review* (Vol. 89, Issue 3).

CSE (2021). INTEGRATION OF INFORMAL SECTOR IN SOLID WASTE MANAGEMENT STRATEGIES AND APPROACHES. www.cseindia.org

Desing, H., Brunner, D., Takacs, F., Nahrath, S., Frankenberger, K., & Hischier, R. (2020). A circular economy within the planetary boundaries: Towards a resourcebased, systemic approach. *Resources, Conservation and Recycling*, *155*. https://doi.org/10.1016/j.resconrec.2019.104673

Gall, M., Wiener, M., Chagas de Oliveira, C., Lang, R. W., & Hansen, E. G. (2020). Building a circular plastics economy with informal waste pickers: Recyclate quality, business model, and societal impacts. *Resources, Conservation and Recycling*, *156*. https://doi.org/10.1016/j.resconrec.2020.104685

Ghorbani, A., Bosch, M., & Siddiki, S. (2020). Institutional Network Analysis. *To be submitted to the journal of policy studies journal special issue*.

Howlett, M., & Giest, S. (2015). Policy cycle. In *International Encyclopedia of the Social & Behavioral Sciences (Second Edition)* (pp. 288-292). https://doi.org/10.1016/B978-0-08-097086-8.75031-8

Jai Singh Rathore, G. (2020). Formality and informality in e-waste economies: exploring caste-class in urban land and labor practices. *Urban Geography*, *41*(6), 902–906. https://doi.org/10.1080/02723638.2020.1785745

McGinnis, M. D. (2011). An Introduction to IAD and the Language of the Ostrom Workshop: A Simple Guide to a Complex Framework. *Policy Studies Journal*, *39*(1), 169–183. https://doi.org/10.1111/j.1541-0072.2010.00401.x

Mesdaghi, B., Ghorbani, A., & de Bruijne, M. (2022). Institutional dependencies in climate adaptation of transport infrastructures: an Institutional Network Analysis approach. *Environmental Science and Policy*, *127*, 120–136. https://doi.org/10.1016/j.envsci.2021.10.010

Nandy, B., Sharma, G., Garg, S., Kumari, S., George, T., Sunanda, Y., & Sinha, B. (2015). Recovery of consumer waste in India - A mass flow analysis for paper, plastic and glass and the contribution of households and the informal sector. *Resources, Conservation and Recycling*, *101*, 167–181. https://doi.org/10.1016/j.resconrec.2015.05.012

Ogunmakinde, O. E., Sher, W., & Egbelakin, T. (2021). Circular economy pillars: a semisystematic review. In *Clean Technologies and Environmental Policy* (Vol. 23, Issue 3, pp. 899–914). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/s10098-020-02012-9

Ostrom, E. (2011). Background on the Institutional Analysis and Development Framework. *Policy Studies Journal*. 39(1), 7-27. https://doi.org/10.1111/j.1541-0072.2010.00394.x

Roggero, M., Bisaro, A., & Villamayor-Tomas, S. (2018). Institutions in the climate adaptation literature: A systematic literature review through the lens of the Institutional Analysis and Development framework. In *Journal of Institutional Economics* (Vol. 14, Issue 3, pp. 423–448). Cambridge University Press. https://doi.org/10.1017/S1744137417000376

Gunsilius, E., Chaturvedi, B., Scheinberg, A., Coad, A. & García Cortés, S. (2011). The Economics of the Informal Sector in Solid Waste Management. https://www.sid.ir/en/journal/ViewPaper.aspx?id=516662

Velis, C. A., Wilson, D. C., Rocca, O., Smith, S. R., Mavropoulos, A., & Cheeseman, C. R. (2012). An analytical framework and tool ('InteRa') for integrating the informal recycling sector in waste and resource management systems in developing countries. *Waste Management and Research*, *30*(9 SUPPL.1), 43–66. https://doi.org/10.1177/0734242X12454934

Wilson, D. C., Velis, C., & Cheeseman, C. (2006). Role of informal sector recycling in waste management in developing countries. *Habitat International*, *30*(4), 797–808. https://doi.org/10.1016/j.habitatint.2005.09.005

Watkins, C., & Westphal, L. M. (2016). People Don't Talk in Institutional Statements: A Methodological Case Study of the Institutional Analysis and Development Framework. *Policy Studies Journal*, *44*, S98–S122. https://doi.org/10.1111/psj.12139

Zolnikov, T. R., Furio, F., Cruvinel, V., & Richards, J. (2021). A systematic review on informal waste picking: Occupational hazards and health outcomes. In *Waste Management* (Vol. 126, pp. 291–308). Elsevier Ltd. https://doi.org/10.1016/j.wasman.2021.03.006

Appendix A: SWM Rules 2016 and tender terms

Hereby, the Solid Waste Management Rules 2016 are presented as gathered in the municipal bylaws of the Corporation of Chennai. Only the rules that are related to the informal waste sector and/or its integration are presented below, since it was only said rules that were coded for the purpose of the research. Some definitions of SWM concepts are included as defined by the National SWM Rules so as to provide the reader with the necessary knowledge to understand this thesis.

Greater Chennai Corporation
DRAFT SOLID WASTE MANAGEMENT BYE-LAWS, 2016

In exercise of the powers conferred under section 3, 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government have enacted the Solid Wastes Management Rules, 2016 to regulate the Management of Solid Wastes. This Municipal Solid Wastes Rules, 2016 shall apply to every municipal authority which shall, within their territorial area be responsible for the implementation of the provisions of these rules, and for any infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes. Further it shall be the responsibility of the generator of wastes to co-operate with the municipal authority concerned to avoid littering and ensure delivery of segregated wastes in accordance with the collection and segregation system as notified in the Municipal Solid Waste Management Rules, 2016.

