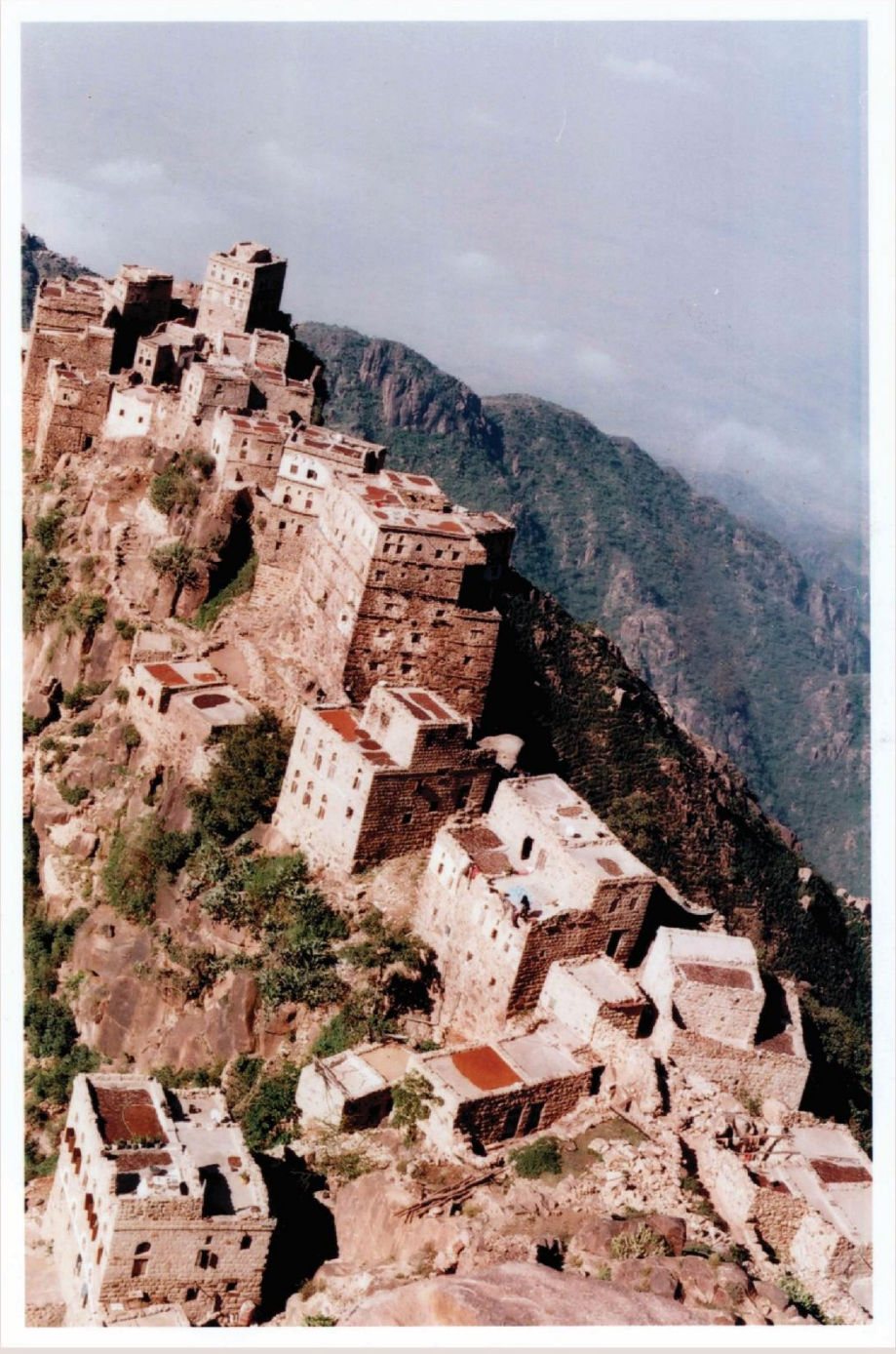
Qat and Coffee

Value Chain Analysis in Yemen



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Executive summary

This study has been commissioned under the 'Qat-to-Coffee for Climate Resilience and Human Security in Yemen' pilot project under the umbrella of the 'SDG Climate Facility Project: Climate Action for Human Security', funded by the Swedish International Development Cooperation Agency. The objective of the pilot project is to promote sustainable coffee production and value chains in Yemen as a high-value alternative crop to reduce groundwater exploitation, enhance livelihood opportunities, and empower women.

During periods of heightened insecurity, many households in Yemen shift away from more profitable crops requiring higher investment to subsistence farming of lower-risk crops and cut back on investments that would increase productive capacity.[1] The fact that the agricultural sector and the rural economy have fared relatively well still compared to other countries in the region can be attributed in large part to the extraction of groundwater and the production of Qat (also known as 'Khat'), which is considered a cash crop that generates substantial revenue. The latter's production has increased considerably over the past 5-10 years and has been estimated to consume one-third of the abstracted groundwater.[2] While Qat production generates income and livelihoods for farmers, it uses up finite groundwater resources and most of the arable land in Yemen, and provides no nutritional value in a country that is struck by protracted conflict and rising rates of malnutrition.[3]

The first representative field survey and investigation aimed at assessing Qat consumption patterns in Yemen was undertaken in 2006 and confirmed the widespread use of the drug, including its negative impacts on society, such as adverse health effects, straining financial budgets of families and contributing to poverty.[4] Qat consumption and production has only increased since then, and accelerated again with the beginning of the war.[5] It has become a systemic root cause of poverty embedded within all branches of society and entrenched by its economic appeal to actors across the value chain. Qat consumption is one of the key causes of poverty in Yemen[6] and should be considered a complex issue underlying other developmental constraints in Yemen and negatively impacting and preventing any progress towards achievement of SDGs across the board. At the same time, Qat consumption is deeply entrenched in society

[1] M.-A. Arias, A.-M. Ibanez, and A. Zambrano (2013): Agricultural Production Amidst Conflict: The Effects of Shocks, Uncertainty, and Governance of Non-State Armed Actors.
[2] According to the World Bank Yemen Country Brief, as referenced in the Climate Risk and Adaptation Country Profile, Global Facility for Disaster Risk Reduction (GFDRR, 2011).
[3] Refer to UNICEF reports on malnutrition in Yemen for current status updates: https://www.unicef.org/yemen/nutrition
[4] Yemen Towards Qat Demand Reduction (World Bank, 2007). Report no. 39738-YE, World Bank.
[5] See, for example, Qat trade in Yemen: flourishing despite a falling economy (World Bank, 2020). Blog by Ebrahim Al-Harazi.
[6] Yemen Towards Qat Demand Reduction (World Bank, 2007). Report no. 39738-YE, World Bank.

and benefits from well-established production and distribution chains, making it difficult to tackle Qat production value chains directly without a cross-cutting approach to its entire value chain. In a nutshell, there are multiple threats to sustainable development, peace and security related to Qat production and consumption in Yemen. As such, alternative crop cultivation needs to be promoted to tackle gender inequality, eradicate poverty, provide sustainable sources of income to locals, and to promote a sustainable and resilient post-war economy.

Coffee from Yemen enjoys a niche market in global trade due to its specialty flavour and high cup value. The value chain analysis of both crops presented in this document seeks to triangulate the inefficiencies in coffee production and value chains, and it discusses potential recommendations towards enhancing the productivity and value addition of coffee value chains in Yemen. The document further presents an assessment of Yemen's qat value chain to ascertain lessons that may inform efforts to enhance coffee value chains in the future.

Yemen is currently one of the least developed and the poorest country in the Middle East. The ongoing civil war has set the country development profile back by more than 20 years, and it will further shrink the country's GDP growth in coming years. Though the conflict is the leading reason for socio-economic strife, the development profile was off course even before the crisis. The Yemen economy drastically contracted following the conflict in 2014, and its export volume significantly depends on crude oil with some nominal share of agricultural commodities. The agriculture sector still dominates the livelihood options for the Yemeni people, but the rural population has continued to decrease due to urban and economic migration. The agricultural sector has declined by 21 per cent during the conflict years, mainly because of market disruption, non-availability of crop inputs, and uncertainty in terms of displacement. Agriculture is still dominant in a few valleys where water becomes available from precipitation and groundwater sources, while most of the land in Yemen is arid and uninhabitable. The cropping pattern identified a good diversity of summer and winter crops, spread throughout the year. The fruit group takes the lead with 13 different fruits, followed by 10 vegetable types, 5 cereals and cash crops each, 6 types of pulses, and 3 main fodder types.

Migration and drought have contributed considerably to the reported shift in cropping pattern. Qat production is reported to have increased as a result of profitability, growing market demand, and a short production cycle, as well as by psychological and behavioural impacts of the protracted crisis.

The effects of climate change on Yemen are fundamental. The country's per capita water availability is the lowest in the world, at 140 cubic meters per year. Droughts, desertification, and an erratic rainfall

pattern are not favourable for a society where approximately 60 per cent of the population still depends on income generated from natural resources. Historically, agriculture in Yemen is predominantly dependent on erratic rainfall, whereas the pumping of groundwater for irrigation purposes shrinks the aquifers at a rapid pace. The rain-spells are concentrated in March–May and July–August, which are mostly drained off into the sea without recharging the aquifers or providing meaningful productive use. For most of recent history, water governance has been regulated informally through user associations and community committees, but the increasing demand of limited water resources for multiple uses has increasingly led to violence between communities. Further, prevailing gender inequalities across the world, mainly in developing and least developed countries, are profoundly linked to climate change, given that women depend more on the natural environment for their livelihoods than men, particularly agricultural production. The climate change affecting water availability for irrigation will certainly affect qat cultivation in Yemen and the agriculture sector in general, but this could have positive implications for coffee cultivation in Yemen – where coffee is traditionally grown in high altitudes and where coffee production may suffer least as compared to coffee production globally.

Coffee is an important cash crop in Yemen, where it is grown in 15 out of the country's 21 governorates. Coffee was introduced centuries back in Yemen, and the commercial trade of coffee beans was reportedly initiated from a port in Yemen (Mocha Port) in the 1400s. Since coffee is grown on steep terraces in Yemen, the average farm size is small. The average plantation per farmer is 0.291 hectares (394 coffee trees), and a production of 114 kilograms per farming family is common. The Buraa and Dhamar governorates are specialized coffee production areas, due to their steep terraces. Additionally, San'aa, Amran, Addaleh, Hajjah Alamhweet, Lahj, Hudaidah, and Ibb are also more specialized locations of coffee production. The traditional cultivation methods, old varieties, and difficult growing conditions result in the specialty characteristics Yemeni coffee, but the yield is low (0.57 tonnes/hectare) compared to such global leaders in coffee production as Malaysia (3.77 tonnes/hectare) and Viet Nam (2.66 tonnes/hectare). The volume of coffee exported from Yemen in nominal (0.02 per cent of global trade). However, Yemeni coffee demands a premium price in the international market, which increased from $5.73/kg in 2017 to $7.15/kg in 2019. Yemeni coffee exhibits a much larger potential of generating value in terms of trade, employment generation, and GDP generation, and could become a driving force behind the socio-economic development of the country. Yemeni coffee has the potential to expand greatly, largely through its good reputation with consumers overseas, by using e-commerce and other digital platforms, and by providing responsible sourcing through reputable coffee outlets across the world.

The input supply function in coffee is limited to the seedling nurseries that are established in 10 governorates, while the use of agro-chemicals is insignificant among coffee farmers owing to their low popularity and the low incidence of insect pest. Management practices are largely traditional, with only 6.5 per cent of coffee farmers having an understanding of modern techniques. There are more than 14 coffee types reported across Yemen, but scientists agree on four main varieties (Udaini, Dawairi, Tufahi, and Bura'ai), while the rest are types renowned for their localities. The harvesting period is the longest in the coffee chain (2–3 months), when beans are picked 6–10 times during October–December, depending on location and variety. The beans are not marketed directly, but rather are considered as 'cash banks' and often are only marketed when cash is required for other family needs.

Collectors play a major role in the marketing channel of coffee, buying coffee from framers and bringing it to wholesalers, traders, and exporters. Some of the quality wholesale markets are situated in Bajel, Hudaidah, Almansuriah, and Bait alfaqeeh, and are concentrated mostly by coffee collectors, wholesaler, retailors processors, and consumers. Peak marketing time is linked with production and harvesting time (October/November), but good prices are fetched in the holy months of Ramadan and Pilgrimage. The coffee and spice shops prepare the coffee and *qesher* (coffee skin) for local markets according to the taste and flavours developed for each business and the demand in the domestic market, which results in about eight different flavors and products.

The regulatory environment for coffee in Yemen is at a standstill, with some necessary policies and frameworks in place but not sufficiently functional to create an encouragingly enabling environment for the farming community in general, and specifically for coffee producers. The enabling role is largely filled by private-sector processors who maintain coffee streams for domestic market as well as exploit the premium for Yemeni coffee in international markets. The gross margins are varied for different players, depending on locality and driven by individual agreements between buyers and sellers. On average, value margins are 40–45 per cent for farmers, 7–10 per cent for collectors, 5–10 per cent for wholesalers, 10–15 per cent for processors, and 15–20 per cent for retailers. Contract farming supported by processing units offer much more lucrative margins for farmers, with greatly reduced chain transactions, and present an exemplary model for encouraging coffee production in Yemen. Coffee production practices are largely performed by family labour, but the use of paid labour is also common for some specific functions. The contribution of women is largely unpaid and in addition to them often leading household-level chores. Women coffee organizations are fundamental for building the capacity of women coffee farmers in the best use of production resources and to better cope with climate change.

Women's traditional roles of fetching water, collecting fuelwood and fodder, and in food production will become increasingly stressed as the result of climate change. Compared to men, women still often have considerably less ownership and control of land, and they face significant barriers to accessing agriculture training, improved agro-inputs, and financial services. As a cash crop, coffee is generally seen as a men's crop, and income from the coffee cherry sales generally goes directly to the men of the household, even though a large part of the labour is performed by women. Significant examples of women ownership in the coffee subsector is missing in the context of Yemen, and poses a potential opportunity to enhance women's role in different functions of the value chain.

Although rural women are the dominant actors in providing the family livelihood and food security through their prominent role in plant and livestock production, qat planting, harvesting, marketing, and sale remain a male phenomenon. Women have limited roles in qat production, but they bundle qat leaves in preparation for market and perform weeding by removing the grasses that grow between qat trees and use these as fodder for livestock.

There are certain inefficiencies recorded at different phases (production, post-production, processing, marketing) of the coffee chain, which affect its productivity and performance in comparison to other crops, especially compared to the production of qat and vegetables. The Strengths, Weaknesses, Opportunities, and Threats analysis highlights a few strengths of the coffee subsector in Yemen and identifies a few important opportunities that, if exploited, can enhance productivity and profitability for coffee producers. The opportunity to invest in the existing management practices of coffee production in Yemen can potentially increase its profitability by not compromising the much renowned traditional flavour of Yemeni coffee. Intervention strategies at the production level will also open up space for reaching disadvantaged segments of the value chain. Specifically, the role of women in the coffee value chain could be further enhanced.

