

Women's Participation in Organizational Decision-Making: Evidence from the National Meteorology Agency of Ethiopia

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ABSTRACT

Based on ethnographic research conducted at the National Meteorology Agency¹ of Ethiopia (NMA)ⁱ, this paper investigates the practice of decision-making within NMA focusing on women's involvement. Agency-level decisions related to collection, organization, and interpretation of meteorological data are made by meteorology experts while communication of meteorological information (e.g. forecast data) to external stakeholders is done by top-level management (comprising the Director General and Deputy Director General) and in consultation with middle-level management (comprising directors of departments). The qualitative evidence resulting from the study also indicates that women generally occupy a marginalized position within the NMA (partly resulting from their underrepresentation in the agency's workforce) in decision making. Diversifying the agency's workforce along gender lines (i.e., increased hiring of female employees) can contribute to a more gender-sensitive NMA. This in turn will lead to the provision of meteorological services where women are also the focus.

KEYWORDS: Women, participation, decision making, meteorology, Ethiopia

1. BACKGROUND OF STUDY

Meteorology is generally regarded as a hard science, like physics and engineering. Traditionally, these disciplines have been male-dominated and influenced by gender stereotypes that portray women as less suited to scientific fields (Cheryan, et al., 2011; UNESCO, 2017; UNESCO, 2024). This challenge is particularly pronounced in countries like Ethiopia where girls often face disadvantages from an early age. In many communities, girls are less likely than boys to receive educational opportunities and encouragement to pursue schooling let alone to continue higher education and graduate in demanding fields like in physics, chemistry and meteorology.

The academic norms and social practices that govern the allocation of students to different fields of study from secondary school through higher education have historically contributed to gender imbalances across many disciplines. Although biological differences do not determine school performance, social and cultural factors have often favored males in accessing educational opportunities (Beede, et al., 2011; WMO, 2021, National Science Foundation, 2023). In many societies, men have traditionally received greater encouragement and support to pursue higher education particularly in STEM fields. Limited access to higher education for women reduces their opportunities to enroll in specialized scientific disciplines such as meteorology thereby decreasing the likelihood of graduating and subsequently pursuing careers as meteorology (UNSCO, 2021; National Science Foundation, 2023). In many parts of the world, women remain underrepresented in science, technology, engineering and mathematics (STEM) disciplines.

Historically, Ethiopian girls have experienced unequal access to educational opportunities, with their participation and attainment constrained by discriminatory gender norms, household responsibilities, early marriage, and limited physical access to schools, particularly because of long distances. As has been observed, Ethiopian women have "...faced systematic inequities. The discrepancies begin early and often persist throughout Ethiopian women's lives" (Africa.com). These disadvantages in education can have consequences

¹The National Meteorology Agency (NMA) has been renamed National Meteorology Institute.

extending into adulthood, affecting women's opportunities for employment, professional advancement, leadership, and participation in decision-making.

Although women constitute approximately half of Ethiopia's population, their representation in scientific and professional occupations remains disproportionately low. For example, a gender audit of the Ethiopian Institute of Agricultural Research (EIAR) found that women constituted only 24% of its staff (Drucza et al., 2017). Gender disparities are also evident in federal employment. Lipinski et al. (2013) reported that women were underrepresented in senior administrative and professional scientific positions, despite their substantial contributions to the economies of both rural and urban households. Such patterns suggest that women's contributions to the economy are not necessarily matched by their representation in professional, scientific, and decision-making positions.

Gender disparities are similarly evident in decision-making processes within the agricultural sector. Aregu et al. (2011), for example, found that decisions concerning the adoption of agricultural technologies and improved farming practices were predominantly made by men. Women have also been underrepresented among agricultural extension personnel, with female extension agents accounting for no more than 22% of extension agents, although the proportion varies across regions. Similar patterns have been reported in water governance. Studies of water users' associations found that women were rarely elected as committee members and were particularly absent from leadership positions (Awulachew et al., 2010; Teshome, 2003). These examples demonstrate that women's limited participation is not simply a matter of numerical representation but also concerns their ability to influence decisions affecting household livelihoods, agricultural production, and access to natural resources.

Gender norms within Ethiopian society can reinforce these inequalities from an early age. Girls and women are often socialized into gendered roles that place greater emphasis on domestic responsibilities and household work. Such expectations may reduce the time and opportunities available to girls for schooling and may contribute to lower educational aspirations and expectations compared with boys. In some cases, these constraints contribute to school dropout and early or child marriage, including marriage before the age of 18 and, in some circumstances, marriage without the girl's full and free consent.

Persistent gender disparities in educational participation and attainment illustrate the continuing nature of these challenges. In 2022, the net primary school enrollment rate was reported to be approximately 90% for girls, compared with 98% for boys. Only about one-third of girls progressed to secondary education (World Bank, 2022). Girls accounted for approximately 48.5% of secondary school enrollment, while only 21.1% completed lower-secondary education (UNESCO Institute for Statistics, 2022; World Bank, 2022). Although substantial progress has been made in expanding girls' access to education, these figures indicate that gender disparities continue to emerge and widen at different stages of the education system.

Limited educational opportunities can, in turn, restrict women's access to formal-sector employment and professional occupations. Women who enter the public sector have often been concentrated in clerical, secretarial, and administrative positions, where opportunities for leadership and participation in institutional decision-making may be limited. This occupational segregation can subsequently contribute to women's underrepresentation at policy, professional, and research levels, thereby limiting the extent to which women's perspectives and experiences are incorporated into institutional decision-making (Regassa, 2012).