[…]

SOLID WASTE MANAGEMENT BYE-LAWS OF THE CORPORATION, FRAMED UNDER SECTION 349 OF THE CHENNAI CITY MUNICIPAL CORPORATION ACT OF 1919

[…]

22. **"Dry waste"** means waste other than bio-degradable waste and inert street sweepings and includes recyclable and non-recyclable waste, combustible waste and sanitary napkin and diapers, etc;

23. **"Dump sites"** means a land utilized by local body for disposal of solid waste without following the principles of sanitary landfilling;

[…]

35. **"Informal waste collector"** includes individuals, associations or waste traders who are involved in sorting, sale and purchase of recyclable materials;

[…]

40. "**Materials recovery facility" (MRF)** means a facility where non-compostable solid waste can be temporarily stored by the local body or any other entity mentioned in rule 2 or any person or agency authorised by any of them to facilitate segregation, sorting and recovery of recyclables from various components of waste by authorised informal sector of waste pickers, informal recyclers or any other work force engaged by the local body or entity mentioned in rule 2 for the purpose before the waste is delivered or taken up for its processing or disposal;

[…]

54. "**Recyclable Waste"** means the waste that is commonly found in the MSW. It is also called as "Dry Waste". These include many kinds of glass, paper, metal, plastic, textiles, electronics goods, etc.

[…]

78. **"Transfer station"** means a facility created to receive solid waste from collection areas and transport in bulk in covered vehicles or containers to waste processing and, or, disposal facilities;

[…]
85. **"Waste picker"** means a person or groups of persons informally engaged in collection and recovery of reusable and recyclable solid waste from the source of waste generation the streets, bins, material recovery facilities, processing and waste disposal facilities for sale to recyclers directly or through intermediaries to earn their livelihood.

5.0 Responsibilities of the Greater Chennai Corporation
The Greater Chennai Corporation shall
[…]
(b) establish a system to recognize organizations of waste pickers or informal waste collectors and promote and establish a system for integration of these authorized waste-pickers and waste collectors to facilitate their participation in solid waste management including door to door collection of waste;
(c) facilitate formation of Self-Help Groups, provide identity cards and thereafter encourage integration in solid waste management including door to door collection of waste;
[…]
(e) setup material recovery facilities or secondary storage facilities with sufficient space for sorting of recyclable materials to enable informal or authorised waste pickers and waste collectors to separate recyclables from the waste and provide easy access to waste pickers and recyclers for collection of segregated recyclable waste such as paper, plastic, metal, glass, textile from the source of generation or from material recovery facilities; Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be painted white and those for storage of other wastes shall be painted black;
[…]
(g) provide training on solid waste management to waste-pickers and waste collectors;
[…]
(w) create public awareness through information, education and communication campaign and educate the waste generators on the following; namely:-
[…]
(viii) handover segregated waste to waste pickers, waste collectors, recyclers or waste collection agencies;

Next, it is shown the tender clause where the Corporation delegates the responsibility of this sector's integration to the private contractor that wins the tender for the outsourced SWM services. The latest tender found dates back to 2017; unfortunately, it has not been possible to obtain a newer version of the tender contract.

Tender notice 4, clause e:

In consultation with the Authority and in line with SBM guidelines/SWM Rules 2016, the Concessionaire shall establish a system for integration of the informal waste collectors to facilitate their participation in formal solid waste management activities.

The sources for the SWM bylaws of Chennai and the clauses of the tender contract are, respectively:

https://chennaicorporation.gov.in/images/swm_bye_laws.pdf

https://www.cag.org.in/database/evaluation-gccs-swm-tender

Appendix B: list of interview topics and questions

Given the fact that the initially proposed AS were not of any use for designing the interviews, I came up with a list of issues that became apparent from the desk research (ambiguities, barriers, etc.) related to the integration of IWS and in an effort to understand the functioning of system. The list of topics to guide the interview included the following:

1. Persisting barriers for the integration of the IWS.
2. Potential measures that can be implemented.
3. Rules and guidelines that apply to the sector and, in particular, to the integration of IWS.
4. Interaction between stakeholders: IWS-FWS, IWS-Municipality, IWS-society, and within IWS.
5. Common problems/issues between informal stakeholders (especially, WPs and aggregators).
6. Views on (integration of) the IWS.
7. Information asymmetry regarding price among informal stakeholders.
8. Implementation status (actual integration efforts), to explore rules-in-use vs rules-in-form issues (especially about IWS' participation in the system (D2D waste collection), legal recognition, access to waste and Material Recovery Facilities).
9. Decision-making processes at the local level (regarding IWS).

From the topics, questions were phrased to enquire about during the interviews. An overview of the questions is given below. They were ordered from less sensitive topics to more (potentially) controversial ones. However, the order was not important because some questions were asked if the respondent brought up something related. In some cases, follow-up sub-questions are included under the main questions, in case it was possible to probe the respondent in a given direction.

Opening questions:

- What is the priority for Organisation X when it comes to the integration of IWS?
- To what extent is the role and ways of working of the informal sector recognized by policymakers, in legislation and practice? *Similarly*: To what extent do you think legal recognition can or has contributed to the integration of the IWS?
- What is the current situation of the IWS in Chennai? What has been done?
- What are persistent barriers for the real integration of IWS?
- Are you aware of any efforts towards the integration of the informal sector, concrete plans or policies, by the municipal or the statal government?
- Are there issues with access to waste for the informal sector in Chennai (as in competition with the formal sector for the waste)?
- What is the motivation of the different types of stakeholders to remain informal?
- What is the interaction between citizens and the IWS? Is it different for WPs and for aggregators? *Similarly*: What is the social perception of the IWS?
- What role does caste play in the (practical) recognition of the informal waste workers?