Qat (*Catha Edulis)* is a very popular hallucinogen and produced in the south of the Arabian Peninsula, mostly in Yemen and East Africa (Ethiopia, Kenya and Somalia). The cultivation of Qat in Yemen has expanded significantly during last three decades, with the plant now taking up about 15 per cent of agricultural land and consuming almost 40 per cent of available water resources for irrigation. Qat cultivation in Yemen is legal and its consumption has increased dramatically across all age groups domestically, where more than 70 per cent of the households has at least one qat user. The key informants consulted during the research for this report affirm that 95 per cent of Almahabeshah in Hajja; 80–90 per cent of Rada'a, Addaleh, Mawiah, and Jabal Saber; 50 per cent of Taiz; and 30 per cent of agricultural land

in Sana'a is used for qat cultivation – with more than 70 types of qat recorded in both the northern and southern parts of the country. The Sarawat region was once home to some of the world's most valuable coffee, which was recently converted to qat production. This expansion is alarming for agricultural livelihoods where economic dependency for farming families is largely linked to the production and marketing of qat. Indeed, some researchers argue that its profitability is 12 times higher than other cash crops, making it the most profitable market commodity. The distribution of value margins also promises a hefty share for farmers (55–65 per cent), and the rest is distributed among collectors, wholesalers, and retailers.

Importantly, qat is not an environment-friendly crop as its water usage brings aquifers to the brink of extinction, and the extensive use of pesticides and fertilizers creates an extra burden on the environment and human health. The marketing channels of qat are short and exist almost everywhere in the country. There have been efforts to regularize the cultivation of qat in Yemen (the qat conference in 2002 and proposed qat policy in 2002), but the fear of international pressure from multilateral institutions has put this on hold to date. Some subsidies on diesel and electricity, and the promotion of solar-PV hydro-pumps for wells in agriculture have even contributed to the expansion of qat.

Programmatic recommendations:

The analysis of both coffee and qat value chains enables us to present a few important recommendations in various domains that have the potential to increase the profitability of coffee in Yemen and thus would help to encourage farmers to replace their qat crop. While replacing qat remains a difficult subject in Yemen, the harsh realities associated with food insecurity, shrinking water resources, and the effects of climate change may change the favourable thinking about growing qat.

The recommendations summarized in the following table, are presented in detail under the coffee value chain. As such, they should be considered as preliminary and should inform further research by government authorities and international development agencies.

Functions	**Key recommendations**
Pre-production	- Certification of coffee nurseries and strengthen their capacities in tracing and tracking of coffee seedlings. - Facilitate contract farming between farming communities and coffee processors/exporters to enable higher returns for farmers.

	- Facilitate micro-finance institutions in expand the share of formal financing options among farming communities.
Production	- Capacity-building of coffee farmers in good agriculture practices of coffee production in planting, irrigation, fertilization, and integrated pest management. - Effectuate the role of coffee associations/cooperatives in production pockets and enhance their role in all important functions of the chain. - Introduction of water-efficient technologies and rehabilitation of irrigation infrastructure can enhance water use efficiency. - Make effective use of sustainable and renewable water resources by constructing water retention structures and rainwater harvesting at community level.
Post-production	- Improve infrastructure in post-harvest handling (drying, storage, packing). - Promote mechanization in post-harvest technologies. - Improve marketing infrastructure of coffee, emphasizing branding and labelling. - Create partnerships with leading baristas and roasters in promoting the scale of Yemeni coffee in international markets.
Research and development	- Genotypic mapping of coffee varieties in Yemen and secure patent for Yemeni specialty coffee varieties. - Hybridization research for developing new varieties or blends of coffee compatible with changing climatic requirements. - Integrated crop management and pest management against coffee pests and diseases. - Agro-ecological zoning of coffee cultivation. - Climate risk management on potential scenarios of Yemen for coming 2–3 decades and informed decision-making on different functions of coffee production.
Enabling environment	- Formulation of coffee sector strategy, emphasizing marketing, branding, price setting, and contract enforcement - Increase coordination, collaboration, and networking among coffee value chain players, and increase transparency across the chain - Knowledge sharing with leading coffee producing countries to adopt best practices for coffee production in a changing climate. - Effective engagement of women across different functions of coffee value chain.

Gender equality	- Strengthening and ensuring women's access, control, and ownership of resources, such as credit, information, training, outreach, and culturally appropriate and labour-saving technologies. - Systematic analysis of climate change factors such as water, fuel, and energy from environmental, development, and gender equity perspectives to fill any gaps in research, knowledge, and data. - Ensure the participation and substantive inputs of women in decision and policy-making in local, community, national, regional, and international institutions, processes, negotiations, and policies related to climate change issues. - Women should be at the centre of adaptation programmes because they are a particularly vulnerable group due to limited access to, control of, and ownership over resources; unequal participation in decision and policy-making; lower incomes and levels of formal education; and extraordinarily high workloads.

Contents

Acknowledgements i
Executive summary ii
List of tables xii
List of figures xiii
Introduction/Context 1
Objectives of the study 2
Methodology and approach 3
Findings of the study 6
Socio-economic overview of Yemen – The context 6
Overview of the agriculture sector in Yemen 7
Cropping pattern 9
Shift in cropping pattern 9
Climatic shift – Water scarcity – Impact on agriculture sector 10
Water stress 11
Climatic effects on selected crops 13
Coffee value chain 14
Overview of the subsector 14
International overview of coffee production 17
Value chain functions 18
Input supply – Coffee nurseries 18
Production 19
Traditional coffee markets 24
Domestic branding of coffee 26
Export market (traditional and specialty coffee) 27
Enabling environment – Value chain governance (VC facilitators and regulators) 29
Coffee value chain map 32
Value addition and gross margins 35
Employment generation (inclusion) 36
Inefficiencies in the coffee value chain 39
SWOT analysis 40

Programmatic recommendations 42
Qat value chain 48
Overview of the subsector 48
Geographic preference of qat cultivation 48
Value chain functions 50
Input supply 50
Production 51
Harvesting 52
Marketing 53
Enabling environment – Value chain governance (VC facilitators and regulators) 54
Qat value chain cycle 55
Production costs 55
Profitability margins 56
Value addition and gross margins 57
Employment generation (inclusion) 58
Inefficiencies in the qat production chain 59
Conclusions 61
Annex I – Details of key informants 63
Annex II – List of coffee associations and related institutions in Yemen 65
Annex III – List of coffee processing institutions 68
Annex IV – Coffee producing governorates in Yemen 69
Annex V – National Yemen Coffee Auction 73
Annex VI – Obstacles and suggestions to improve coffee production in two governorates in the north and two in the south (according to key informants) 74

List of tables

Table 1: Sample size of the study 4
Table 2: Average yields of coffee producing countries 18
Table 3: Coffee nurseries in Yemen (Source: survey) 19
Table 4: Characteristics of leading coffee types (Source: key informants) 21
Table 5: Traditional markets associated with coffee marketing (Source: key informants) 25
Table 6: Potential international markets for coffee 27
Table 7: Management examples of Water Users Association in Yemen 31
Table 8: SWOT analysis of coffee in Yemen 41
Table 9: Characteristics of leading qat types 52
Table 10: Variable cost of qat production (Qat Conference, 2002) 57

List of figures

Figure 1: Steps of conducting the study 3
Figure 2: Export trend of Yemen 7
Figure 3: Land use of agriculture pockets in Yemen (Central Intelligence Agency, 2017) 8
Figure 4: Yemen agriculture cropping seasons 10
Figure 5: Average annual temperature range in Yemen, 1901–2020 11
Figure 6: Dispersion of precipitation in Yemen 11
Figure 7: Coffee production governorates in Yemen (Annual Agricultural Statistics, 2018) 15
Figure 8: Coffee area in Yemen 16
Figure 9: Coffee area as per key informants and National Agriculture Statistics (2018) 17
Figure 10: Coffee terraces in slopes of Bura'a. 21
Figure 11: Export potential of coffee in Yemen (International Trade Centre, 2022) 29
Figure 12: Value chain map of coffee (SMEPS, 2009) 33
Figure 13: Coffee value chain map 34
Figure 14: Interactions between value chain players of coffee 36
Figure 15: Yemeni women's traditional roles (Photo: Abdul Gabbar Al Kirshi) 37
Figure 16: Women's roles by decision-making and activity implementation in three main coffee production functions 38
Figure 17: Traditional practices of collecting, drying, and transporting coffee beans (Photos: Abdul Gabbar Al Kirshi) 40
Figure 18: Qat producing areas (International Water Management Institute, 2016) 49
Figure 19: Qat cultivation area by governorate in Yemen (Agriculture Statistics, 2018) 50
Figure 20: Qat value chain 55
Figure 21: The proportion of production costs 56
Figure 22: Interactions between value chain players of qat 58

Introduction/Context

Yemen remains the poorest country and the only least developed country among the Middle East region. The pace of accelerating the Sustainable Development Goals (SDGs) in Yemen is far slower than in other comparable countries in the region because of increased strife emanating from security conflicts and the brunt of climate change stretched over decades, among others. An ever-increasing poverty rate, diminishing livelihood opportunities, and competition over scarce natural resources (especially water) have been among the key triggers for the social and political strife since 2011. The conflict has aggravated the disproportionate inequalities manifold since 2015, and it continues to sink development gains for any real progress on the SDGs. The majority of the more than 30 million Yemeni population live in rural areas,[7] and depend on agriculture as the main source of livelihood – representing 25 per cent of national GDP and 45 per cent of the country's workforce. Clearly, agriculture is a major source of income and is vital for food security, but today the needs are largely hampered by decreasing precipitation and depleting groundwater sources. The rate of depletion is three times more than the replenishment of the major water basins in the country.[8]

Such pressure on agricultural productivity has diverted the tendency of farming families towards value chains that are not healthy and sustainable, despite having good economic benefits in the short term. Increase in qat production is one of the stark examples of such a tendency within the rural economy of Yemen. Qat is not contributing to the growing food security and nutritional needs of the populace; and the finite water resources that could potentially be used for the cultivation of agriculture crops is being diverted for qat production. If the current rate of groundwater depletion continues, the known reserves of Yemen's groundwater are expected to be exhausted in another two to three decades.[9]

The internal conflict and civil strife intensified in 2014, further aggravating living conditions for the country at large. In 2021 some 20.7 million people (two out of every three Yemenis) needed some form of humanitarian and protection assistance, and of these approximately 12.1 million people needed lifesaving humanitarian support on a daily basis.[10] The humanitarian situation was still further aggravated in 2020 by escalating conflict, the COVID-19 pandemic, disease outbreaks, torrential rains and flooding, a desert locust plague, economic collapse, a fuel crisis across northern governorates, and

[7] Yemen Population 2021 (Demographics, Maps, Graphs) (worldpopulationreview.com).
[8] Assessing the Impact of War on Development in Yemen (UNDP, 2019). Report commissioned by UNDP and prepared by the Frederick S. Pardee Center for International Futures, Josef Korbel School of International Studies, University of Denver.
[9] Yemen country information, Climate Change Knowledge Portal, World Bank (19 July 2020).
[10] Final_Yemen_HRP_2021.pdf (reliefweb.int)

reduced humanitarian aid. Food insecurity and malnutrition will only increase owing to increased escalation in the conflict, the deteriorating economic situation, and worsening livelihood conditions across the country.[11]

Objectives of the study

The 'Qat-to-Coffee' project seeks to address qat production as a critical contributing factor to poverty, health and social problems, and groundwater depletion in Yemen. The pilot project commissioned a team of consultants (national and international) to analyse and compare the value chains of qat and of coffee. This study seeks to perform the analytical part of the assignment and to provide independent recommendations for intervention pathways for promoting coffee production in Yemen, preferably through reducing qat production.

Research rationale and research questions

1. Given the context, what factors can lead to the selection of the most appropriate pro-poor and market-oriented value chain intervention strategies, emanating from an authentic evidence base and robust methodological approaches?
2. What is the status of the value chain under study that results in an understanding of sustainable economic development? What functions and actors are involved in generating the end products and related business interactions within a value chain?
3. What is the status of the value chain with respect to value added, employment creation, governance structure, and competitiveness in relation to the end products and key markets?
4. What are the opportunities and relevant constraints that can form the basis for interventions for a future pro-poor value chain development strategy?
5. What are the possible scenarios for converting qat to a climate-resilient and sustainable coffee production pattern that reduces groundwater exploitation while enhancing socio-economic development? And/or what are the factors within the qat value chain that could potentially provide avenues for transitioning to sustainable coffee production in Yemen?

[11] Humanitarian Response Plan for Yemen - 2021

Methodology and approach

The sequence for conducting this study has involved seven steps (Figure 1)

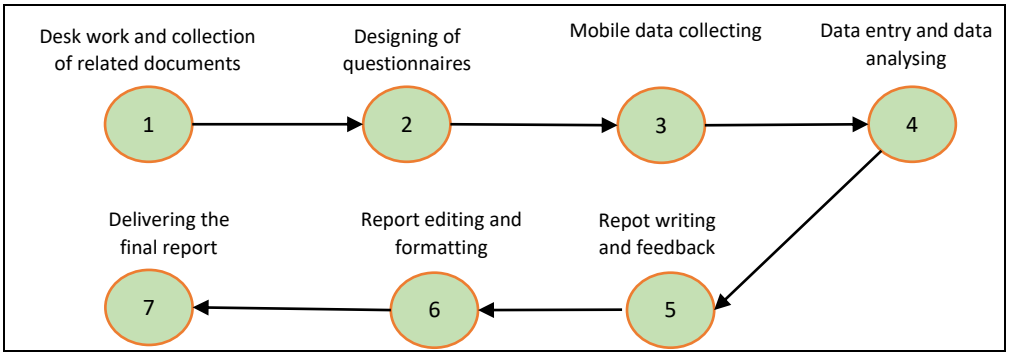


Figure 1: Steps of conducting the study

Analytical framework

The value chain approach is mainly an analytical methodology that systematically assesses the commodity chain with respect to value addition. The purpose of value chain analysis is to understand the underlying causes that hamper competitiveness of a given subsector. The consulting team followed a systematic process of assessing the commodity chain from start to the end through mapping, analysis, and identification of potential opportunities and relevant constraints. For this assessment, the consulting team adopted the methodology of ValueLinks.[12] This methodology, together with the "Market for Poor" concept, provided the much-needed framework to make analysis more inclusive in the context of pro-poor development, since socio-economic analysis anchors the overall analysis pattern.

Scope of the study

The consultants holistically analysed the environment of both the qat and coffee value chains with respect to its stakeholders, supporters, and influencers, converging three layers: micro, meso, and macro levels. The start and end points of a value chain are usually determined to be input supply and end use/consumption, respectively. Hence, the methodology included all key aspects of the selected value chains. Triangulation by combining primary and secondary research vis-a-vis implying qualitative and quantitative tools are customized for the adopted approach. Data collection in the field was case building for each operator, and looked at the chains from the perspective of the private sector and in the context

[12] ValueLinks methodology by GIZ and agreed principles by the Donors' Committee on Enterprise Development; ValueLinks 2.0.

of poverty reduction and the sustainable management of the natural resources. The assignment has been separated into different phases for systematic analysis and achievement of the milestones. The inception phase focused on redefining the landscape of research; inception meetings helped in adjusting tools for the study, identification of key informants, and analysing key project documents/relevant research papers for defining the study's scope and scale. The data collection phase focused on establishing contacts with key informants and providing them with the information required for the study. The analysis phase focused on drawing inferences from primary and secondary data sources and aligning these with the expectations of the study.