The marginalization of women in leadership and decision-making is not unique to Ethiopia. As Corner (1997) observed, in many societies, girls are socialized into more passive roles and have fewer opportunities than boys to develop decision-making and leadership skills outside the family. Gender-based discrimination, stereotyping, underrepresentation, and restrictive gender socialization therefore constitute broader global patterns of inequality. The position of Ethiopian women should consequently be understood within this wider context of gender inequality. The global evidence presented by the Overseas Development Institute (ODI) similarly indicates that women continue to have limited access to leadership positions. Although progress has been made in increasing women's representation in elected positions at both local and national levels, women remain less likely to occupy executive positions and key cabinet posts. Similar disparities persist in the private sector, where women remain substantially underrepresented in business management, corporate decision-making, and business associations (Domingo, 2015).

In Ethiopia, increased participation in education has not yet translated proportionately into women's representation in senior leadership and decision-making positions. Although there has been considerable progress in women's participation in education, particularly at the primary and lower-secondary levels, women remain underrepresented in the leadership of major public and private institutions. For example, the representation of women in senior leadership positions in higher education, banking, regional government, and other influential institutions has historically been very limited. These patterns highlight the need to move beyond improving women's access to education toward creating institutional and social conditions that enable women to translate educational attainment into professional advancement, leadership, and meaningful participation in decision-making.

Women's participation in decision-making is particularly important in sectors such as agriculture and meteorology, where decisions and services directly affect household livelihoods. Women make substantial contributions to agricultural production and household economic activities and possess valuable experiential and local knowledge concerning weather, climate variability, and agricultural practices. Consequently, regional meteorological service centers should seek to incorporate women's perspectives and local knowledge into the design and delivery of climate and weather information services. Increasing women's participation in decision-making within meteorological institutions can therefore contribute not only to gender equality but also to the relevance, inclusiveness, and effectiveness of meteorological and climate services.

This paper aims to understand the practice of decision-making within NMA regarding weather forecasting, and publication as well as dissemination of meteorological data. The extent in which employees, especially females, are engaged in the decision-making process and the gendered-dimension of decision making are main issues for investigation by this qualitatively-oriented study. The findings will inform NMA of its practices of decision-making and women employees' role in the decision-making process. A women-friendly meteorology organization is beneficial for society since women represent half of the Ethiopian population. In addition, an organizational analysis of NMA and its decision-making is fundamental for appreciating the social structures and cultural context within which meteorologists perform their expert tasks. These are some of the key issues highlighted by this study.

2. Theoretical Framework: The Social Rules System Perspective

In this study, the social rule system framework is employed to examine the formal and informal cultural norms, rules, and operating procedures embedded in the everyday functioning of the National Meteorology Agency (NMA), Ethiopia's leading meteorological institution, striving to meet the country's need for improved meteorology services. According to Burns and Flam (1987), organizational interactions, decision-making processes, and patterns of behavior are produced, reproduced, and maintained through rule systems that sustain structured relationships between organizations and their members. Similarly, Burns and Dietz (1992) argued that rules are central to understanding organizational and institutional continuity and change, with broader implications for societal transformation shaped by environmental pressures and human agency. Organizational rules encompass both explicit and implicit mechanisms of communication, including written policies and procedures as well as unwritten norms and expectations, which structure formal and informal interactions within an organization.

Meteorology agencies are organizations which operate within social and cultural contexts whereby “... **local features of interaction influence how employees conceptualize their workplace self**” (Fine, 2006). Drawing on research conducted by Burns & Flam (1987) and March (1994), Eckel & Hartley (2011: 202) argue:

Members of organizations develop rules for regularizing their work and mitigating confusion and conflict. The scaffolding of such rules reveals a great deal about shared norms and values, that is organizational culture. Social rules significantly influence people's expectations about participating in decision-making, establish participant obligation and rights, set parameters for work activities, and act as a guide to determine feasible obligations.

Rules give directions for management and employees to channel resources and carry their respective roles to meet organization's objectives. They set limits and boundaries as well as provide autonomy for employees in discharging their obligations and protecting their rights from unnecessary encroachment by management or superiors. Regarding the double-edged characteristics of rules, Perrow (1986:26) says:

Rules do a lot of things in organizations: they protect as well as restrict, coordinate as well as block, channel effort as well as limit it, permit universalism as well as provide sanctuary for the inept, maintain stability as well as retard change, permit diversity as well as restrict it.

An important aspect of the social rule system framework is **organizational culture**, which encompasses spoken and unspoken, written and unwritten rules, norms, and practices that guide the conduct of organizational members. Organizational culture also refers to “**values and behaviors that contribute to the unique social and psychological environment of an organization**” (Cancialosi, 2017). It is reflected in the ways an organization: (1) conducts its activities and treats its employees; (2) allows employees autonomy and freedom in decision-making; and (3) promotes employees' commitment to the achievement of organizational goals. Organizational culture is broad and pervasive, encompassing shared attitudes, beliefs, values, customs, and both formal and informal rules that develop over time and are regarded as essential to the continued functioning and sustainability of an organization.