    - There appears to be a social differentiation between WPs and aggregators (meaning they are perceived different), can you elaborate on this? Why is this the case?
- Do you have any current programs or plans for the IWS at Organisation X?
- What measures and/or policies do you think could be implemented to achieve real integration of the informal sector?
- WPs pick up from typically door to door, landfill, roadside bins, employed at apartment complexes, collection at gate (of commercial/residential complex). Do they dedicate to one of these categories or is it common that they do several of them?
    - How do they choose where to get the waste from? And whom to sell it? Do they organise their job around a certain area?
- Can you elaborate on what are typical situations where WP or IWS might suffer harassment from the authorities or other?
    - What measures could tackle this?
- How do you think it can be ensured that informal workers (WPs) get a fair price?
- What are common problems that WP (waste pickers) or IB (itinerant buyers) can have with scrap dealers or small aggregators they sell the waste to?
- Is the IWS allowed/recognised in the recycling market? *Similarly*: Are there barriers or limitations for the participation of the IWS in the recycling market?
- Can you explain what MRF (material recovery facilities) are? Any interaction with IWS (access allowed?)?
- How could self-organisation lead to IWS integration?
    - How can this self-organisation be facilitated?
    - What are the key barriers for the self-organisation of the IWS?
- The concept of Self-Help Groups (SHG) is recurring in policy documents regarding SWM. Can you briefly explain how they are related to the IWS?
- Why is giving IDs and WPs registration usually the first step when integrating informal workers?
    - Why is it problematic (if this is the case)?
    - What steps follow normally?
- Can you give a general overview of what the Rules 2016 meant for SWM and the IS? *Similarly*: What practicalities did the SWM Rules 2016 bring, particularly for the IWS?
    - Are there any voids and/or conflicts in these Rules?
- Have you or Organisation X participated in policy making or decision-making processes regarding SWM and the integration of the IWS?
    - Do the informal waste workers have a say?
    - How are strategies or measures chosen?
    - Are there any conflicts in what parties or stakeholders consider a (successful) IWS integration?

Appendix C: Institutional Network Diagrams

The image resolution of the diagrams should be high enough so that the reader can zoom in to read the whole diagram. The diagrams are read from the top left corner following the connections between institutional statements (dashed lines).

IND 1: Informal Waste Supply Chain

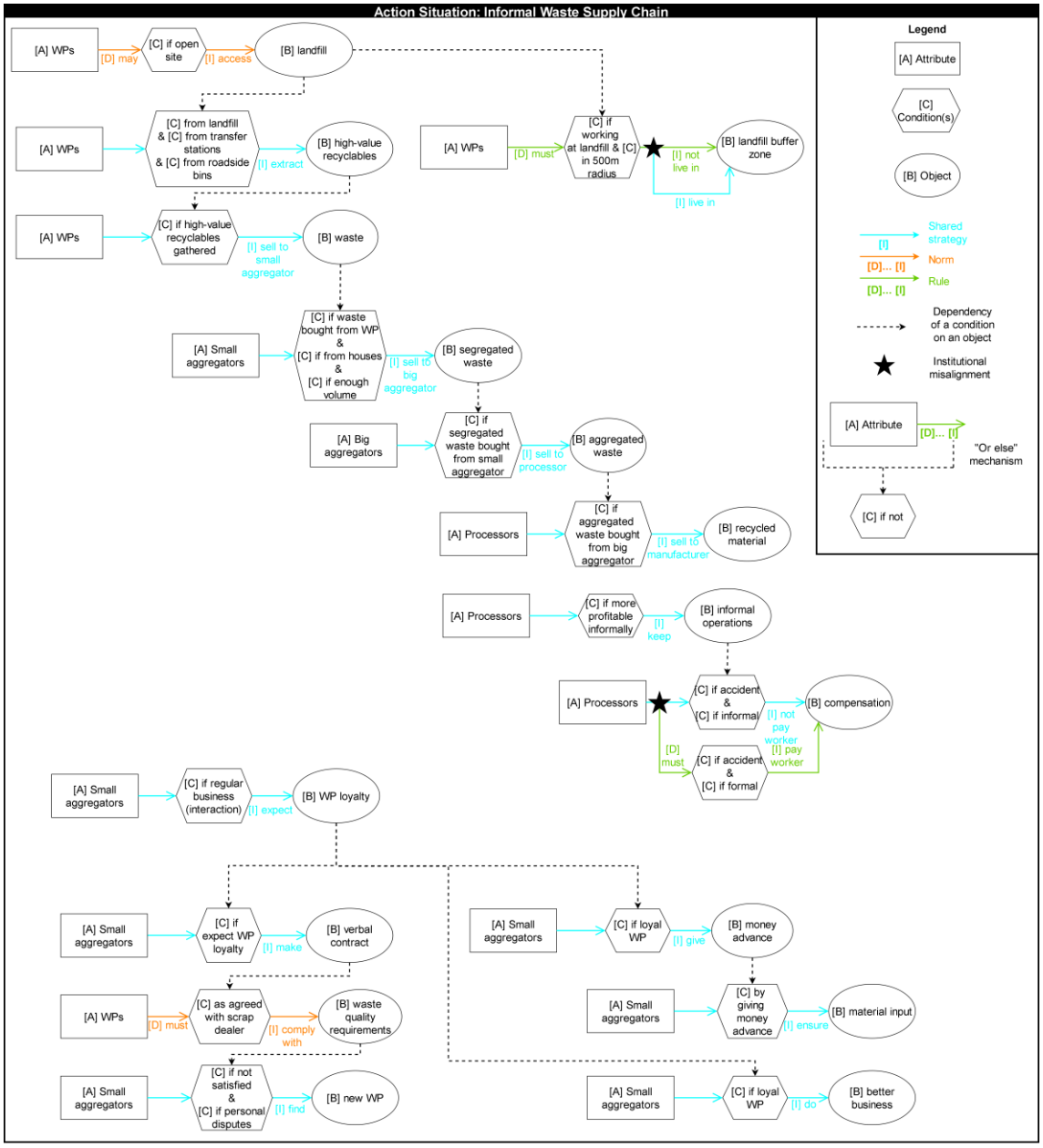

Figure 22. IND 1: Informal Waste Supply Chain.