Tools and sampling frame

The study scope was based on the purposive sampling of actors from important stake-holding groups and relevant to the various areas of the value chains. The approach was mainly explorative, and key informants were drawn for different levels of analysis based on their relevance, collaboration, institutional knowledge, referral, and credibility.

Focus group discussions and key informant interviews were initially planned to be used as the primary tools for this study. However, movement restrictions (COVID-19 protocols and security considerations) compelled us to collect primary information from key informants only. Since in-person meetings were not allowed, outreach efforts were redirected to semi-structured interview guides that helped in reaching identified key informants electronically, and some interviews were held via phone. Representatives from important stakeholders such as the farming community, research institutions, coffee experts, and some private-sector coffee processors were all part of the outreach for this study. Given that both qat and coffee farming are spreading throughout the country, the outreach efforts were diverse and reached important growing areas for both crops. The key informants represented seven governorates (12 districts), and 20 per cent of the farming, research, and processing stakeholders were female. In total, 30 key informants formed the sample size for the study, detailed in Table 1, below.

Table 1: Sample size of the study

Classification	Sample	Description
Governorates	7	Taiz, Dhamar, Hudaidah, Lahj, Sana'a, Sa'adah, Abyan

Districts	12	Al-Shamayteen, Almesrakh, Jabal Alsharq, Almawaset, Bura'a, Toor Alabaha, Taiz city, Sana'a city, Sa'adah city, Yafe'e Suflah, Yafe'e, Haifan
Male/Female ratio	24/6	Female includes farmers, researchers, processors
Farmers/Associations	7	Farmers, coffee associations, cooperative unions
Government representatives	4	Qat Department, District Agriculture Department
Researchers, academic, experts	7	Sanaa University, coffee experts
Development partners	2	Danish Refugee Council, Yemen Family Care Association
Private sector	6	Processing units

Limitations to the data collection

The consulting team was able to touch base with important stakeholders as key informants in the data collection phase. However, the movement restrictions (COVID-19 and security issues) implied certain important caveats for the data collection process. There were limitations on conducting face-to-face meetings, the focus group discussions were ruled out entirely, while the information from key informants was recorded only electronically. The nature of value chain analysis depends heavily on in-depth discussions with key informants on the pertaining issues and challenges faced by different layers of the chain. This limitation hinders the chances of expanding discussion on important interconnected indicators, which affected the quality of analysis.

Data collection from private-sector and market players are always challenging due to the complexity involved and the lack of a desired trust level. The remoteness of data collection has also affected outreach to private-sector actors. The market players of the qat value chain remain sensitive to providing information, since criticism of that community is growing in Yemen. Hence, reliable estimates for both the qat and coffee trade were not provided as it was desired.

As mitigation measure, the analysis has relied heavily on secondary sources and published documents. It should also be noted that the pace of research was at times affected by the ongoing conflict, and the research capacity of institutions was at a minimum during this difficult period.

Findings of the study

Socio-economic overview of Yemen – The context

Yemen is a least developed country and often considered the poorest country in the Arab region. The socio-economic outlook of Yemen is not promising picture, with more than 40 per cent of the population living on less than $2 per day. According to one UNDP-commissioned study, conflict in the country has already set Yemen´s development back by 21 years. Even if the conflict comes to an end in 2022, development will have been set back 26 years – over one generation.[13] If the conflict persists through 2030, Yemen will revert nearly four decades, and indirect deaths (caused by lack of access to food, health care, and other basic services) will be five times greater than direct conflict-related deaths. The socio-economic profile even before the crisis was far short of development goals, with almost half of all Yemeni youth not in school, getting trained, or employed.[14] Prior to the current crisis, unemployment was three times higher for youth than for adults, and three times higher for female youth than for male youth, and this deteriorating performance has been exacerbated during in recent years. As of 2019 the country was ranked 110 in terms of GDP– ($1,100 per capita) and 173 in GDP per capita generated; 146 in terms of total exports and 93 in total imports; and 132 as the most complex economy (Economic Complexity Index).[15] Though Yemen became a member of the World Trade Organization in 2014, that stature did not pay dividends due to the eruption of civil conflict. The economic outlook did show signs of improvement between 1995 and 2014, when the export volumes increased every year, but this positive trend dropped significantly during the conflict period (Figure 2). Yemen's export commodities continue, though at a low pace, with exports reaching $1.45 billion in fiscal year 2020–2021. Crude oil account for 85 per cent of the Yemeni exports, while the remaining commodities are fish, naphthalene, cigarettes, fruit, soap, and animal hides. Coffee represents around 1.38 per cent of total exports ($20 million). Primary export partners are Saudi Arabia (63 per cent), the United States (9.84 per cent), Japan (8.2 per cent), and Switzerland (5.79 per cent).[16]

[13] Prolonged conflict would make Yemen the poorest country in the world, UNDP study says | United Nations Development Programme.
[14] Yemen Damage and Needs Assessment (ilo.org).
[15] Yemen (YEM) Exports, Imports, and Trade Partners | OEC - The Observatory of Economic Complexity.
[16] Ibid.

Figure 2: Export trend of Yemen[17]

Such a low level of trade directly affects the livelihood pattern; and the employment in productive sectors has shrunk considerably owing to the uncertainty created by the unstable environment at large.

Overview of the agriculture sector in Yemen

Agriculture is still one of the leading livelihood sources in Yemen, where more than 60 per cent of the population are associated with the agriculture sector, and where 44 per cent of the land area (approximately 24.4 million hectares) is used for agricultural practices. The rural area is still populated by more than 1.1 million farming families out of a population of 28.5 million, but the rural population declined from 77 per cent in 1997 to 64 per cent in 2017.[18] The agriculture sector shows diversity in terms of fruits, vegetables, fodder, cereals, and cash crops. Yemen is a net importer of agriculture commodities for its domestic needs; and the domestic productivity of agricultural crops is far below the regional and global averages. While agriculture statistics were not thoroughly updated during the conflict years, the Ministry of Agriculture published statistics in 2018 based on projection and estimation, but these do not exactly reflect the realities on the ground. Owing to the rainfed conditions, cereals constitute almost half of all agricultural land, followed by qat plantations (16 per cent), fodder (12 per cent), cash crops (7 per cent), and vegetables (6 per cent). [19] The reported agricultural area decreased during the conflict years by

[17] Yemen Imports - 2021 Data - 2022 Forecast - 1970-2020 Historical - Chart - News (tradingeconomics.com).
[18] World Food and Agriculture - Statistical Pocketbook 2019 (fao.org).
[19] Agriculture statistical book, Ministry of Agriculture Yemen, 2018. agri_stat_2018.pdf (agricultureyemen.com).

21 per cent, mainly because of market disruption, non-availability of crop inputs, and uncertainty in terms of displacement.[20]

The coffee area is reported as 32,984 hectares (ha), while qat is cultivated on 166,745 ha with a decreasing trend in governmental statistical book. However, consultations with key informants and independent research sources report an increasing trend in the area and production of qat. These ambiguities raised questions on the authenticity of government reported data, but there is no independent source that can provide reliable estimates of both crops.

The land use map (Figure 3[21]) shows that agriculture is concentrated mostly in valleys where the precipitation level favours agriculture production, mostly in the high and low land mountain belts in the north/west regions of the country and some coastal regions. Together with annual precipitation, some of the irrigation sources in practice are wells, floods, streams, dams, and water trucking as the most recent introduction. On average, almost 52 per cent of the agriculture interventions received some sort of irrigation, while the remaining is dependent on rainfall. More than half of the country is characterized as hyper-arid and arid where both the cultivation of crops and habitation is literally impossible.

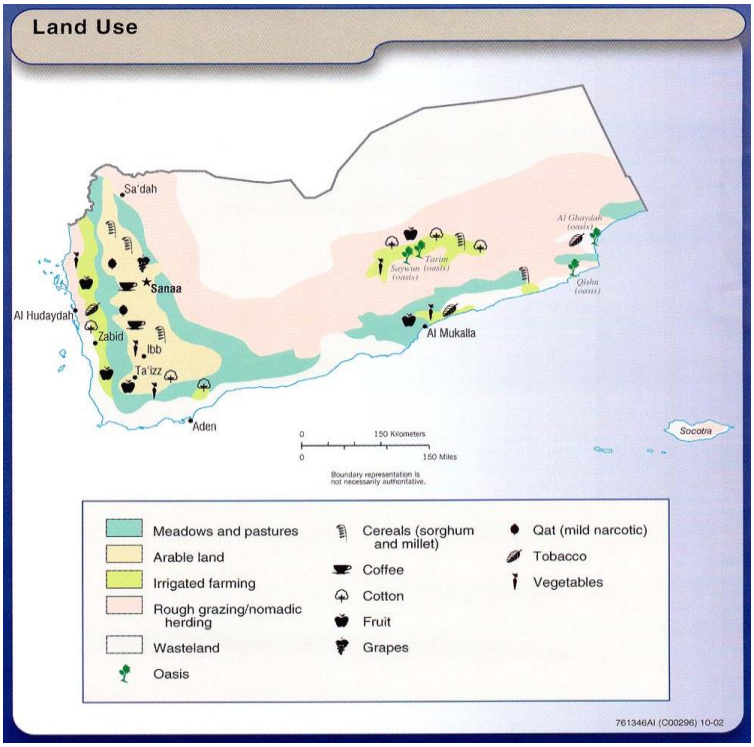


Figure 3: Land use of agriculture pockets in Yemen (Central Intelligence Agency, 2017)

[20] Ibid.
[21] Yemen - The World Factbook (cia.gov).

Cropping pattern

The cropping pattern identified a good diversity of summer and winter crops, spread throughout the year. The fruit group takes the lead with 13 varieties, followed by 10 vegetable types, 5 cereals and cash crops each, 6 type of pulses, and 3 main fodder types. Qat is reported as a separate group due to its economic importance and acceptance in Yemeni society. Key informants identified a good mix of summer and winter crops in the research areas. Sorghum and maize are mainly grown as fodder crops in summer, while grapes and coffee in summer months are mostly for generating cash. The winter crops (wheat, barley) are grown for household consumption. Both qat and coffee are considered as permanent cash crops having many harvesting seasons during the year.

Shift in cropping pattern

The key informant interviews identified some important shifts in the cropping pattern during last 5–10 years (mostly before the conflict). Immigration and drought have contributed to the reported shift in the cropping pattern. The area of **qat** has reportedly increased, with profitability margins, growing market demand, and short production cycles quoted as important reasons. Some development partners (FAO, SMEPS, World Bank, Dawoodi Bohra Community initiatives, etc.) have influenced the expansion in **coffee** production as well, but at a slower rate and limited to a few targeted areas. The introduction of greenhouses has helped to stimulate the expansion of culinary vegetables such as **tomato** and **cucumber,** while **fig** was being introduced as a new crop, especially in San'aa and Bur'aa regions. The lack of availability of quality seeds and pest infestation reduced the area cultivated under **cotton**, but the opening of cigarette factories has boost **tobacco** cultivation in a few pockets.

The evidence suggests (Figure 4) that agriculture patterns in Yemen are quite flexible and depend on the enabling environment to encourage or discourage important crops. The same analysis applied to the crops under study. Coffee growing is motivated by both the domestic and export market demand, while the depressive mind-set brought on by the protracted crisis pushes society towards qat chewing at a greater pace.

The cropping season is illustrated below, presenting the link between the agriculture cropping season and the rainy season, and its link with seasonal livestock migration.

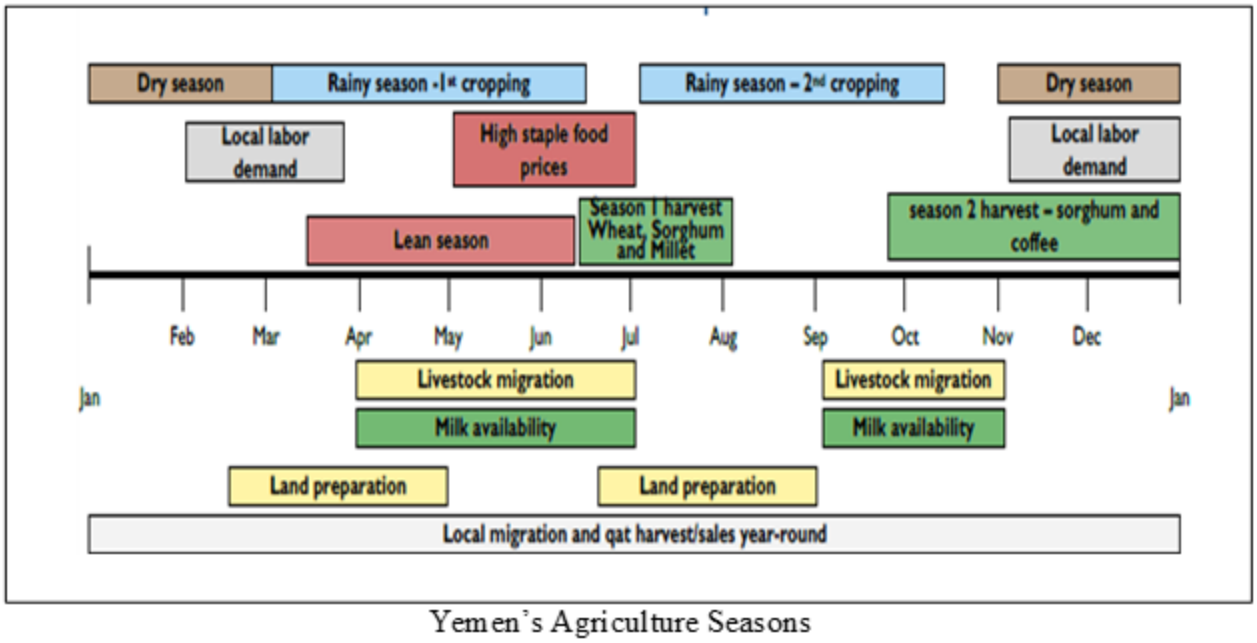


Figure 4: Yemen agriculture cropping seasons[22]

Climatic shift – Water scarcity – Impact on agriculture sector

The climate change impacts on Yemen and its agricultural sector are significant and are expected to become detrimental in the near future. Yemen's temperatures are rising more rapidly than the global average,[23] and the detrimental effects of an expected temperature increase of more than 3°C by 2060 are not unimaginable. The per capita water availability in Yemen is the lowest in the world (140 cubic meter per year) and groundwater can never be replenished to their former levels. Droughts, desertification, and an erratic rainfall pattern are particularly unfavourable for a society where still approximately 60 per cent of the population depends on incomes generated from natural resources.[24]

The gradual rise in mean annual temperature has been recorded since the 1960s (highlands), while the coastal belt (Aden) has witnessed an increase of 1.4°C per century since the 1900s. As seen in Figure 5, the country has experienced an average warming of 0.5°C during the 20th Century across the country.[25]

[22] Rainwater Harvesting for Domestic Household Use and Small Scale Horticulture Production in Yemen: A Multi-Use Water System Approach, https://www.academia.edu.
[23] Template (climatelinks.org).
[24] WPS cover (american.edu).
[25] Yemen | World Bank Climate Change Knowledge Portal.