Rules shape an organization's internal functioning as a system and influence its interactions with the external stakeholders. Compared with broader organizational values and cultural norms, rules are generally more concrete and specific and play a more direct role—formally or informally—in guiding the day-to-day activities of an organization. They are particularly important in structuring relationships among employees and between employees and management. Organizational rules may be expressed through informal maxims, such as “the way we do things around here,” or through formal policy statements and guidelines related to the organization's core mission and operational practices. As Eckel and Hartley (2011: 202) observed, “**Identifying rules that guide behavior is an effective strategy for gaining insights into the beliefs, assumptions, and norms of institutional members.**”

Rules determine an organization's internal functioning as a system and also its interaction with the outside environment. They are more concrete and precise and play a more deterministic role (formally or informally) in the day-to-day affairs of the organization but especially roles dealing with employees' relationship to each other and with management. They are often expressed in the form of informal maxim “the way we do things around here” or declared policy statements (guidelines regarding the organization's core mission). “**Identifying rules that guide behavior is an effective strategy for gaining insights into the beliefs, assumptions, and norms of institutional members**” (Eckel & Hartley, 2011; 202).

The social rule system perspective enables organization theorists to see how, for example, participatory or restrictive is an organization's decision-making process. Organizations that rely on too many rules to get things done are likely to be less democratic in their decision-making than those with fewer rules. Though rules are important for every organization, the existence of many rules can be at times as damaging for the organization as the lack of rules because the former stifles creativity and change while the latter creates conducive environment for disorder and anarchy. The social rule perspective also deals with policies related to gender and minority issues across an organization's workforce.

In this regard, NMA's operation is characterized by rules which are stated and applied in the form of policies, operating procedures, and code of conduct for employees. For example, NMA has a data policy that describes the procedures regarding delivery of meteorological data for users. One of the stated policies is that users requiring meteorological data should submit written application to the Data Management and Dissemination Department which is responsible for processing, compilation and delivery of meteorology data for users. However, if the request covers more than 5 years of daily weather data series, approval is required by higher agency officials (e.g. Deputy Director General). The data policy also describes who can access meteorology data free of charge (e.g. Office of the Prime Minister, Council of Ministers, Regional Governments, Research Institutes) and fees for the different types of services. This shows that rules also specify the agency's relationships with other organizations and define its interaction with external environment. Certainly, rules are essential to maintain transparency and accountability as well as to ensure accessibility of the agency and its services.

NMA has also policies that deal with employees in the workplace. One of the rules deals with working hours where every employee is required to sign four times a day – early morning at 8:30 AM, shortly before leaving for lunch break at 12:30 PM, resumption of work after lunch break at 1:30 PM and shortly before leaving for home at 5:30 PM. This policy is designed to ensure that employees do not leave work between working hours – eight hours a day and five days a week is mandatory for every government employee. Employees resent that they are required to put their signature four times a day, a sign the agency does not seem to trust its employees, and this might have a negative effect on employee morale and loyalty toward the agency. Some rules are internal to the agency while others originate from the federal government; and some rules are control-oriented while others are mission-and task-oriented.

3. METHODS

Data was obtained through expert interviews held among staff of NMA's head office in Addis Ababa and from its Amhara region meteorology service center branch offices based in Bahir Dar and Kombolcha sub-stations. Face-to-face interviews were conducted with NMA's Deputy Director General (1) with directors of various units of NMA (13), and experts working within NMA (10). Two follow-up interviews were undertaken with director of research development and with forecast & early warning case team leader to clarify some key issues. Telephone interviews were held with meteorologists working in the Amhara region meteorology service centers (3). The study participants were selected based on a combination of top-down (with the Deputy Director General recommending directors of departments under him for interviewing) and bottom-up (with experts recommending their respective team leaders to give additional information on some technical issues) research approaches. All data collection activities took place between April and October 2019.

Separate interview guides were developed and used for interviewing management, midlevel management and expert staff because of their varied experience in relation to the decision-making process. In some cases, follow-up interviews were conducted to clarify certain issues. The interviews were held in the premises of the NMA head office in Addis Ababa, located near the Black Lion Hospital, Kirkos sub-city, Addis Ababa. Most of the interviews lasted on average for 45 minutes. The collected qualitative data was analyzed using thematic analysis.

4. FINDINGS

Organizational and Human Resources Aspects of NMA

The national meteorology agency of Ethiopia was established by proclamation No. 201/1980. Two factors were mainly responsible for its establishment. The first and most direct reason was the 1970s famine that exposed Ethiopia's major faultline, which was absence of well-organized collection, analysis and dissemination of meteorology information contributing to the country's ill-preparedness to deal with the famine and its aftermath. The second factor was the change of government in 1974 resulting partly from imperial government's inept response to the 1973/74 famine, and the new military regime's aggressive approach to address Ethiopia's long-standing vulnerability to drought and famine.

In terms of organization, the NMA has seen different organizational arrangements over the years. It grew from a small organization in the early 1980s to current staff level of 900 plus. It was first established under the Water Commission and then reorganized in 1994 under the Ministry of Water Resources before it was reconstituted as an autonomous federal agency reporting directly to Office of the Prime Minister. Both the Director-General and Deputy Director-General are appointed by the Prime Minister subject to approval by the House of Representatives of the Ethiopian Parliament.