IND 2: Market and Informal Waste Sector

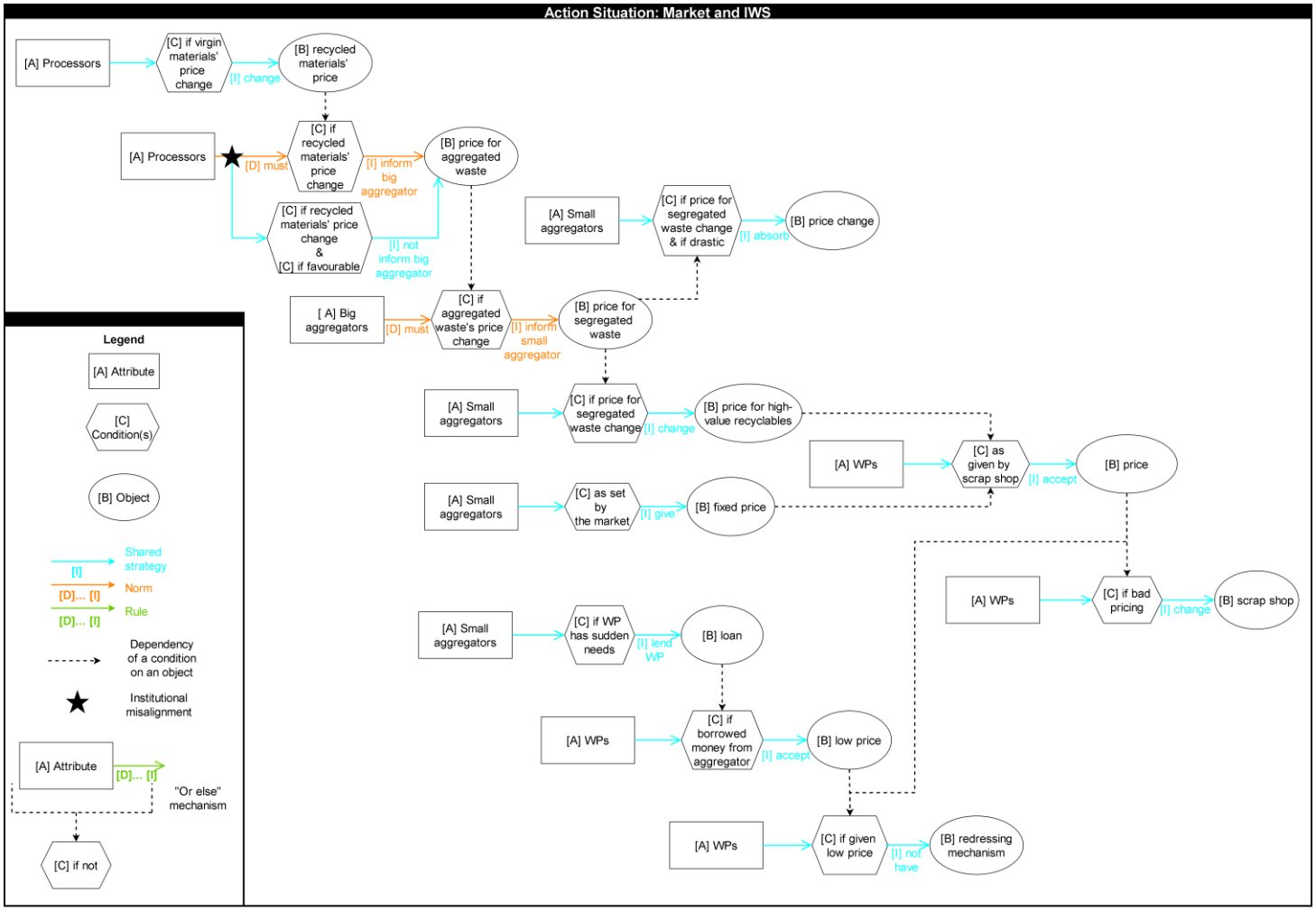

Figure 23. IND 2: Market and Informal Waste Sector.