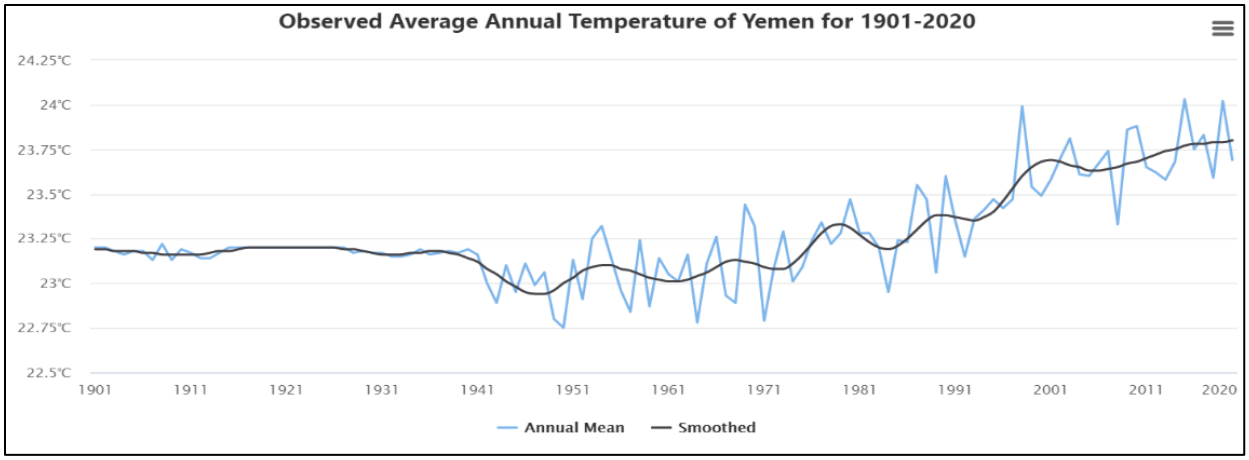


Figure 5: Average annual temperature range in Yemen, 1901–2020[26]

The precipitation level is not uniform across the country, as there is a stark difference in the rainfall pattern for highlands and in coastal areas while the rainfall in central parts of the country is minimal. Coastal areas receive 80 per cent of the annual rainfall during the winter months. The rain-spells are concentrated in March–May and July–August (Figure 6), which are mostly drained off into the sea without recharge of aquifers or providing meaningful productive use.

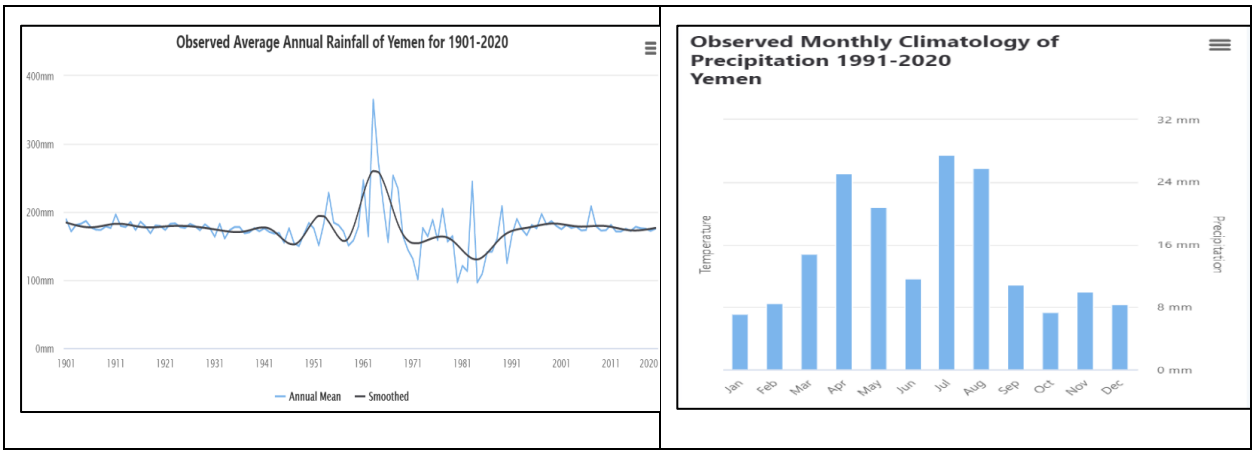


Figure 6: Dispersion of precipitation in Yemen[27]

Water stress

Yemen is categorized at an "extreme risk" due to water scarcity, and is predicted to become the 16th most water stressed country by 2040 by all five major sectors of the economy.[28] Experts feared that Yemen could be the first country in the world to run out of water in the coming few years.[29] Apart from these

[26] Ibid.
[27] Ibid.
[28] Ranking the World's Most Water-Stressed Countries in 2040 | World Resources Institute (wri.org).
[29] What If Yemen Is the First Country to Run Out of Water? | TIME.com.

harsh realities, water governance is challenged by rising water demand, depletion of recognized aquifers, expansion of irrigated agriculture, and the recent rate of urbanization. Groundwater pumping has increased at an alarming rate, which is consumed by the agriculture sector. The availability of renewable water has dropped from 128 cubic meters per person in 1997 to 74 cubic meters in 2017.[30] The land cultivated using irrigation sources has increased dramatically from 37,000 to 500,000 hectares in a matter of just 40 years. The annual decline in groundwater levels is typically 2.5–4.5 meters in many areas, and the rise in competition for water resources has resulted in communal conflicts. This is an area in need of further research. However, it seems clear that the social fabric has weakened with water-related conflict, and this might be contributing to the ongoing civil war among tribes in Yemen. Lichtenthaeler (2010)[31] noticed that the conflict around water related issues was not violent in Amran till 2000, but in 2010 the growing competition led to protests and blockages. The water shortage in Yemen provides a glimpse of what the entire Middle East and North African region will face in coming decades. Though increasing conflicts over water usage is limited to specific sectors such as agriculture, this will likely spread to all walks of life due to ever increasing competing needs for water.

Water stress affects all walks of life, but the deepening water table will have a particularly strong impact on the flourishing agriculture sector, especially the growth of vegetables. Diverting scarce water resources to crops such as qat, which has no positive impact on a sustainable/legitimate livelihoods pattern, leads to the country's growing food insecurity and malnutrition. In the current circumstances, the country is largely dependent on food assistance and commercial imports to satisfy its domestic consumption requirements for wheat as a staple crop. Yemen became the world's 12th largest importer of wheat in 2019.[32] As a result of the ongoing conflict combined with natural hazards (pest infestation), total cereal production in 2020 was estimated at 365,000 tonnes, about 5 per cent below the previous year's harvest and almost 25 per cent below the five-year average. The domestic production of cereals covers only 20 per cent of the overall country demand, while the rest is being imported through various channels.[33] Over the next few years the water stress will further exacerbate the nation's food insecurity and malnutrition profile.

[30] World Food and Agriculture - Statistical Pocketbook 2019 (fao.org).
[31] Lichtenthaeler, G. (2010), "Water conflict and cooperation in Yemen," *Middle East* 254 (Spring 2010), pp. 30–36.
[32] Wheat in Yemen | OEC - The Observatory of Economic Complexity.
[33] FAO GIEWS Country Brief on Yemen.

Climatic effects on selected crops

The Yemen National Adaptation Programme of Action identifies three main sectors most vulnerable to climate change: water resources, agriculture and livestock production, and coastal zones/fisheries. In 2018, Yemen submitted its third National Determined Contribution to the conference of parties of the United Nations Framework Convention on Climate Change.[34] The communication updated the vulnerability context of Yemen and vowed its commitment to mitigation and adaptation plans in all relevant sectors that are causing/are affected by climate change scenarios. The major impacts of climate change in Yemen will include: increased water scarcity and reduced water quality; more frequent droughts with a steady increase in temperatures; and erratic rainfall patterns leading to the degradation of agricultural lands, soils, and terraces. The changing weather pattern will have a direct impact on crops under this study. Coffee is highly sensitive to climate change. Models indicate that the impact of climate change will be highly negative for arabica coffees, effectively reducing the areas suitable for production by 20–50 per cent by 2050.[35] Impacts will be greatest in low latitudes.[36]

The flowering of both crops collapsed in the heavy snow/rainfall in 2019–2020. Snow is relatively new to the highlands of Yemen and has only being reported occasionally during last five years. The frost and hailing have become more regular in winter months. Frost is more detrimental for qat than coffee since its productivity depends on the vegetative growth of green leaves.

Prevailing gender inequalities across the world, mainly in developing and least developed countries, are profoundly linked to climate change where women depend more on the natural environment for their livelihoods, particularly agricultural production. Women's traditional roles of water fetching, collecting fuelwood and fodder, and food production will become increasingly stressed as a result of climate change.[37] Female-headed households with few assets are particularly affected by climate related disasters. Women's labour roles in the qat and coffee value chains will be similarly affected. Fairtrade has submitted a position paper (October 2021[38]) to the ongoing Conference of Parties (COP-26) conference on climate change highlighting the impact of climate change on important cash crops, including coffee. Over 70 per cent of the respondents in this research reported some level of climate impact on crops, including coffee, in the last decade. Water scarcity, drought, extreme temperatures, and stormsare all

[34] Third National Communication to the Conference of the Parties of United Nations Framework Convention on Climate Change (unfccc.int).
[35] Crops under a changing climate: What are the impacts in Africa? (cgiar.org).
[36] Bunn, C., Läderlach, P., Rivera, O. O. and Kirschke, D. (2015), "A Bitter Cup: Climate Change Profile of Global Production of Arabica and Robusta Coffee," *Climatic Change* 129 (DOI 10.1007/s10584-014-1306-x), pp. 89–101.
[37] CLIMATE CHANGE: IMPACTS, VULNERABILITIES AND ADAPTATION IN DEVELOPING COUNTRIES (unfccc.int).
[38] FAIRTRADE AND CLIMATE CHANGE.

affecting coffee in major producing areas. Respondents reported medium to high severity in terms of the climate effects on coffee yield, quality, harvest, processing, and storage. Significant reductions (up to 50 per cent) in the global area suitable for coffee farming are projected in the coming decades (Bunn et al., 2015[39]). Production of coffee could therefore be displaced to higher latitudes or elevations due to increased temperatures (Zullo et al., 2011[40]). Though this projection would not be enough to replace the lost production of existing coffee areas, this would create some space for encouraging coffee production in pockets such as Yemen, which is accustomed to growing in high altitudes. Moreover, the increase in conflicts emanating from water distribution systems and digging boreholes are more likely to intensify due to excessive water usage technologies as compared to less water intensive usage. Hence, qat cultivation is likely to fuel more tension among Yemeni society, leading to violent conflicts, while coffee production with less water requirements are more sustainable in terms of using scarce water resources.

Coffee value chain

Overview of the subsector

Coffee is produced in 15 of the 21 Yemeni governorates, and study indicates that over 104,000 farming families are involved in coffee production.[41] Recent genetic fingerprinting has suggested that while there may be no known Arabica species native to Yemen, the first commercial cultivation of Arabica is believed to have occurred there in the 1400s, after native Bourbon and Typical varieties were moved there from the upland forests of Ethiopia.[42]

Since coffee is cultivated on steep terraces, the average farm holding is not classified as large production units. The average plantation per farmer is just 0.291 hectares (394 coffee trees), and a production of 114 kilograms (kg) per farming family is common. Large farms above five hectares are rare in Yemen.[43] The same study reported that the volume of coffee production in Yemen was shrinking even before the crisis, having declined by about 50 per cent from what it was during the 1950s.

The agriculture statistics of Yemen show coffee cultivation on an area of 32,984 ha for 2018 (Figure 7). Extrapolation from different agreed parameters (export share and yield) help to arrive at an

[39] A bitter cup: climate change profile of global production of Arabica and Robusta coffee | SpringerLink.
[40] Potential for growing Arabica coffee in the extreme south of Brazil in a warmer world | SpringerLink.
[41] Analysis of five value chains in Yemen: World Bank/SMEPS, 2009.
[42] History Of Coffee: Origins, Waves, and More (coffeebrewster.com).
[43] Roche and McCarthy, "Yemen Coffee Production and Competitiveness Assessment," November 2006.

approximation of coffee cultivation in Yemen at nearly three time the reported cropped area (92,308 ha).[44]

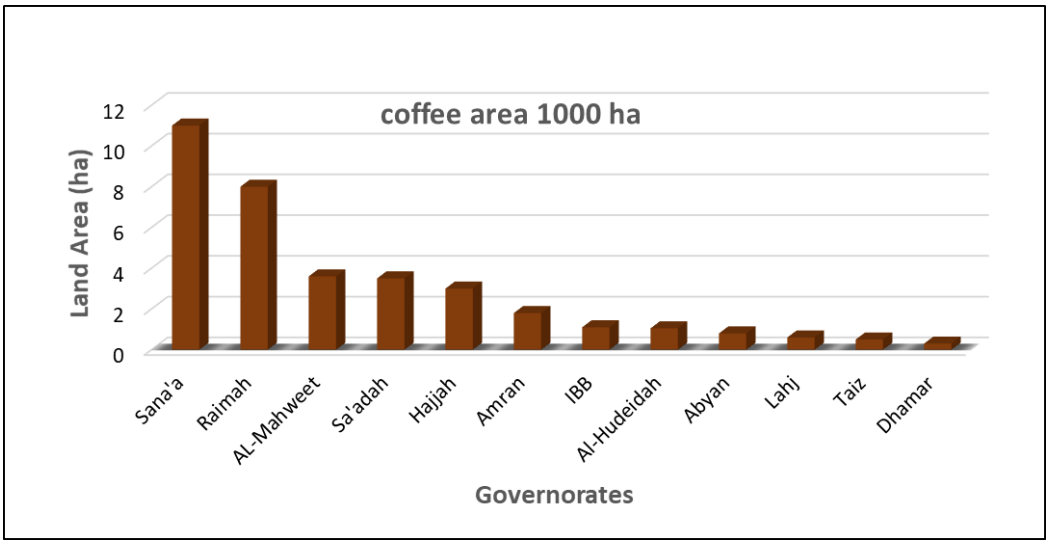


Figure 7: Coffee production governorates in Yemen (Annual Agricultural Statistics, 2018)

Buraa and Dhamar governorates are specialized coffee production areas due to their steep terraces. Additionally, San'aa, Amran, Addaleh, Hajjah Alamhweet, Lahj, Hudaidah, and Ibb are also more specialized locations of coffee production.

[44] Yemen exported 600,000 kg of coffee, which is 26 per cent of total production; the average yield was 250 kg per ha.