There are currently 16 directorates/departments under the NMA: eight bear the label 'meteorology' indicating that they directly relate to the agency's core-process activities while the remaining eight departments are responsible for support functions. Also, there are 11 meteorology services centers across the nine regional states: one each in Tigray, Afar, Benishangul-Gumuz, Gambella, SNNPR, Somali; two in Amhara, and three in Oromia regions.

At the time of data collection in 2022, there were two types of staff: technical and support staff. The former are those who are directly involved in the collection, analysis and interpretation of climatology data while the latter consist of employees working in ICT, human resource department and administration whose main task is to support the work of meteorologists. By March 2019 NMA has a total workforce of 990 employees – 51 percent are professional/technical staff and remaining are support staff (see Table 1). This includes employees working in the head office (Addis Ababa) as well as those stationed in the 11 regional meteorology services centers.

Table 1: Number of NMA Employees by Education (April 2019)

Education Level	Professional/ Technical	Support/Admin.	Total
MSc/MA	38	4	42
Postgraduate diploma	47	1	48
BSc/BA/BED/LLB	150	114	264
College/advanced diploma	73	42	115
Others©	197	324	521
Total	505	485	990

©Including graduates from technical and vocational schools, preparatory schools, grade 12 certificate, grade 10 certificate and primary education (1st and 2nd cycle).

In terms of educational qualifications, only a small proportion of the professional staff has MSc/MA (7.5 percent) and postgraduate diploma (9.3 percent) while the majority of the support/administrative staff (75 percent) do not have college degrees. This shows that NMA needs to do more work to professionalize its staff by way of training existing staff at MSc level and hiring new staff with graduate level of education. NMA's ability to deliver quality meteorology services for the public depends on quality of its employees and level of education is a major contributing factor to the attainment of desired level of professionalization within NMA. The management seems to be acutely aware of the necessity of boosting the education level of staff as demonstrated by providing sponsorship for 12 employees to attend graduate level of education in 2018/19.

Those who actually do meteorology mostly have MSc and BSc degrees. They are graduates in the fields of physics and mathematics and come from Arbaminch University, Mekele University, Adama Science and Technology University and Haramaya University. Some have specialty education in agro-meteorology, aviation meteorology, and health meteorology which are mostly offered at MSc/postgraduate diploma level.

There seems to exist some friction between professional and support staff arising from differential access to education opportunities, to promotion and to benefits (e.g. refresher training, participation in conferences/workshops, salary increment, overtime, etc.). There is a feeling shared among the support staff that some kind of, though tacit, marginalization of support staff is present within NMA. For example, an electrician working in the electronics department may feel that he/she is disadvantaged because they do not have a progressive career structure that would allow them move up in the agency, unlike a meteorologist who can be promoted from expert to case team leader to director, etc. This was expressed by one of the informants representing support staff: ***"They have recently done the career structure. They have done for the meteorologists and nothing is done for the support department. When the salary for meteorologists grew, there was nothing done for us"***.

The NMA, like many other similar organizations, has its own organizational culture, defined as employees' accepted manner of acting and behaving in the workplace including the things that the organization values most, principles it adheres to, and standards it sets for. In this regard, NMA has sets of values identified by informants. These include (1) respect for the profession, (2) emerging research culture and (3) teamwork.

Respect for the Profession

Meteorology experts who were interviewed for this study indicated that they have a deep sense of respect for meteorology as a profession. For them, meteorology is a science-based profession which has an international character as represented by the umbrella World Meteorology Organization (WMO), with more than 193 member countries. As science, meteorology imparts knowledge and skills regarding climate and weather forecasting which are practiced and accepted world-wide by those who are trained as meteorologists. For young university graduates who aspire to become meteorologists, getting a job and working in NMA is a source of pride (because of its emphasis on science and international recognition) and this has kept many to continue to work in the agency despite not-so-much attractive pay and benefits. The excerpts below confirm this:

Meteorology is worldwide science and the World Metrology Organization has 193 member countries. That is one thing that makes me to stay here. There are also many training chances, ranging from short term to long term, in and outside the country. I have been part of these training courses, and it helped me upgrade my skills and increase my experience. It is good and helps you to develop your capacity. You also get to know well-known professionals worldwide in such kinds of meetings and training (Meteorology Research and Development Directorate Director).

Starting form 18 years old, I am here. So, metrology is my life. I love the profession. The profession gives you a chance for international education if you are clever. I take education as a big opportunity. When you are doing metrological work, you read. As I told you, World Metrological organization has 189-200 member countries. You get experience sharing and teach yourself both vertically and horizontally. So, it is the science which attracts me (Data and Climatology Directorate Director)

The above was echoed by Director of Forecast and Early Warning Directorate who stressed that his love for the field of meteorology is the reason why he still works in the NMA:

I really love the field. It is very deep and you can learn and do a lot of things in the science especially if you start at a very young age. The science by itself is very engaging and the interaction in the agency gives me a huge satisfaction, I am very happy.

So, where does this strong devotion to the profession come from? For some, the presence of relaxed working environment is a source of encouragement, though this has been mirrored by the presence of somewhat stricter rules governing working hours. For others, training opportunities NMA offers, both nationally and internationally, are vital for the development of the profession. The opportunities trainings offer (in terms of networking, nationally as well as internationally, including interaction with scientists in the field) provide good incentives for employees to continue to work in the NMA. Because NMA is a multi-sector organization, it also gives employees a sense of national relevance and recognition.