IND 3: Interaction Informal Waste Sector and Formal Waste Sector

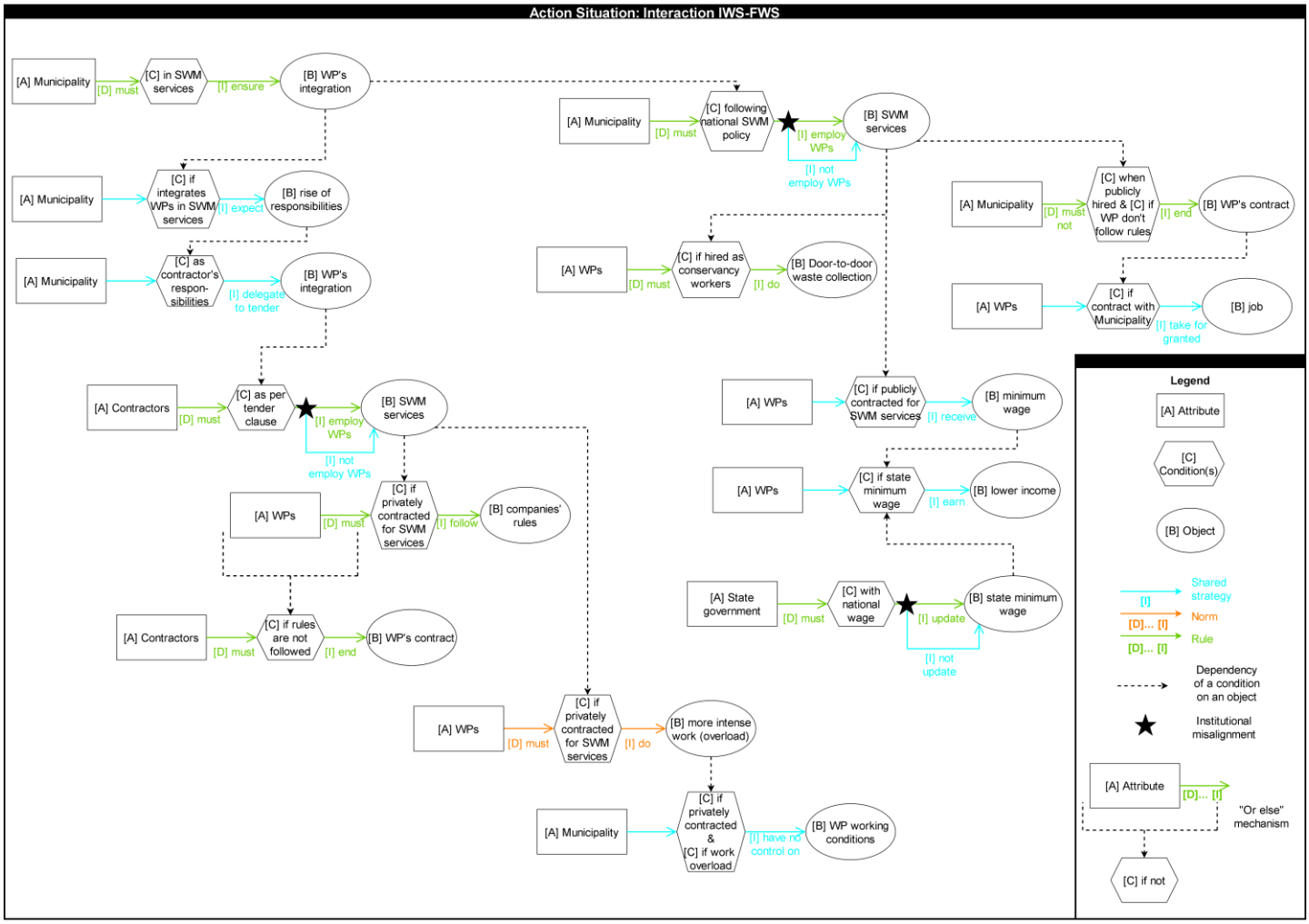

Figure 24. IND 3: Interaction Informal Waste Sector and Formal Waste Sector.

IND 4: Interaction Informal Waste Sector and Society

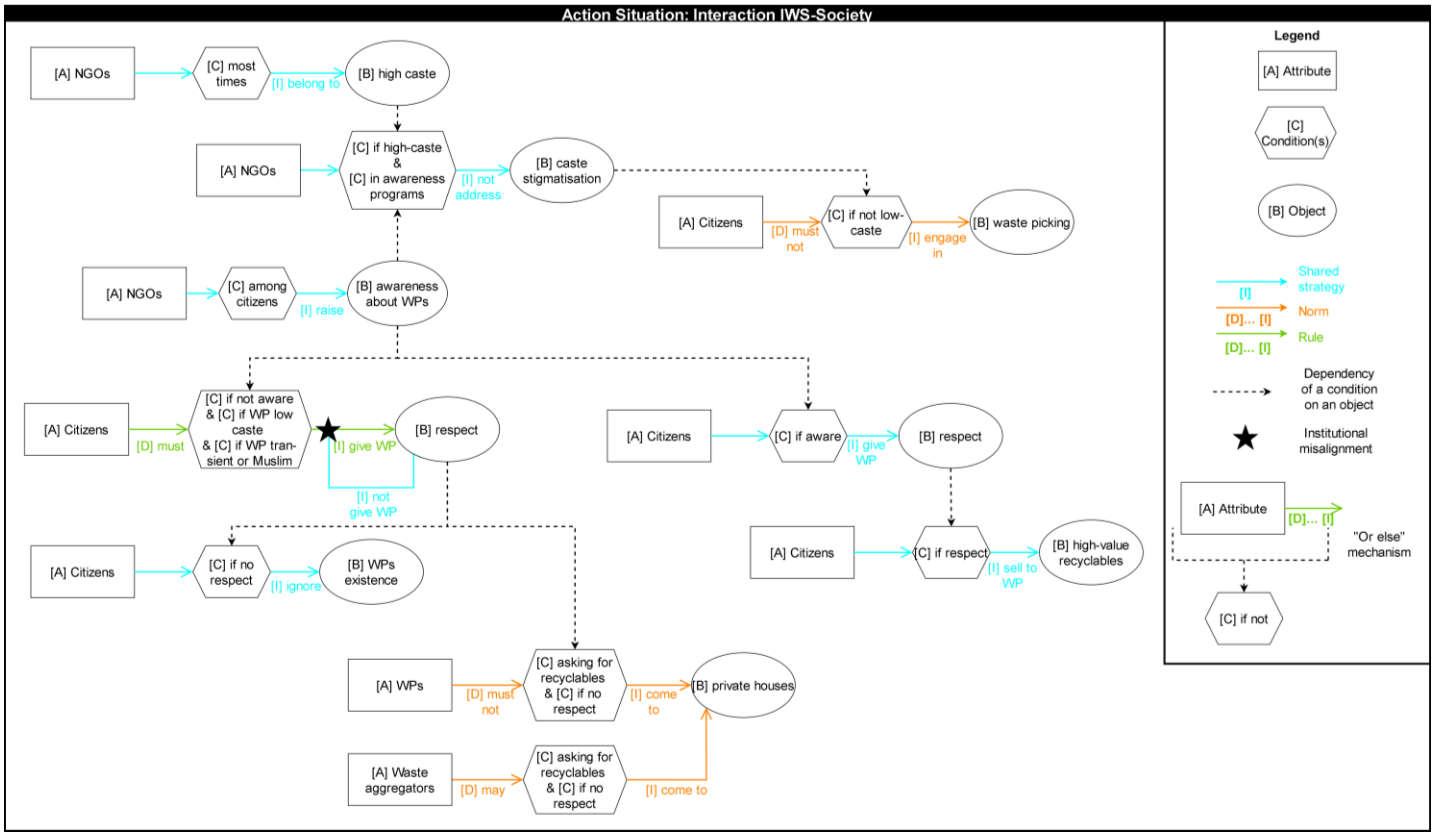

Figure 25. IND 4: Interaction Informal Waste Sector and Society.