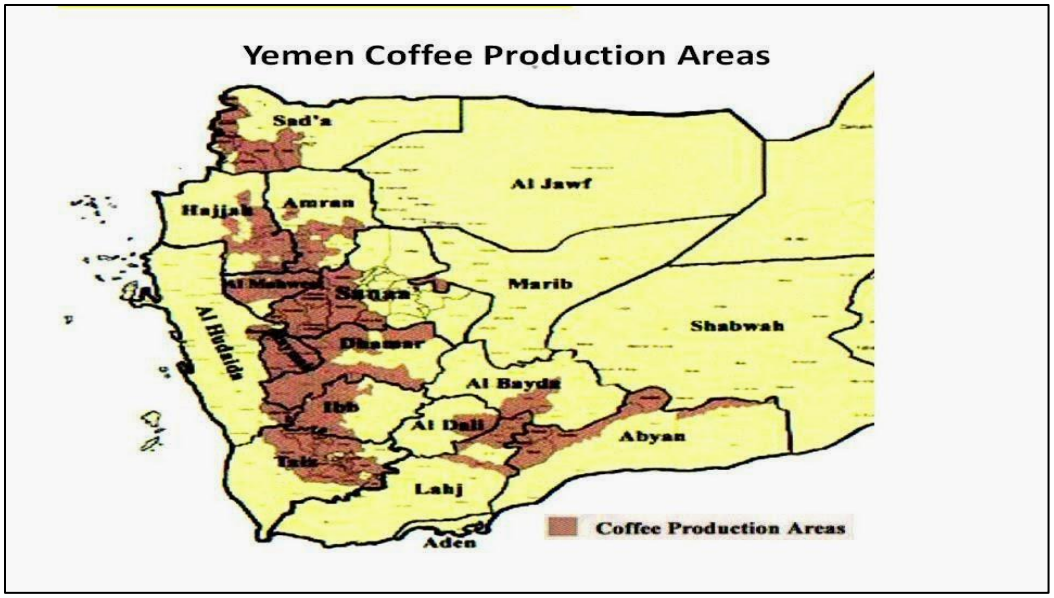


Figure 8: Coffee area in Yemen[45]

The area under coffee production was also being discussed with key informants of the study to know the extent of change from what was reported by USAID in 2017.[46] Figure 8 is the triangulated presentation of what was reported by key informants combined with agricultural statistics of 2018. The information collected through key informants (Figure 9) depicts a good reflection of where coffee production has been reduced during the last decade, and most of the reduced area has been taken over by a strong competitive crop such as qat. The governorate-wise distribution of coffee producing districts is mentioned in Annex VI for further reference.

[45] Yémen - utilisation des terres • Carte • PopulationData.net.
[46] ibid

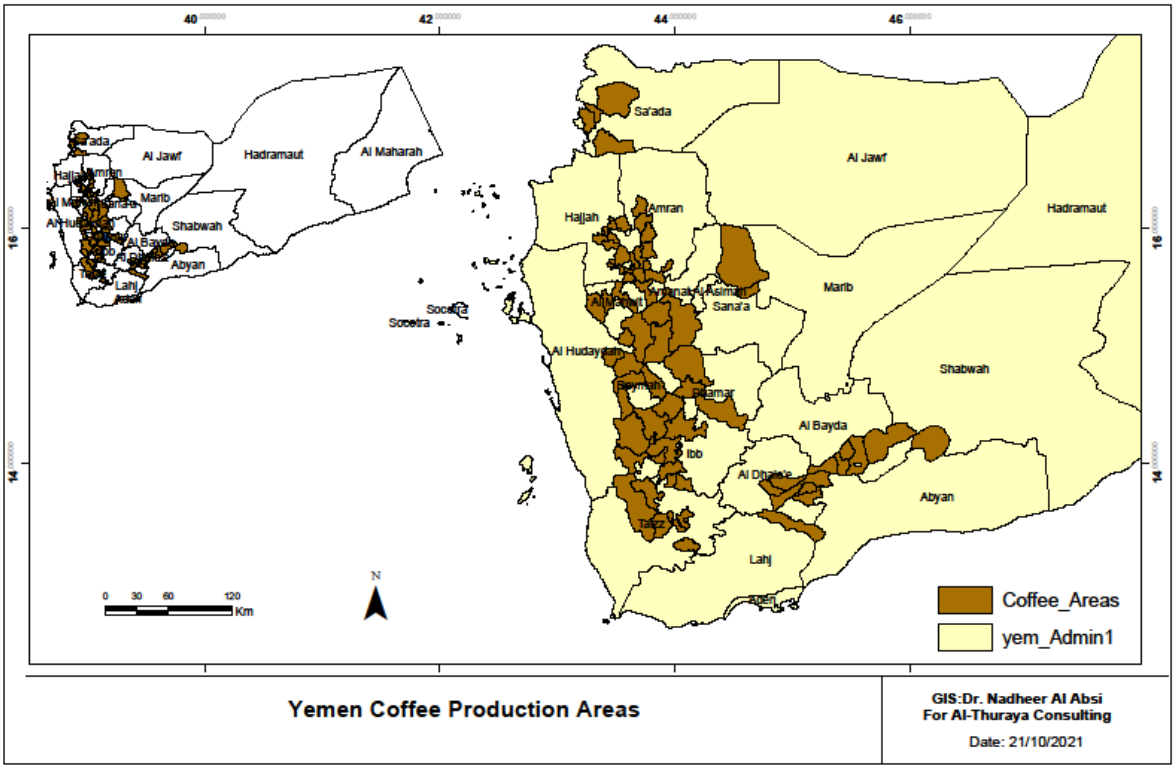


Figure 9: Coffee area as per key informants and National Agriculture Statistics (2018)

International overview of coffee production

Coffee is produced by more than 70 countries across the globe, but the global output is concentrated (more than 75 per cent) from the five top producing countries: Brazil, Viet Nam, Colombia, Indonesia, and Ethiopia, respectively. Though some web sources[47] have designated coffee as the second most traded item in the world just after crude fossil fuel, this is not an agreed phenomenon. Instead, it is the second most important export (in terms of value) from developing countries.[48] Malaysia and Viet Nam history in coffee production is not as old as for some countries in the African and South American region, but progressive farming, a robust private sector, and an enabling environment provided by government support has helped to achieve the highest yield level among all coffee producing countries (Table 2).

[47] WORLD'S TOP TRADED COMMODITIES - WORLDTRADIA.
[48] Economics of coffee - Wikipedia.

Though Yemeni coffees fetch the best export prices in the world, productivity in terms of yield is lowest in the world – attributed to traditional production practices and tough production terrain.

Table 2: Average yields of coffee producing countries[49]

Country	Yield (Metric ton/ha)
Malaysia	3.77
Viet Nam	2.61
Malawi	2.33
Brazil	1.91
Laos	1.86
Ghana	1.68
Paraguay	1.38
Honduras	1.11
Columbia	0.9
Ethiopia	0.69
Yemen	**0.57**

Today, 45 countries are exporting coffee every year, and the total export volume exceeded 129 million 60 kg bags during the last coffee year (September 2020–August 2021). The share of Yemen is only 0.02 per cent (1.5 million kg).[50] Thus, coffee export from Yemen represents only a nominal share of global production lines.

There are usually four coffee categories exported from Yemen: roasted, unroasted, decaffeinated, and roasted decaffeinated combined with coffee husks (*Qesher*) – all of which had an export value of $2.7 million in 2019.[51]

Value chain functions

Input supply – Coffee nurseries

Coffee nurseries have been developed in 10 governorates across the coffee-growing regions to provide seedlings either at no cost, from the Ministry of Agriculture and Irrigation, or at a low cost at approximately $0.20/seedling. Investments in private-sector nurseries can facilitate plant multiplication and dissemination. Currently, there are more than 20 governmental and private coffee nurseries throughout the coffee production areas in Yemen. The biggest one is located in Ibb city, some 160 km south of Sana'a, with an annual production capacity of more than 600,000 seedlings. The actual capacity

[49] Crop Yields - Our World in Data.
[50] International Coffee Organization - Historical Data on the Global Coffee Trade (ico.org).
[51] Ibid.

of the nurseries is around 1 million seedlings per season. Table 3 lists 17 coffee nurseries and their approximate capacity.

Table 3: Coffee nurseries in Yemen (Source: survey)

No.	Name of nursery	Governorate	District	App. capacity of coffee seedlings/ year
1	Ibb nursery	Ibb	Ibb city	600,000
2	Alma'asarah	Hajjah	Hajjah city	50,000
3	Almaqash	Sa'adah	Alsafra	50,000
4	Alrujum	Almahweet	Alrujum	20,000
5	Lahemah	Almahweet	Almahweet	30,000
6	Mausanah	Sana'a	Sa'afan	30,000
7	Alrasa'ah	Sana'a	Alhaimah Al-Kharejiah	40,000
8	Al-Rebat	Raimah	Al-Salafiah	10,000
9	A'aloojah	Raimah	Al-Ja'afariah	10,000
10	Adn	Raimah	Al-Jabeen	5,000
11	Blad Alta'am	Raimah	Blad Alta'am	5,000
12	Bani Aldawn	Raimah	Al-Jabeen	10,000
13	Alsaqee	Raimah	Al-Ja'afariah	10,000
12	Jabal Al-Sharq	Dhamar	Al-Sharq	50,000
13	Hamam Ali	Dhamar	Al-Manar	5,000
14	Talooq	Taiz	Almesrakh	5,000
15	Bani Hammad	Taiz	Almawaset	10,000
16	Alhad	Lahj	Alhad	5,000
17	YASAD[52]	Sana'a	Sana'a city	15,000
	Total			**960,000**

There are also around 150 so-called "village coffee small nurseries" owned by individual farmers or associations with a capacity of 500–1,000 seedlings each.

Production

Coffee cultivation is dominant in rain-fed conditions and considered a natural product, with limited/no agro-chemical use in the majority of farms. It is estimated that fewer than 5 per cent of all coffee farms are using modern irrigation techniques,[53] such as drip irrigation. When compared to qat, coffee greatly reduces water consumption, increases water retention, and elevates drought resilience. Groundwater pumping is rarely used for coffee plantations, and is restricted to cases where farmers are using groundwater irrigation for other agriculture crops in addition to coffee, especially vegetables and qat. Drip

[52] Yemeni Association for Sustainable Agricultural Development, the nursery supposedly for research activities only.
[53] Verbal communication with A. Alasabry, an irrigation specialist, FAO, Yemen.

irrigation was introduced more than 15 years ago by a development programme – the Sana'a Basin Water Management Project – but it was not successful due to poor operation and maintenance.[54]

The flowering starts in February–March, followed by management practices (mostly hoeing and weeding) and occasional pesticide spray. The harvest season starts in October and continues till December, and in a few areas during January as well. Men are responsible for clearing land, planting seedlings, and stumping and pruning the coffee trees. Harvesting is done both by men and women. Male workers are mostly involved in carrying and weighing, while women mostly do the drying and sorting. Men are generally responsible for the transport and marketing, with hardly any role being recorded by key informants for women in these functions. Seasonal workers normally stay on for three to four months. Most of the labourers have no contracts as part of the informal sector, and thus are hardly protected by law. Many sector actors feel that labour is used inefficiently. Workers are hardly skilled and often there are too many labourers for the work at hand. Better planning and higher wages, combined with worker training, could both improve efficiencies and improve the livelihoods of the labourers. It is known that smallholder coffee farms generally rely heavily on family labour, where the burden of unpaid extra work for women and children is most likely to occur.

Technical capacities of farmers

The technical capacities of coffee farmers remain traditional across Yemen and have established chores in the production cycles. In hard-to-manage terraces (Figure 10) production is restricted to units as small as possible, giving a unique character to coffee cultivation in Yemen. This culture-driven low capacity results in the unique traits of Yemeni coffee, but it also reflects a number of inefficiencies in the production system. Research shows that 51 per cent of respondents had a low knowledge of technical standards, and only 6.5 per cent of farmers had a fair understanding. Further, just 12.5 per cent of farmers had actually used improved practices in coffee production.[55] Such limited technology affects the production capacity and yields of coffee. Moreover, positive correlations were found between the degree of knowledge and its application, educational qualifications, land tenure, area under coffee cultivation, extension service satisfaction, and exposure to sources of information. Clearly, introducing modern

[54] World Bank Document.
[55] Abdullah et al., "Level of knowledge and its application by coffee farmers in the Udeen area, Ibb, Yemen," *The Journal of Animal & Plant Sciences* 26(6): 2016.

techniques in the coffee cultivation cycle can promise much larger financial returns against competing crops such as vegetables and qat.

Figure 10: Coffee terraces in slopes of Bura'a.

Coffee varieties

Consultations with key experts highlighted that there are four main varieties of coffee in Yemen: Udaini, Dawairi, Tufahi, and Bura'ai. The Coffee Research Unit in Yemen suggests a potential fifth basic variety called Abu Sura, but this has not been confirmed. In addition, there are 15 types of coffee grown in Yemen: *Mattari, Yafei, Haimi, Hirazi, Ismaili, Ahjuri, Mahweet, Buraai, Hammadi, Raimi, Wasabi, Anisi, Odaini, Sabri, and Saadi*).[56] However, there is no scientific classification of coffee varieties in Yemen, and names are usually adopted from the places of plantation and the different flavours that the coffee developed due to climatic conditions. Among the list of coffee types, three are the most popular due to their trade value. The characteristics of these types are listed below.

Table 4: Characteristics of leading coffee types (Source: key informants)

Coffee	Matary	High quality, high market and export demand, high return
	Hiamy	Highest quality after Matary, middle market and export demand, good return
	Udainy, Hammady	Quality low, low market and export demand, low return

[56] Al-Monitor (2014), "Yemen's coffee revival" (newspaper article), http://www.al- monitor.com/pulse/culture/2014/02/yemenrevive-historic-coffee-trade.html#.

Post-production

The harvesting of coffee has some variation in Yemen, depending on the type of coffee and agro-climatic conditions. The harvest period is the longest in the chain (2–3 months) due to the slow growing and/or maturation of the means and the manual harvest. The post-production functions are divided into phases, such as harvesting, drying, packing, transportation, wholesale, and retail. The drying takes between 12 and 21 days, followed by selection, hulling, roasting, backing, and transport. The beans are stored for several months, and in some instances for more than a year. The coffee stock is considered as a 'cash bank' and is marketed when cash is required for household needs.

Coffee has two harvesting cycles, i.e., the first cycle has six harvest and the second has four harvest. *Dwairy* and *Udainy* each has one production season per year (September–March), while *Tuffahy* and *Bure'e* have two seasons according to the altitude and growing conditions.[57] Normally, coffee trees start to produce beans in their third year. The peak production and trading months are November–January, while the peak marketing to retail and consumption are the Islamic months of Ramadan and Pilgrimage, when the best prices are fetched.

Abdul Aziz Al Hamdani coffee processors

Collect varities (types): Haimy, Matary, Harazy.
Processing: hulling, grading and roasting
Buying price: 1,500–3,000 YR/kg
Selling prices: 4,000–7,000 YR/kg
Selling coffee special: $50/kg
Financing options: credit and cash
Daily roasting volume: 500 kg
Auction: auction procedures are not fair for all companies.
Peak production months: November onwards
Peak marketing and pricing months: during Ramadan and Hajj time (Haymi, Matary, and Harazy)
Marketing sites: Altaleh market Sa'adah, Bani Amer Sa'adah
Export destination: Saudi Arabia, gulf countries, Egypt and Europe
https://www.coffee-yemen.com/

The processing is done at two levels. The first, preliminary processing is done immediately after production, and consists of drying and packing. The processing units then procure coffee beans from third parties (wholesale traders) and perform hulling, grading, and roasting to separate green beans.