Emerging Research Culture

Technically speaking, NMA is a research-oriented organization that is routinely engaged in the collection, analysis, forecasting and dissemination of weather and climate information. However, supporting these activities with research has not been given due attention because of shortage of staff with research skills and lack of research budget. Though, this has been slightly changing following the recent restructuring of the agency where emphasis is given to research, its research policy emphasizes on encouraging staff to do research and publish research results which count towards their promotion.

The meteorology research and development directorate is responsible for promoting research on climate and related topics, and some research budget is available for employees who develop and have successfully defended research proposals. For example, in 2019, 90 research papers were produced leading to financial incentives for researchers in the form of salary increment and/or honorarium. In 2019/20 a research call was made for meteorology personnel to submit research proposals on selected thematic areas including **belg** rain forecast verification, climate classifications of Ethiopia, assessing scientific seasonal forecasting and indigenous knowledge systems in pastoral areas.

To develop its employees' research capacity, NMA is actively collaborating with universities and research organizations (e.g. ILRI, IFPRI) in organising and providing research methodology training for staff. Mekelle University and Hawassa University have been partners in conducting research on tools and approaches to enhance farmers' ability to forecast and apply climate information at farm or micro-level. A national professional association, Ethiopian meteorological society (ETMS), has been established since 2008. According to its website, ETMS **aims to promote the science of meteorology, hydrology and atmospheric science** through research and practice in Ethiopia. A journal to serve as a vehicle to publish and disseminate scientific papers together with a quarterly newsletter to communicate current scientific and technical information pertaining to meteorology, has been established. However, by 2020 the website contains information that dates back to 2012 only and has not been updated, suggesting ETMS might not currently be as active as it should have been².

Teamwork

We have one culture – that is – **everyone shares what he/she learnt either from abroad or locally**. This is the motto shared by meteorologists at the NMA. While team work is important in every organization, this is more so in meteorology science where every experience, perspective and context-specific observation counts in achieving optimal forecasting of weather and climate conditions. At the heart of team work is the urgency of timely collection (from different weather stations), transportation (by mail, radio-transmission, electronically), analysis and publication of weather and climate data to arrive at near-ideal scenario of weather condition in a given area. This requires collaboration among those who collect, organize and analyze weather data and publish forecast to make it available for different stakeholders in a timely manner.

There is another aspect in which teamwork is reflected in the NMA. This is related to the notion of helping each other to ensure that no colleague is blamed for failing to accomplish a given assignment. For example, every department publishes periodic reports detailing activities performed during a month or quarterly. Each case-team member contributes his/her share of the workload. However, if a member fails to meet deadlines, he/she can expect help from other colleagues. This often is seen during preparation of reports (monthly or quarterly) where everyone chips in to ensure that the department is not lagging behind its plan.

²The First Series of Ethiopian Meteorological Research publication appeared in April 2020 under the title Joint Scientific Journal of National Meteorological Agency (NMA) and Ethiopian Meteorological Society (EtMS).

The human resource directorate lauds teamwork as one of the strategies for attaining its objectives. This was noted in its March 2019 nine-month activities report in which teamwork and team spirit is identified as key for success of the human resources directorate's work plan. Here, teamwork is demonstrated in working outside working hours and during weekends to accomplish tasks set out in the department's annual plan.

Decision Making within NMA

Overall Trends

Broadly, decision making refers to the process of taking actions concerning financial, technical and administrative matters of NMA. Here, the focus is on decisions related to the provision of meteorological services which constitute the agency's main mission.

Generally, the decision-making process within NMA can be described as consisting of lower-level, middle-level and top-level management. The lower-level decision making is practiced by experts (including case team leaders) who often collect meteorology data (via computer-generated images and data collected from regional meteorology service centers), organize and analyze it so that it can be digested by middle-level management (consisting of directors of the different directorates/departments). This group in turn deliberates on the issue (often involving back and forth consultation with experts who organize and analyze the information) before passing on to the top management (consisting of the Director General, Deputy Director General and others, as may be necessary).

Important decisions (e.g. overseas travel, staff promotions, opportunity for further education, etc.) are mostly made by top management, with middle management providing the necessary scientific and technical information. This view is shared by an informant working in the women directorate who indicated that decision-making tends to be top-down.

Experts do not normally engage in decision-making, except in organizing and producing reports, and this is echoed by an informant working in the electronics and ICT department: ***“Team leader doesn't engage in decision making, it has been two year since I become team leader, and before that I worked as a lay worker. It is the director who decides. Employees at the lower level accept what they decide”.***

However, employees can react to decisions made by management if they think that the decision will affect their work negatively, or they would be impacted personally negatively. This was revealed by an expert in the Training and Climatology directorate, who is also coordinator of the training programme, who said that whenever he senses something is wrong, he confronts his boss:

If there is some decision the managerial team makes and when our boss tells us about it because he is a member of that managerial team, on my part if there is some issue I don't agree with, I will say that the decision you made is not correct so pass this message for them. Do not come here as an empty vessel and transfer what is decided only so we raise different issues I can't list down all of them.

However, most technical activities are decided and executed at lower level, though these activities should reflect and be in-line with the agency's annual plan. This observation was made by one of the informants working in the electronics case team who describes the manner each department prepares its own activities to be accomplished during the first, second, third and fourth quarter as follows:

I say it is bottom up. Works goes from the team leader to the department's director and again go to the top-level managers. Nothing comes from the top. We plan our activities which go to the department's director [for approval] and then to the top-level management.