IND 5: SWM Agenda I

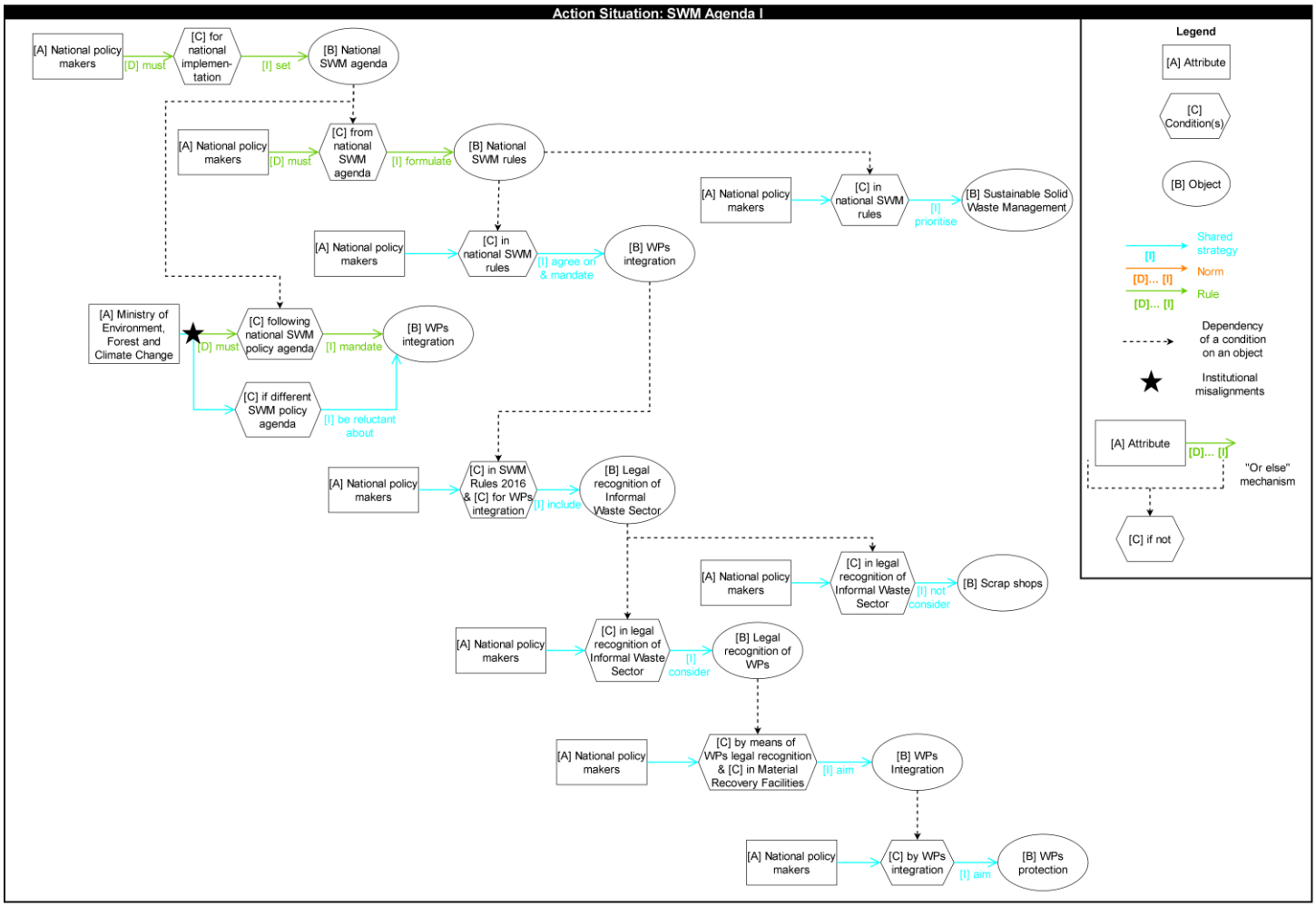

Figure 26. IND 5: SWM Agenda I.