The shorter shelf-life of roasted coffee beans compared with their green form necessitates that coffee roasting is done close to the end market. Thus, coffee-growing nations tend to export green beans to richer countries, where most coffee is consumed and where this value-added activity takes place. The roasting industry is highly concentrated and controlled by big corporations located in the European Union and the United States, such as Nestlé, Jacob Douwe Egberts, Tchibo, Lavazza, and Starbucks.

[57] Source: consultation with key informants.

Traditional coffee markets

Conventional channels still dominate coffee marketing in Yemen, where coffee is mostly sold at the farm gates and can pass through several hands before reaching the processing stations and exporters. Coffee is traditionally routed through intermediary traders to the domestic and export markets. Most production areas are now active with farmer associations (such as the Talooq Association), which negotiate good prices with large traders. Collectors play a major role in the marketing process, buy coffee from framers and bring it to wholesalers, traders, and exporters. Some of the quality wholesale markets are situated in Bajel, Hudaidah, Almansuriah, and Bait alfaqeeh. The traditional auction method in these markets is open and does not wait for a specific quantity to reach the market. Sometimes just two 60 kg bags is sufficient for an auction. The commission of the wholesaler supporting the auction is pre-determined. Peak marketing time is linked with production/harvesting time (October/November), though (as mentioned above) particularly good prices are fetched in the holy months of Ramadan and Pilgrimage.

Traditional coffee marketing starts with the harvest from coffee production governorates (Figure 8) and producing coffee on steep terraces (Figure 9). The harvest lasts for a couple of months depending on bean maturity (some are become red before others). The picking of red coffee beans is a family chore and is conducted by all family members. From the small bags used for harvest the coffee beans are then collected in large sacks for bringing to the roofs of houses for drying. During the drying period the beans are turning over from time to time to dry the stock. The process of drying takes two weeks, after which the farmer either stores the dried beans for several months (or even years), according to the market demand and his need for cash, [58] or he brings his coffee (mostly using donkeys) to the weekly market. Some formal organizations work with farmers during production, harvest, and marketing, for example, the Talooq organization and Bani Sina in Taiz, the Dhenakheb organization in Lahj, and the Alikleel organization in Menakha, Sana'a. Weekly markets are distributed throughout Yemen. Table 5 lists the main weekly markets where raw coffee production finds its first market. Coffee collectors, wholesaler, retailors, processors, and consumers visit these weekly markets. Green coffee beans are mostly bought by the wholesalers and retailers for further processing, bringing them to the main coffee and spices shops in the big and small cities of Yemen. Traditional processing is conducted in the coffee and spices shops with small roasting and milling machines.

[58] Coffee is a credit stock and stored for liquidation of cash up to three years. (Source: key informants.)

Table 5, below, lists some of the usual coffee markets in Yemen, but the scope and scale vary from year to year.

Table 5: Traditional markets associated with coffee marketing (Source: key informants)

Governorate	Traditional Market	Market day	Location
Old city of Sana'a	Al-Meleh	Daily	In the old city of Sana'a
	Al-Hab		
	Spices		
Sana'a	Bait Zaher	Thursday	Qa'a Al-Rahbah
	Al-Qabel village	Friday	Wadi Dhahr
	Al-Rawdha	Sunday	Al-Rawdha city
	Monday market	Monday	Arhab City
	Wednesday market	Wednesday	Al-Haymah Aldkheliah
	Tuesday market	Tuesday	Bani Alsaid, Bani Hushaish
Taiz	Al-Shaniny	Sunday and Thursday	Taiz city
	Al-Dhabab	Sunday	Wadi Al-Dhabab
	Demnat Khadeer	Tuesday and Wednesday	Demnat Khadeer
	Hajdah	Tuesday	Hajdah, Maqbanh
	Al-Mesrakh	Thursday	Al-Mesrakh
	Al-barh	Thursday	Al-barh, Maqbanh
Al-Hudaidah	Bajel	Wednesday	Bajel city
	Bait Alfaqeeh	Friday	Bait Alfaqeeh
	Al-Marawa'ah	Monday	Al-Marawa'ah
	Al-Zuhrah	Tuesday	Al-Zuhrah
Hajjah	Al-Toor	Friday	Al-Toor
	Wadi Shares	Sunday	Wadi Shares
Dhamar	Dhamar city market	Wednesday	Dhamar city
	Utumah	Wednesday	Utumah
	Je'ear (Wesab Ala'aly)	Wednesday	Wesab Ala'aly

	Mesharafah	Saturday	Mesharafah, Wesab Alsafel
Abyan	Saturday market	Saturday	Rasd
	Sabah market	Monday	Sabah
Ibb	Alsahool market	Saturday	Alsahool
	Alqae'edah market	Tuesday	Alqae'edah
	Saturday market	Saturday	AlUdeen
Sa'adah	Al-Talh market	Saturday	Al-Talh
	Old market	Daily	Sa'adah old city
Lahj	Al-Hebeelain market	Sunday and Wednesday	Laboos Yafe'e
	Yahor	Tuesday	Radfan
	Al-Muflehy	Tuesday	Yafe'e
Amran	Haoof	Friday	Haoof
	Khamer	Sunday	Khamer
	Raidah	Tuesday	Raidah
Al Mahweet	Alrugoom	Monday	Alrugoom

Domestic branding of coffee

The coffee and spice shops prepare the end coffee and qisher[59] for local markets according to the taste and flavours developed for each business and the demand in the domestic market. There are different end products prepared the local markets, such as:

- *Yemeni coffee:* mostly coffee cooked directly with water
- *Arabic coffee:* highly concentrated coffee for drinking in small cups
- *Baidhany coffee:* Yemeni coffee with some additional natural flavours,[60] initially used in Albaydah governorate
- *Rada'a coffee:* Yemeni coffee with some additional natural flavours, initially used in Rada'a city
- *Husks coffee:* qisher drinks with some natural flavours
- *Barley coffee:* coffee with an additional grain, usually barley
- *Turkish coffee:* concentrated coffee used in some coffee sites

[59] Qisher is a traditional south-eastern Arabic hot drink made of spiced coffee husks, ginger, and sometimes cinnamon. In Yemen it is usually drunk as an alternative to coffee because it does not need to be roasted.
[60] Cardamom, carnations, cinnamon, ginger, etc.

- *Espresso coffee:* used only in some coffee sites

Export market (traditional and specialty coffee)

In recent years coffee sectors across the world have been evolving, and conventional markets are expanding from industrialized nations to developing economies. Coffee has become a commodity where value addition provides a diversified portfolio in terms of specialty and blending, as well as in terms of 'fair trade' to encourage traceability and accountability within the chain. Overall, the volume, quality, and type of coffee determine the market segments to be targeted for individual suppliers. For instance, small suppliers of high-quality coffee with distinctive flavour or processing techniques can look into direct trade with high-end small roasters. What is noteworthy is the growing importance of new, non-saturated markets for all types of coffee, and the movement of mature markets towards high-quality ingredients and sustainable practices, as well as appreciation for uniqueness and transparency.

Specialty coffees can be defined as coffee with zero flavour-defects and excellent cup-value, and most often is sourced from countries such as Columbia, Ethiopia, Guatemala, and Kenya. USAID has defined some of the features for specialty coffee grown in Yemen.[61] The existence of unique heirloom varieties with rich flavour profiles, the production at altitudes above 2,000 meters, centuries-old traditions, and the challenging growing conditions are a few of the distinguishing characteristics of coffee grown in Yemen. The demand for greater transparency, sustainability, and quality in the chain means much higher certification and traceability requirements on the part of end consumers who are willing to pay a premium for specialty commodities. Such customers are mostly located in developed countries, but the recent rapid growth in developing economies has also created a segment of wealthy people who are following trends from developed countries. The outlook for coffee exports is presented in Table 6, emphasizing the potential for high-end markets for different coffee types.

Table 6: Potential international markets for coffee[62]

Region	Main market	Product type	Segment	Main sales channel
Europe	Italy	Robusta of high quality and consistency	Conventional	International traders and roasters

[61] USAID (2013), "Rediscovering Coffee in Yemen," (1.+USAID+Final-Report_Rediscovering-Coffee-in-Yemen_August-2013.pdf (squarespace.com).
[62] FAO (2020), "Coffee Value Chain Analysis: Opportunities for Youth Engagement in Uganda."

	Germany Scandinavia England France	- Mainstream Robusta for in-home consumption - Organic certified, signature blend, single origin (Arabica)	Conventional, organic, fair and sustainable specialty, alternative	International traders and roasters, specialty traders, small roasters and coffee shops (direct trade)
	Eastern Europe	Atypical flavors (Arabica)	Specialty Alternative	Small traders and roasters
North America and Japan	USA Canada and Japan	Certified, specialty, atypical flavors	Organic, fair and sustainable	International traders and roasters
Non-Japan Asia	China Taiwan	Robusta and Arabica	Conventional	International traders
North Africa	Algeria Morocco Sudan	Robusta	Conventional	Regional traders

The coffee tree is a cash crop that supports the Yemeni economy with hard currency when it is exported and sold worldwide. It also does not need much marketing and advertising given its reputation as one of the finest coffees in the world. It is because of this reputation that Yemeni coffee commands exceptionally good prices in international markets. Indeed, in recent years prices have risen even further owing to reduced production potential in a few important coffee producing countries, as well as the promotion of niche markets for Yemeni coffee outlets at the global level. For instance, the price of Yemeni coffee increased from $5.73/kg in 2017 to $7.15/kg in 2019.[63]

Yemeni coffee is already well placed internationally in terms of recognition and worth associated with its historical goodwill. However, the export potential has not been fully capitalized upon due to the lack of an enabling environment, exacerbated by prolonged civil strife in the country. The International Trade Centre speculates that there has been some lost potential of coffee exports based on existing realities (Figure 11). Nonetheless, Yemeni coffee exhibits the potential for far greater value in terms of trade, employment generation, and GDP, and could become a major contributing factor in the socio-economic development of the country.

[63] Coffee Market | 2022 - 27 | Industry Share, Size, Growth – Mordor Intelligence.

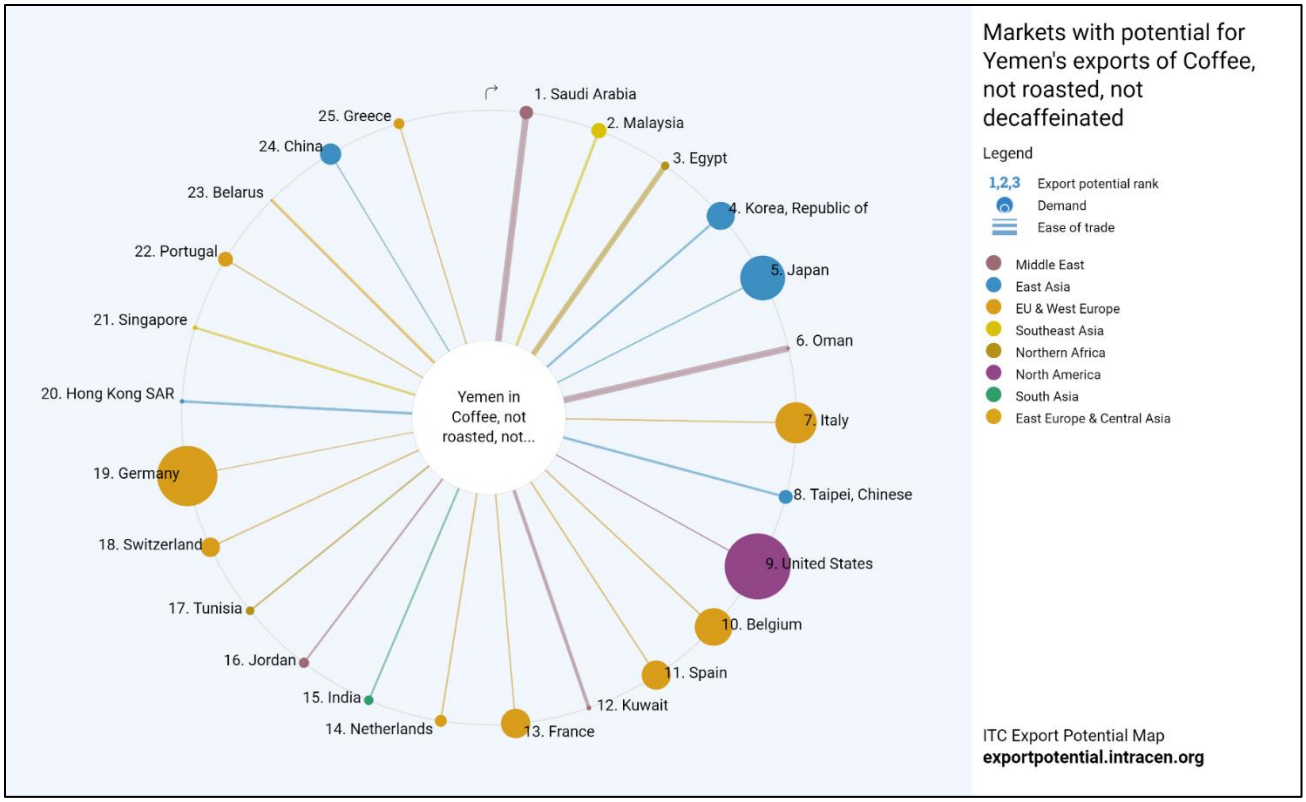


Figure 11: Export potential of coffee in Yemen (International Trade Centre, 2022)

Enabling environment – Value chain governance (VC facilitators and regulators)

The Ministry of Agriculture and Irrigation (MAI) is the umbrella governing structure for issues related to food security and agriculture. MAI also look after water management relevant to irrigation, while the National Water Resources Authority (NWRA) actively engages in water management. MAI is primarily responsible for improvements in agriculture production, and the operation wing is maintained through the Agricultural Research and Extension Authority. The Authority has four administrative units located in each of the country's regional administrations and sub-offices, and also has agents at more local levels. Additionally, MAI has research institutions and divisions that provide support for key productive sectors, such as livestock and coffee. The legal framework derives from the Law on Agricultural Wealth (1999) and Law on Water Resource Management (2002, amended 2006) for agriculture and water resource management. This shows that the regulatory environment in Yemen is relatively strong in terms of written laws and outreach. The government recently passed a regulation recognizing Water Users Association (WUAs) as community-based organizations. The official status allows agreements between the NWRA and a WUA to be legally binding; and it specifically requires a WUA to access water for agricultural purposes.

The area coverage of a WUA is well established in the agreement, and its outreach extends to the grassroots level. For instance, Sana'a alone has around 38 registered WUAs at the sub-basin level.

However, regulatory enforcement, performance, and monitoring are difficult. Prior to the conflict, implementation was challenging due to capacity constraints, but the conflict period has further hindered implementation and a low government priority. Community-based approaches have been shown to be effective with local producer groups organized to coordinate resource conservation and production practices, especially when it helps to resolve issues related to land demarcation and water distribution. Communities have established informal mutual agreements on local rules, including measures such as water-well spacing, the closure of disputed wells, and the ban on sales to water tankers. There is often considerable community effort to improve groundwater recharge. However, local efforts are often constrained by various factors, such as the lack of technical knowledge about aquifers and the most effective approaches to adopt, and there is little external support for enforcing rules.