The above also finds support from director of the Forecast and Early Warning Directorate who acknowledged that meteorologists have full say in technical issues such as producing forecasts: ***“So, we have full involvement on the technical issues. However, there might be issues dealt with by the management only. But all the technical issues are discussed with experts 100 percent”.***

Specific Areas of Decision-Making

Here, four specific areas of decision making are identified. These are decisions related to (1) data collection and organization, (2) data analysis, interpretation and publication, (3) dissemination and media publicity, and (4) stakeholder engagement and feedback. Each is discussed below.

Data Collection and Organization

Weather and climate data is very critical to NMA's work. Weather data (mostly consisting of daily temperature, and rainfall) is collected from weather stations that operate manually (that is, the reader goes to the station and records the data manually) and is then transmitted using a radio with single-side radio band (SSB) system with the sender transmitting weather information and the receiver recording the data. The hand recoding takes place on a sheet of paper containing the Ethiopian map and location of each weather station on it, with new weather figures going to the respective weather stations (the data displayed in Figure 1 shows Max-Min temperatures for Aug 20, 2020). This happens every 24 hours at 06 GMT (09 hours local time). The data stored in the head office is transferred electronically to the respective regional meteorological centers and is used to forecast the region's or sub-region's weather.

On the other, the automatic weather stations (equipped with automatic data-recording devices) collect climate data by themselves and transmit daily-recorded data to a central server system located in the NMA head office in Addis Ababa. These stations store more detail data including wind stream, precipitation, cloud cover, rainfall and temperature. NMA also gets data from WMO and bilateral cooperation involving sharing of meteorological data. For example, the USA-based National Center for Environmental Prediction (NCEP), UK Meteorological Office, European Center for Medium Weather Forecast and French meteorology, all provide NMA with weather data.

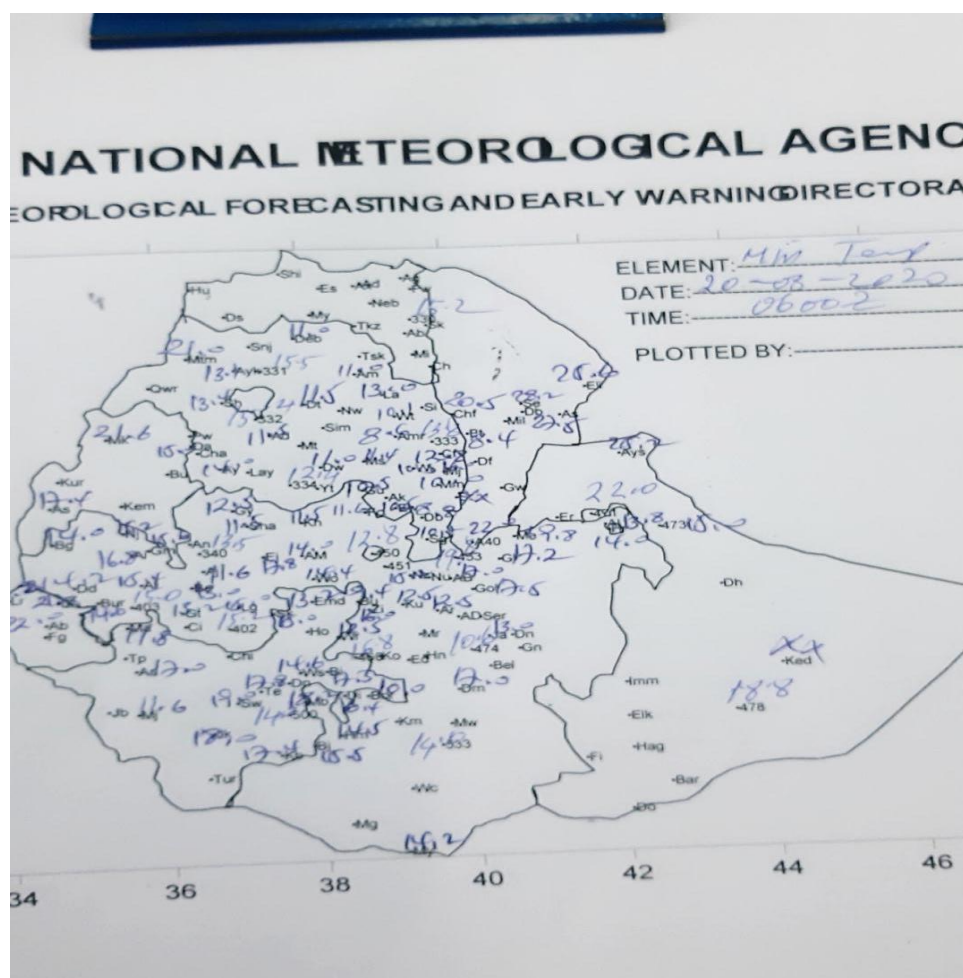


Figure 1: Max-Min Temperature Collected from Conventional Weather Stations across Ethiopian, 20 Aug. 2020

Regional meteorological service centers are responsible for collection and organization of climatological data originating from meteorology stations located in their respective jurisdiction. The center director for the respective regions takes full responsibility to collect and organize the data. To be more specific, experts and data collectors under them collect weather data on daily basis and the collected data is kept, organized and analyzed at the regional meteorology center, which makes its own weather forecasts about the region.