IND 6: SWM Agenda II

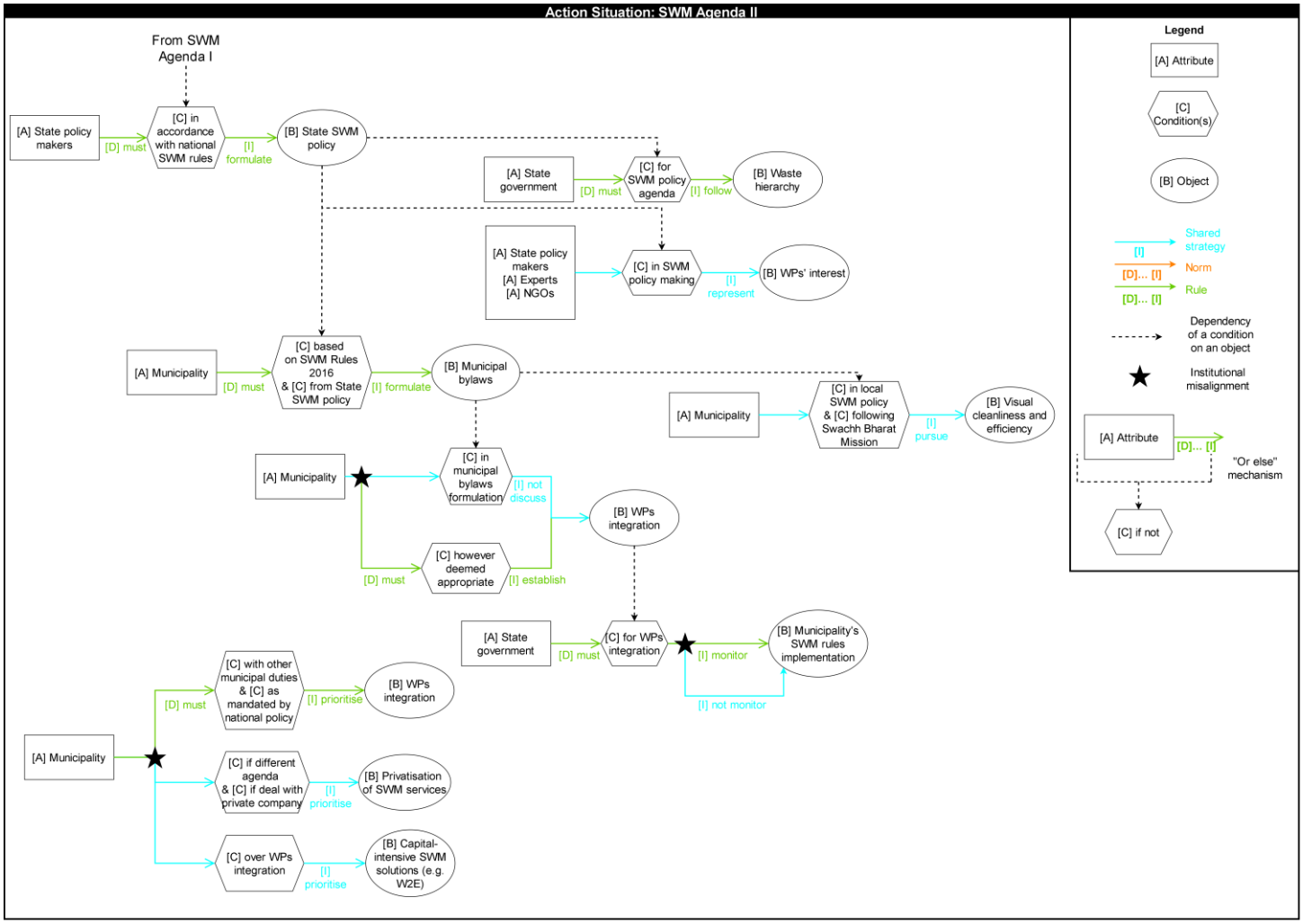

Figure 27. IND 6: SWM Agenda II.

IND 7: Municipal Integration Obligations

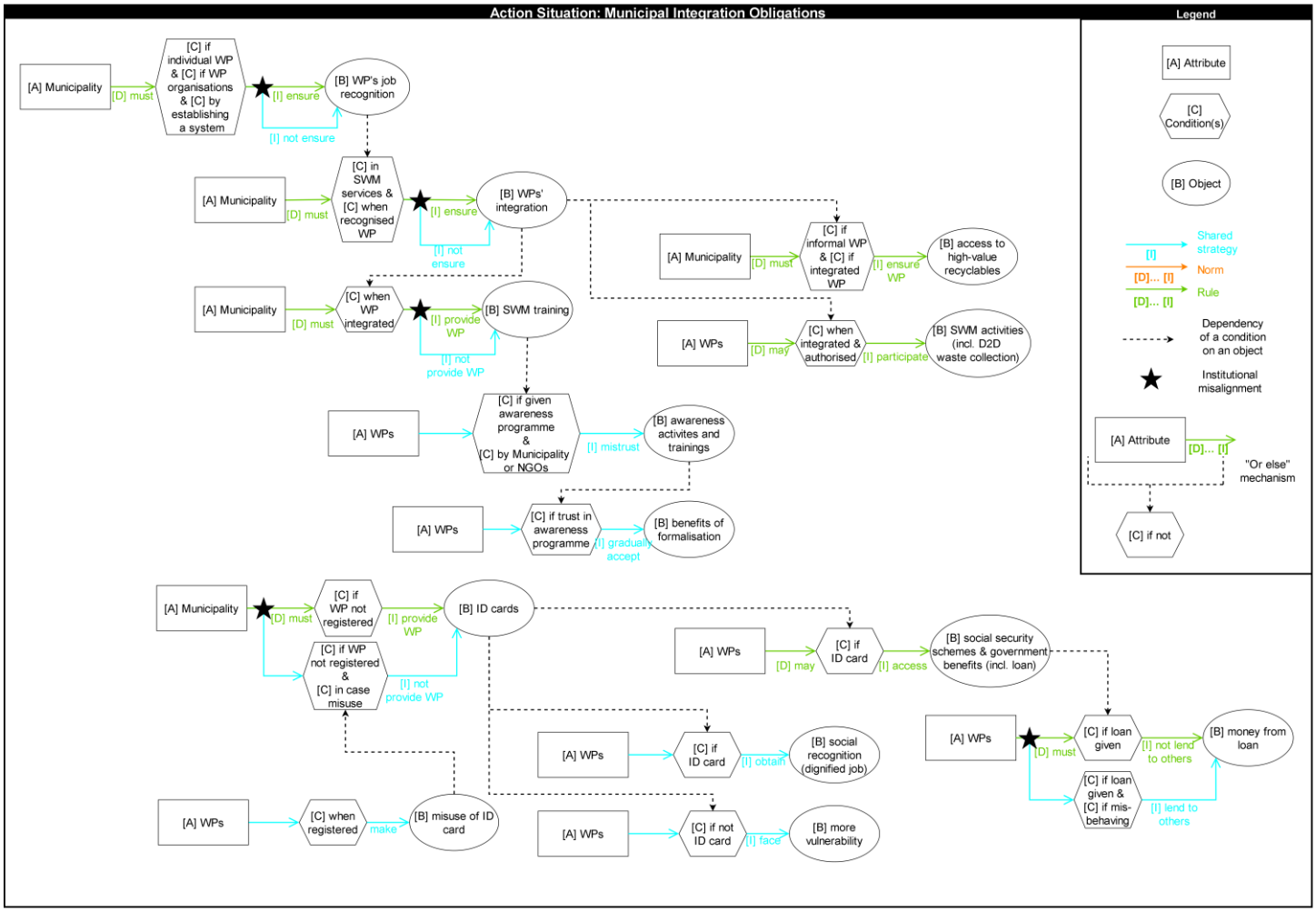

Figure 28. IND 7: Municipal Integration Obligations.