The coffee department of the Ministry of Agriculture (MAI) is active in providing extension services to the farming community, but these services are not public and are offered only for payment, and usually through the engagement of development partners. The coffee department has no budget to maintain the technical services on its own, a situation that became worse during the crisis period. There are government-run coffee nurseries in some cities (with the largest in Ibb governorate), and these support themselves by selling coffee seedlings and other seedlings. The nurseries, especially in Ibb, provide MAI with thousands of coffee seedling for official activities. Unfortunately, the coffee research unit, located in Taiz, is paralyzed due to the current ongoing conflict and the lack of financial resources.

Yemen ranked last (153) according to the 2020 Global Gender Gap Report, a reduction of four places from the previous year, which dramatically demonstrates the country's widespread gender inequality.[64] Compared to men, women still often have considerably less ownership and control of land, and they face significant barriers to accessing agriculture training, improved agro-inputs, and financial services. As a cash crop, coffee is generally seen as a men's crop, and income from coffee cherry sales generally goes directly to the men of the household, even though a large part of labour is done by women. Significant examples of female ownership in the coffee subsector are missing in Yemen, and this poses a potential opportunity to enhance the role of women in the various functions of the value chain.

[64] Global Gender Gap Report 2020 - Reports - World Economic Forum (weforum.org).

The regulatory and enabling environment is rather weak in Yemen, especially for agricultural departments. The World Bank composite indicator of 'ease of doing business' has assigned Yemen one of the lowest ranks in 2020, which depicts a discouraging environment for establishing or flourishing entrepreneurship in the country.[65] The governance structures are rather self-regulated and are largely maintained by private-sector actors, with only minimum transparency and accountability regarding value chain functions. The visible and more effective governance at the farming community level is through registered WUAs, which play an effective role in issues related to the distribution of water. Table 7[66] shows some of the very practical water-related issues dealt by such informal governing structures.

Table 7: Management examples of Water Users Association in Yemen

S #	Place (reference)	Type of management	Local rule
1	Wadi Qaradah, Bani Hushaish, Sanaa	Informal norms, leadership, WUA	Restrict well drilling, recharge weirs in wadi beds, well sharing
2	Khrabat, Mulayab, Bani Matar, Sanaa	Informal norms, WUA	Restrict well drilling, well spacing
3	Wadi Dhelaa, Hamdan, Sanaa	Informal norms, leadership, WUA	Well sharing, well spacing, dam development
4	Al Sinah, Almaafer, Taiz	Community organization	Well distance, blocking down well development in sensitive areas, permission by the National Water Resource Authority (NWRA) only with the consent of cooperative
5	Wadi Areesha, Nahem, Sanaa	Informal norms, WUA	Restrict well drilling, ban on tankers, well depth limit
6	Hejrat Al Asham, Jabal Al Sharaq, Dhamar	Informal norms	Restrict well drilling
7	Qerwah Beshar, Jahanah, khawlan, Sanaa	Informal norms	Restrict well drilling
8	Wadi Sanaa, Dhamar	Informal norms	Spring protection by zoning, distance rule
9	Wadi Akarem, Dhamar	Leadership	Restrict well drilling in the main wadi
10	Bani Garban, Al Kafr District, Ibb	Community organization	Protection zone
11	Al Gawaref, Ibb	Informal norms	Ban on irrigation of qat
12	Waalah, Amran	WUA	Ban on water transport by tankers
13	Bait Sarhan, Alhamarmaly, Amran	Leadership	Ban on water transport by tankers

[65] Score-Ranking (doingbusiness.org).
[66] T. Taher et al., "Local groundwater governance in Yemen: Building on traditions and enabling communities to craft new rules," *Hydrogeology Journal* (2012) 20: 1177–1188.

14	Al Maakhad, Amran	Leadership	Ban on water transport by tankers
15	Qa'a Alshams, Amran	Leadership	Ban on water transport by tankers
16	Bani Maymoun, Amran	Leadership	Tankers only within village
17	Al Aroosi, Mehan, Sanaa	Informal norms, leadership	Closure of disputed wells, agreement on reservoir operation
18	Al Mashra, Dhamar	Leadership	Ban on drilling
19	Wadi Al Har, Anss, Dhamar	Community organization, leadership	New agriculture well only if they are serving drinking too
20	Mawia, Taez	WUA	Joint WUA to regulate new well development, replacement of qat in few areas
21	Wadi Al Zabera, Qadas, Al Mawaseet, Taiz	Informal norms, community organization	Restrict/ban well drilling, closure of disputed wells
22	Hijrat Al Muntasir, Amran	Informal norms, leadership	Ban on new drilling
23	Al Wahda, Al Maafir, Taiz	WUA	Ban on new wells, non-well owners to share in existing wells
24	Zuberia, Wadi Sihsam, Hodeidah	Leadership	Prevent new shallow development by referring cases to local council and NWRA

Coffee value chain map

The coffee value chain map was visualized ona number of occasions, as cited in the literature review. A good example is depicted by the value chain study by SMEPS in 2009 (Figure 12), where traditional and specialized coffee is illustrated with lead times (retaining period), and where the relationships among value chain players are strong. (see schematics below). In terms of relevancy, the traditional coffee marketing chain remains valid today with little variation.

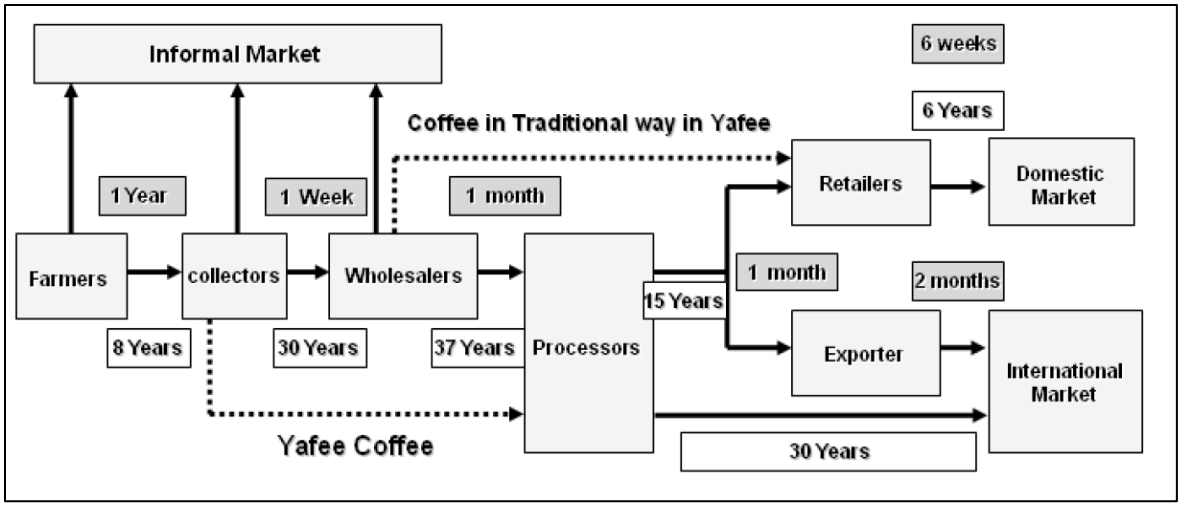


Figure 12: Value chain map of coffee (SMEPS, 2009)

Findings from secondary sources and consultation with key informants during field work helped in updating the traditional value chain map of the coffee subsector in Yemen. Figure 13 presents the overall situation of coffee in Yemen, indicating value chain players, regulators, and facilitators in the overall context of the country. The chain begins at the right with the input supply function and ends in local and international markets. The interactions are somewhat straight forward among the chain players, where every player is well aware of the functions they are performing. However, the facilitation and regulatory environment has become inconsistent during the civil war.

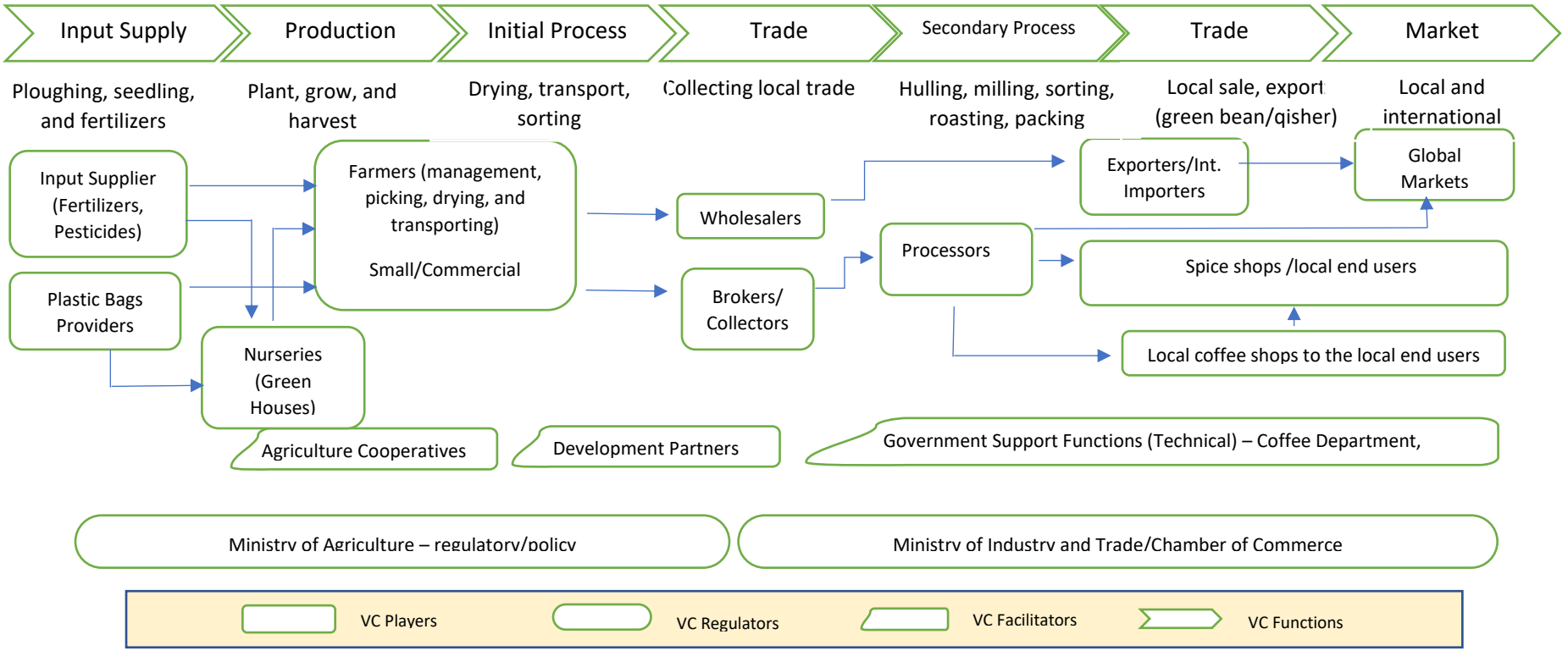


Figure 13: Coffee value chain map[67]

[67] After Mocha Valley, 2021 (modified), www.mochavalley.com.

Value addition and gross margins

Value chains in Yemen are governed in traditional settings, and thus the various transaction across the chain are not always transparent. The gross margins are unevenly distributed, with a number of variations recorded across the chain's various links. For instance, the key informant during the data collection process depicted 40–45 per cent margins for farmers, 7–10 per cent for collectors, 5–10 per cent for wholesalers, 10–15 per cent for processors, and 15–20 per cent for retailers. However, these margins vary by area and depend a lot on the understanding between farmers and market players, not exactly on market rates. For instance, a farmer might reduce the price of his coffee stock when money is required for some urgent household needs.

SMEPS (2009) reported a variety of value margins for coffee producers. For example, farmers in Yafee get the most out of the total value generated (80 per cent) while collectors and processors shared the remaining portion (20 per cent). In Taiz, farmers got 42 per cent, while the rest was distributed among collectors (4 per cent), wholesalers (4 per cent), processors (7 per cent), retailors (14 per cent), and exporters (21 per cent). Though the study did not mention specific reasons for the uneven distribution, the short chain transaction in Yafee and the specialty market coffee produced there put farmers in a strong position. Taiz is a more traditional version of the coffee marketing chain.

There are Yemen-based exporters, such as Port Mokha, dedicated to promoting Yemeni coffee throughout the world. Bloomberg reported that Port Mokha engages more than 120,000 farmers in the highlands, producing 10 tons of coffee each year exclusively for Port Mokha. The company pays farmers 12 times higher than the usual market rate ($6 instead of 50 cents/kg) to ensure they follow strict picking and sorting protocols; and it provide technical know-how and microloans to finance equipment upgrades and other necessities. This is a cycle of empowerment that keeps driving up the quality and quantity of Yemeni coffee, and such incentives are necessary to convert more qat farmers to coffee until the drug trade is eradicated.[68] Port Mokha is a good example of contract farming and has a strong chance of replication in the coming years. This high-quality product is sold at a premium price, one of the highest in the international market.[69]

One possible justification for improving the gross margins for collectors, processors, and exporters is their speciality and dedication to the coffee business, i.e., these actors derive 100 per cent of their income from

[68] The Best Coffee in the World Now Comes From Yemen - Bloomberg.
[69] Ibid.

coffee, whereas farmers, wholesalers, and retailers tend to have other business lines beside coffee production.

The relationships between the various players of the chain are depicted below, where coffee farmers are only linked with collectors and wholesalers in the traditional value chain. Farmers are affected from their own established practices, where they seldom try different marketing options to increase their value share. The wholesaler and processors are much better positioned in the value chain, which is why they are fetching maximum financial benefits from the coffee trade.

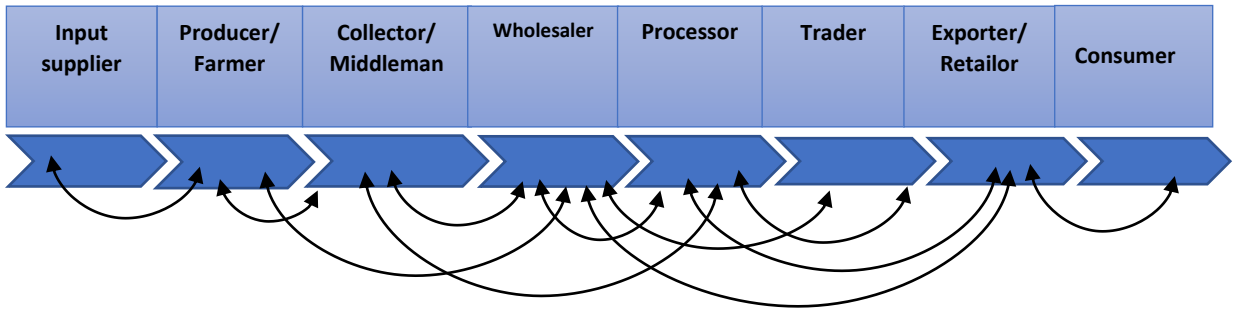


Figure 14: Interactions between value chain players of coffee

Employment generation (inclusion)

The production practices in coffee cultivation are not labour intensive and are largely performed by family members, both male (60 per cent) and female (40 per cent). When required, paid labour is provided by male labourers (90 per cent) and by some female labourers (10 per cent). Such paid labour occurs primarily during the harvesting, processing, and marketing functions of the chain (70 per cent male; 30 per cent female). The women's role usually involves cleaning/seedling, hoeing, picking (to some extent), drying, and packing. The positive impact of these engagements are additional family income and improved health and education indicators, while it does have some negative implications for women's caring responsibilities and routine household chores.