Data Analysis and Publication

Raw climate data, if not analyzed and interpreted in ways that is easy to use, is of little value for decision making in agriculture activities. Therefore, the role of the meteorologist here is to analyze and interpret the collected data so that users can understand it and make use of it in their business operations/farming decisions. NMA follows a relatively decentralized decision-making structure in the production and dissemination of weather and climate data.

Region-wise forecasts are produced by the respective regional meteorological service centers (RMSC) while national-level forecasts covering major cities are produced by NMA at the head quarter in Addis Ababa. At region level, each RMSC is responsible for collecting, analyzing and disseminating the weather data covering its own region. Of the different case teams/work teams, the forecast case team is most responsible for weather forecasts. Members of the forecast case team sit together to discuss the collected data

Dissemination of Forecasts

Once climate forecasts are produced by NMA, the data is disseminated to various stakeholders via a variety of dissemination mechanisms. In the case of short-term and medium-term forecasts, published weather data is made available to users via email, electronic reports, radio, TV and posted on NMA website. In the case of long-term, seasonal forecasts, NMA organizes a stakeholders' meeting where PowerPoint presentations and short-written briefs are provided for the attendees. Most of the dissemination workshop invitees come from National Disaster Risk Management Commission, Ministry of Agriculture, Ministry of Water, Electricity and Irrigation, Ministry of Health, NGOs, and so on.

Stakeholder Engagement

Depending on the type of stakeholder involved, engaging stakeholders is done by different groups of NMA experts. Again, in the case of communicating seasonal forecasts, NMA invites stakeholders to a meeting where PowerPoint presentations are made by experts and middle-level management. During the presentations, assessment of the previous season forecasts is presented and discussed, including the forecasts deviation from actual climate occurrences. Disparities are explained in terms of unexpected occurrence of climate-changing events in the atmosphere or in the oceans, or both. Here, both experts and middle level management are involved in organizing the workshop, reaching out to stakeholders by email, or telephone, and also in presenting forecasts. Sometimes, however, the Director-General or Deputy Director-General may be required to make presentations of forecast data for high-level stakeholders such as the Ethiopian Parliament or Prime Minister's Office. The diversity of stakeholder groups NMA has to deal with shows the importance of meteorology for the various sectors of the Ethiopian society.

Gender Aspects of Decision-Making

Women as broadcasters of meteorological information are seen on TV. The images of Yenenesh Hailegebriel and Almaz Tadesse who used to describe weather maps during evening TV news in the 1980s have not faded away from memories of many Ethiopians. These women in some ways represented the public face of NMA and might indeed give the agency positive public perception regarding presence and participation of women in the agency. However, a closer look at the position of women in the agency might otherwise reveal stark reality of domination of men in most aspects of the agency's life. Here, three areas are relevant: (1) women representation in the agency, (2) women in leadership positions, and (3) women in decision-making.

Women's Representation in the Agency

Meteorology is a scientific profession and attracting women to specialize in the hard sciences is not easy. There is a general lack of women in physics and mathematics, which form the backbone of meteorology science. As has been stated, women constitute 30 percent of the agency's staff, and a small proportion of the professional staff is women. This shows that they are underrepresented in the agency. Their representation diminishes further when seen in terms of level of education. Women employees with MSc/graduate diploma represent a very small proportion of all employees with same level of education. Therefore, women are disadvantaged in three important indicators: access to employment, access to professional positions, and opportunities for graduate-level education, which of course opens an employee's chance for professional employment in the agency. This shows that women are underrepresented in multiple fronts, which are connected to each other in historical, education and economic contexts.

Women in Leadership Positions

Women employees, when assigned to leadership positions, are often given non-technical leadership posts. Out of the 16 directorate positions, six are women who mostly hold non-technical positions of human resources, ethics & anti-corruption, women affairs, change. Worse still, in the regional meteorological services centers, the representation of women in leadership roles is non-existent – all the 11 directorship positions are held by men. There are about 16 directorates; out of these six are women so there is about 20-31 percent women participation in leadership positions. This means, there is nearly about 30 percent women participation.

Women face many challenges while working in the NMA. This was described by a female electronics case-team leader, who overcame gender bias through hard work, determination and perseverance:

There are many challenges as a woman. It is considered as if women cannot perform tasks because they are women. We also consider self as weak. I personally work as a man. They can be a witness for this...when I first joined the agency; they sent me to a challenging place. They wanted me to say "I cannot" ... but I worked properly. As a woman, they wanted me to say, "I can't" and leave the position for them. I have faced these kinds of things, and I got used to it. If a woman says, "I can" and if she is strong, she will get used to it. Such kinds of problems are not only evident in our workplace; they are present in any workplace. Men do not want to be inferior to women. They want to make women inferior in education and other aspects. They do not even want to be parallel. I have seen this in my work experience.

The informant points to several factors that have challenged her position. One major challenge was being assigned to a more difficult role prior to her appointment as director. Her reference to "they" signifies the male-dominated management team responsible for making critical decisions, such as appointing directors. Furthermore, the informant notes that women often doubt their own leadership abilities, which men then use as a pretext to deny them promotions to management positions. Her experiences within the NMA demonstrate that men's desire for superiority actively prevents women from attaining leadership roles within the agency.