Appendix D: Institutional Network Metrics

Centrality

The centrality of every actor or attribute present in each Action Situation is calculated.

Table 14. Centrality of the attributes for each Action Situation or diagram.

Action Situation: Informal Waste Supply Chain	
Attribute [A]	**Centrality**
Waste pickers	1,25
Small aggregators	1,75
Big aggregators	0,25
Processors	0,75
Average	1,00
Action Situation: Market and Informal Waste Sector	
Attribute [A]	**Centrality**
Processors	0,73
Big aggregators	0,36
Small aggregators	1,45
Waste pickers	1,45
Average	1,00
Action Situation: Interaction Informal Waste Sector and Formal Waste Sector	
Attribute [A]	**Centrality**
Municipality	1,60
Contractor	0,53
Waste pickers	1,60
State government	0,27
Average	1,00
Action Situation: Interaction Informal Waste Sector and Society	
Attribute [A]	**Centrality**
NGOs	1,20
Citizens	2,00
Waste pickers	0,40
Waste aggregators	0,40
Average	1,00
Action Situation: SWM Agenda I	
Attribute [A]	**Centrality**
National policy makers	1,80
Ministry of Environment, Forest and Climate Change	0,20
Average	1,00
Action Situation: SWM Agenda II	
Attribute [A]	**Centrality**
State policy makers	1,00
State government	1,00
Experts	0,50
NGOs	0,50

Municipality	2,00
Average	1,00
Action Situation: Municipal Integration Obligations	
Attribute [A]	**Centrality**
Municipality	0,77
Waste pickers	1,23
Average	1,00

Embeddedness

The embeddedness of every object present in each Action Situation is calculated.

Table 15. Embeddedness of the objects for each Action Situation or diagram.

Action Situation: Informal Waste Supply Chain	
Object [B]	**Embeddedness**
Landfill	0,67
Landfill buffer zone	0,00
High-value recyclables	0,50
Waste	0,50
Segregated waste	0,50
Aggregated waste	0,50
Recycled material	0,00
Informal operations	0,50
Compensation	0,00
WP loyalty	0,75
Verbal contract	0,50
Waste quality requirements	0,50
New WP	0,00
Money advance	0,50
Material input	0,00
Better business	0,00
Average	0,34
Action Situation: Market and Informal Waste Sector	
Object [B]	**Embeddedness**
Recycled materials' price	0,50
Price for aggregated waste	0,33
Price change	0,00
Price for segregated waste	0,67
Price for high-value recyclables	0,50
Price	0,67
Fixed price	0,50
Loan	0,50
Low price	0,50
Redressing mechanism	0,00
Scrap shop	0,00
Average	0,38

Action Situation: Interaction Informal Waste Sector and Formal Waste Sector	
Object [B]	**Embeddedness**
WPs integration	0,60
Rise of responsibilities	0,50
SWM services	0,56
Companies' rules	0,00
WP's contract	0,33
More intense work (overload)	0,50
WP working conditions	0,00
Job	0,00
Door-to-door waste collection	0,00
Minimum wage	0,00
Lower income	0,00
State minimum wage	0,33
Average	0,24
Action Situation: Interaction Informal Waste Sector and Society	
Object [B]	**Embeddedness**
High caste	0,50
Caste stigmatisation	0,50
Waste picking	0,00
Awareness about WPs	0,75
Respect	0,50
WPs existence	0,00
High-value recyclables	0,00
Private houses	0,00
Average	0,28
Action Situation: SWM Agenda I	
Object [B]	**Embeddedness**
National SWM agenda	0,67
National SWM rules	0,67
WPs integration	0,33
Sustainable Solid Waste Management	0,00
Legal recognition of Informal Waste Sector	0,67
Scrap shops	0,00
Legal recognition of Waste pickers	0,50
WPs protection	0,50
Average	0,42
Action Situation: SWM Agenda II	
Object [B]	**Embeddedness**
State SWM policy	0,75
Waste hierarchy	0,00
WPs' interest	0,00
Municipal bylaws	0,67
Visual cleanliness and efficiency	0,00
WPs integration	0,33
Municipalities' SWM rules implementation	0,00

SWM privatisation	0,00
Capital-intensive SWM solutions	0,00
Average	0,19

Action Situation: Municipal Integration Obligations	
Object [B]	**Embeddedness**
WP's job recognition	0,33
WPs integration	0,60
SWM training	0,33
Access to high-value recyclables	0,00
SWM activities	0,00
Awareness activities and trainings	0,50
Benefits of formalisation	0,00
ID cards	0,60
Misuse of ID card	0,50
Social recognition	0,00
More vulnerability	0,00
Social security schemes and government benefits	0,50
Money from loan	0,00
Average	0,26

Institutional Dependency Rate (IDR) and Conformance Index (CI)

Table 16. IDR and CI for each Action Situation or diagram.

Action Situation	**IDR**	**CI**
Informal Waste Supply Chain	0,10	1,13
Market and Informal Waste Sector	0,15	1,09
Interaction Informal and Formal Waste Sector	0,12	1,20
Interaction Informal Waste Sector and Society	0,15	1,10
SWM Agenda I	0,16	1,10
SWM Agenda II	0,11	1,50
Municipal Integration Obligations	0,10	1,38