Women in Decision-Making

Women's participation in decision-making is affected by the share of their contribution to the agency's workforce in general and to the professional staff in particular. In both cases, women, as has been observed, lag men. This would negatively affect their decision-making roles. Both positions of the Director-General and Deputy Director-General are held by men. These are the two key positions where real decision-making power lies. This was confirmed by the Women Directorate: **"Most decisions are given by top managers. Even though it is not bold, there are some decisions decided by middle managers"**. It is obvious that the top management tier is entirely composed of men, to the complete exclusion of women. Consequently, women's decision-making roles are limited to non-technical positions, such as those in administrative services.

Several factors discourage women from participating in decision-making within NMA. The first one, as described by the electronics case team leader, is bias against women – they are seen not as competent as men. This view is shared not only by men but also some women who are likely to succumb to gender stereotypes thereby contributing, (un)knowingly, to the women-inferior mindset. The second reason is related to shortage of women in the fields of science and mathematics which are often sought by the meteorology profession. Fewer young girls graduate in hard sciences and of those who graduate with a bachelor's degree only a handful can proceed to graduate programs with a major in meteorology and related fields. No wonder girls in these fields become scarce and subsequently boys often fill job vacancies in meteorology.

Finally, in Ethiopia meteorology remains entirely in the public domain and a very limited market exists for its services in the private sector. This makes it less attractive for young people (especially girls) to pursue training in meteorology. This situation leads to a very competitive job market that is gender selective, with meteorology becoming less of a priority for women, and in the context of shortage of female employees within NMA, issues related to women as leaders and decision makers become somewhat rhetorical.

5. DISCUSSION

Decentralized decision-making regarding the collection, analysis, and dissemination of meteorological data characterizes most of the internal decision-making practices of the NMA (Author's field data, 2019/20). Seasonal forecasts are developed through conference-style, face-to-face dialogues and consultations involving meteorologists from the head office and all regional meteorological service centers. However, at the time of data collection in 2019/20, none of these centers was headed by a woman. The underrepresentation of women in meteorological science reflects deeply rooted social and gender norms that have historically discouraged women from pursuing education and careers in STEM fields. These broader societal barriers appear to be reinforced

within the NMA (e.g. rules and policies related to recruitment and appointment), contributing to the continued underrepresentation and exclusion of women from meteorology and related fields.

In the past, the NMA was more public-oriented, and weather forecasts were widely accessible through television broadcasts. However, its current approach appears to be more **stakeholder**-focused. This shift may have reduced the NMA's visibility in the public domain and, consequently, limited its responsibility and capacity to promote gender diversity. Improving meteorological literacy among citizens, particularly farmers and women, could strengthen the NMA's societal visibility and enhance its role in promoting inclusive access to meteorological information and services.

In the absence of closer collaboration between the NMA and farming communities, challenges related to the communication and effective use of weather forecasts are likely to persist, as highlighted during the National Framework for Climate Services Regional Launching Workshop held in July 2018 (Melese & Abate, 2018). Therefore, there is a need to move beyond viewing meteorology and society as separate yet interacting domains toward greater and more meaningful engagement of citizens and farmers in the NMA's day-to-day operations.

Decision-making within the NMA appears to be predominantly male-dominated, with men occupying a greater proportion of senior decision-making positions and exercising greater influence over the organization's institutional, material, and financial resources (Author's field data, 2019/20; Kabeer, 1999). Shortage of trained female meteorologists who can assume top-decision making positions within NMA is the main contributing factor to women's limited involvement in decision making. This confirms previous global research which shows that in many public organizations "... **there may not be enough women leaders to fill senior leadership positions**" (Kulkarni and Mushira, 2021).

Another important consideration is that the male-dominated organizational culture characteristic of the NMA is likely to be self-perpetuating, as successive generations of leaders may be reproduced in the image of those who preceded them (Bagilhole & White, 2011). Furthermore, gender and social norms that have historically constrained women's access to education, particularly training in scientific and technical fields such as meteorology, have contributed to women's limited representation and participation in decision-making positions within the NMA. This situation is highlighted by the UNSCO 2024 Education Monitoring Report which identifies gender norms, stereotypes, and unequal access to educational opportunities as important factors contributing to women's underrepresentation in STEM education and related careers (UNSECO, 2024).

To address the critical gender-imbalance, NMA should implement a workforce diversity management strategy focusing on developing policies and creating skills that will push for an increased representation of women in leadership and management positions (Gordon, 2005). Diversifying the agency's workforce along gender lines (i.e. hiring female workers) and undertaking a gender-balanced (meteorology-oriented) graduate-level training programme are some of the practical steps NMA can take to promote women's participation in decision-making. In addition, NMA should capitalize on global trends of improving access to technology, science education, and workplace improvement including fair hiring practices, and transparent promotion and leadership pathways for women meteorologists. These policies could be supported by international organizations such as the World Meteorological Organization (WMO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), which can provide technical expertise, capacity-building support, and other resources to promote the mainstreaming of gender diversity in meteorological education, training, and related fields. For example, WMO's gender equality initiatives could provide technical expertise, capacity-building support, and institutional guidance for mainstreaming gender diversity (WMO, 2015) within the NMA.

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7. DISCLOSURE STATEMENT

The author reports that there are no competing interests to declare.

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