Gender perspective in changing climate

Women in Yemen and in many other countries are often on the frontline with respect to the impacts of a changing climate. Men tend to migrate to cities to earn an income, leaving women to combat a harsh life in villages. In addition, women are particularly vulnerable during conflicts and any type of climate-related disaster or hazard. Women are also more vulnerable to climate change than men because they make up the majority of the economically poor, do most of the agricultural work, bear unequal responsibility for household food security, carry a disproportionate burden for harvesting water and fuel for daily survival,

and rely on threatened natural resources for their livelihoods.[70] Yemeni women often have greater workloads with having to walk long distances to access water for household consumption (drinking, cooking, childcare, washing, etc.).[71] Moreover, they have unequal access to, control over, and ownership of natural resources, and are often excluded from important decision and policy-making forums and institutions. Differently positioned women and men perceive and experience climate change in diverse ways because of their distinct socially constructed gender roles, responsibilities, status, and identities, which result in varied coping strategies and responses.[72] There are not only differences between men and women in their vulnerability to cope with climate change, there are differences in how women and men perceive and experience extreme events, such as too little water. An increased workload for women means that parents take girls out of school in order for them to carry out household and agricultural tasks.[73] Adapting to climate change will require a broad range of efforts, incentives, resources, commitment, and active interventions throughout most parts of society.[74] In the Yemeni context there is broad involvement of women in the agriculture sector, including coffee and qat crops. The involvement of Yemeni women in coffee production starts with land preparation and continues through the planting of seedlings, the field agricultural practices till harvest, and the drying and packing. Moreover, women provide the majority of the total labour required for coffee production, in addition to their daily family care activities and managing their need to transport potable water and fuel from far distance (Figure 15).

Figure 15: Yemeni women's traditional roles (Photo: Abdul Gabbar Al Kirshi)

[70] Terry, G. (2009), "No Climate Justice without Gender Justice: An Overview of the Issues," *Gender and Development* 17(1): 5–18.
[71] Alshargabi, Awatif, "Gender and Climate Change in Yemen" (presentation without date).
[72] Lambrou, Y. and Nelson, S (2010), "Farmers in a Changing Climate: Does Gender Matter? Food Security in Andhra Pradesh, India" (Rome: Food and Agricultural Organization).
[73] Baten, M. A. and Khan, N. A. (2010), "Gender Issue in Climate Change Discourse: Theory versus Reality" (Dhaka: Unnayan Onneshan).
[74] Nellemann, C., Verma, R., and Hislop, L. (eds., 2011), *Women at the frontline of climate change: Gender risks and hopes.* A Rapid Response Assessment (United Nations Environment Programme, GRID-Arendal).

As per Yemeni traditions and conservative socio-cultural norms, women play a significant role in maintaining coffee trees, although they lack decision-making power with regard to coffee production.[75] Figure 16 shows that women are the main actors in implementing the activities of coffee growing and harvest, but that the decisions to conduct these activities are made by men. It is interesting to note, however, that women in Kusmah district seem to enjoy slightly more decision-making opportunities, especially regarding the use of fertilisers.

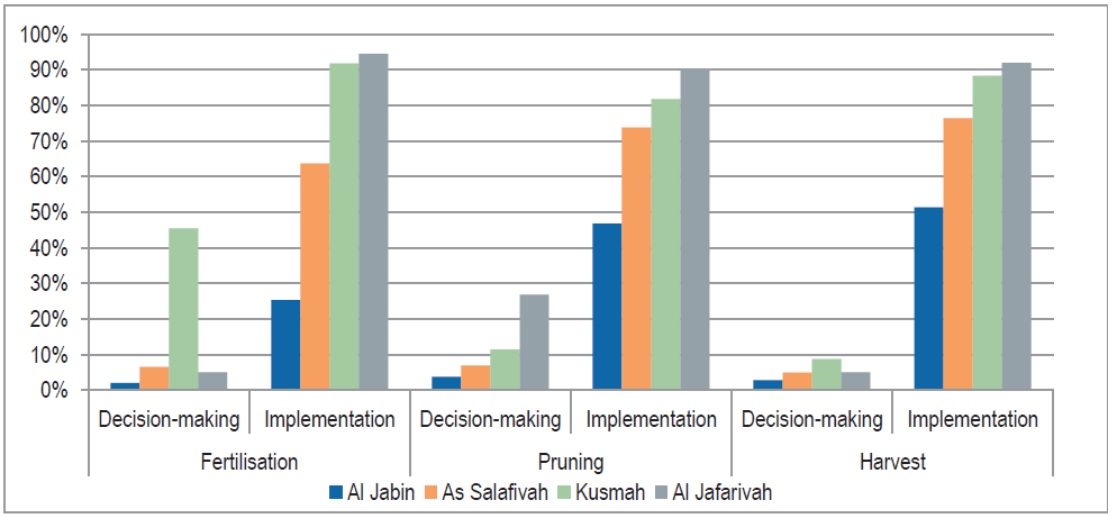


Figure 16: Women's roles by decision-making and activity implementation in three main coffee production functions[76]

The foreseen project should continue the training and capacity-building of the women already started by some governmental and international organizations (SMEPS 2017 and 2018 in Bura'a, Hudaidah governorate; and SMEPS 2018 in Talooq, Taiz governorate, and Acted in Raima governorate). Within the coffee intervention of the Yemen Emergency Crisis Response Project, the project aimed initially to train and work with 600 female coffee farmers in Burra by introducing modern agricultural practices, such as the use of organic pesticides; by training them on the simple preparation of a neem solution (*Azadirachta indica*); and by helping them to reduce the cost of chemical products for the better organic and quality production of coffee. By the end of the project, SMEPS reached 800 female farmers (33 per cent above target); the coffee production of the target farmers increased 122 per cent (from 0.9kg to 2.0kg per tree); and coffee quality increased from 72 to 83.7 cupping value.[77] In Bura'a alone there are around 6.5 million coffee trees,[78] and women care for the majority of these trees. Productivity could be increased to 2kg/plant if the capacity and training of women started by SMEPS were to continue to expand, which

[75] Reach Initiative, "Coffee production assessment in Raymah Governate – Yemen: Preliminary findings report, April 2014."
[76] Ibid.
[77] Yemen Emergency Crisis Response Project (2019), finale project review report, unpublished.
[78] Final report of coffee trees survey in Bura'a, Hudaidah governorate, conducted in November/December 2017, SMEPS (in Arabic).

could in turn increase overall production by 10 tons per year (around half of the country's current coffee production). In addition, key informant interviews with women coffee farmers, women academics, and women entrepreneurs (processing, trade, evaluation certificates, etc.) showed that women are the main players of coffee production in Yemen. Therefore, women coffee organizations are fundamental for building their capacities in various locations so as to lead women coffee farmers in the rational use of production resources and to better cope with climate changes.

Inefficiencies in the coffee value chain

There are certain inefficiencies recorded at different phases of the coffee chain that affect its productivity and performance in comparison to other crops, especially qat and vegetables. These inefficiencies could be largely dealt with by good agricultural and management techniques.

Production

- Average losses of up to 20–35 per cent are due to fallen and broken beans, pests, and diseases; and since coffee is a cash crop, these losses have significant financial implications. The major pest is the Coffee Berry Moth, which sometime damage up to 70 per cent of a crop if left unattended.
- Though coffee is one of the least water-intensive crops, erratic precipitation patterns have affected the production capacity in Yemen where coffee trees are inadequately provided with the supplementary irrigation required for their reproductive growth. In some cases, the production capacity is reduced a further 20 per cent in the fruiting stage. In addition, some losses are due to the variety itself. For instance, Matary beans are weak and tend to break apart during hulling (10–20 per cent).

Post-production

- The low level of skill set, paying insufficient care, and the lack of modern technologies are a few of the important reasons for high post-harvest losses in the coffee chain.
- Half of all losses during post-production is due to unskilled labour, manual picking, and the use of improper packaging (small flour bags), which affect the cleanliness of beans (Figure 14).
- Drying on roof tops also exposes beans to inert material (dust); and exposure to sun at various temperatures can affect the uniformity of beans (Figure 14).
- The tradition of storing coffee at the household level for longer periods also affects the longevity of the produce, which is not good for the quality of the beans. Storage by farmers can stretch

from months to years, whereas beans remain for just weeks with intermediaries and only days with processors.

Yields

The coffee yield potential in Yemen is significantly lower compared to global leaders, and even in regional coffee producing countries. Table 2 presents the average yields realized by coffee producing countries, illustrating that Yemen is far below the market leader (Viet Nam: nine times higher) and even fairly lower than neighbouring countries (Ethiopia: three time higher). This presents an opportunity to invest in the existing management practices of coffee production in Yemen, and can potentially increase the profitability by not compromising the much renowned traditional flavour of Yemeni coffee.

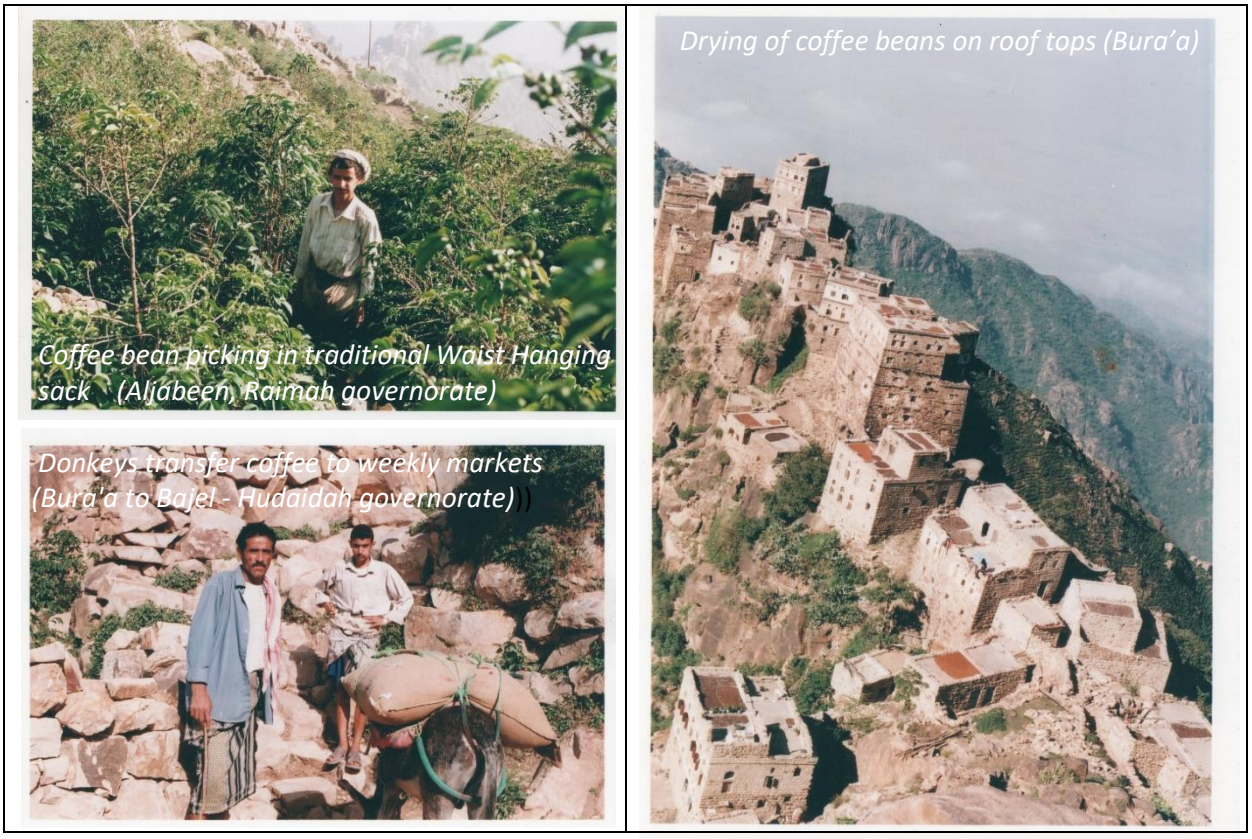


Figure 17: Traditional practices of collecting, drying, and transporting coffee beans (Photos: Abdul Gabbar Al Kirshi)

SWOT analysis

The coffee subsector in Yemen possesses a number of encouraging and disappointing attributes, which are summarized in the Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis. The

strengths and opportunities are mainly related to the speciality nature of Yemeni coffee, while the weaknesses and threats are mostly related to the traditional way of production, weak infrastructure, expansion of qat cultivation, and market uncertainty related to growing civil strife. The elements of the SWOT analysis are further expanded in the programmatic recommendations for UNDP consideration.

Table 8: SWOT analysis of coffee in Yemen

Strengths	**Weaknesses**
- Coffee from Yemen has a competitive edge due to its unique flavour and cup value - Coffee in Yemen is grown at high altitudes, making it less prone to climatic shifts and environmental hazards - Yemen coffee has a well-established market reputation fetches premium prices - Domestic demand is also consistent for coffee consumption	- Coffee in Yemen is still grown in traditional ways, which affects yields and profitability - The collection and processing functions are manual, which exhibits a number of in-efficiencies in the overall chain - The remoteness of coffee production areas and limited access to infrastructure make it hard to reach market - Yields are substantially low for coffee in Yemen as compared to regional and global standards - Government and institutional support is quite weak for coffee - Weak governance structures in the agricultural value chains create imbalances for such crops as qat and coffee
Opportunities	**Threats**
- Capacity-building of farming communities on good/best agricultural practices to improve production and post-production efficiencies - Protection of indigenous coffee strains (branding) to preserve original speciality name of Yemen coffee (Mocha Coffee) - Contract farming with international processing and outlet chains can increase	- Competition from qat is ever growing, directly impacting the production potential of coffee and other agricultural crops. The profitability margins of qat are currently far greater than that of other crops - The threatening security situation creates uncertainty for the overall business environment for coffee

market share, and premium prices can encourage farmers to expand coffee - Growing international demand couples with reduced coffee supply from leading producing countries could promote encouraging returns for coffee producers and processors from Yemen - Presence of institutional development partners and their willingness to invest in the promotion of coffee subsector - New business opportunities with expansion of café shops and baristas in domestic market of Yemen is encouraging for coffee production	

Programmatic recommendations

The coffee promotion strategy in Yemen should be anchored on increasing the production and yield per tree, reducing the cost of production, improving soil fertility, strengthening the integration among the different various stakeholders, and improving traceability in the value chain. The fame of Yemeni coffee could potentially be further exploited by greater marketing of its distinctive qualities. A 'differentiation strategy' is characterized by a deep and holistic understanding of customers, intensive brand building, jealously guarding customers, and a commitment to innovation.[79] Coffee is an exciting market within which trends are constantly changing. This creates space for innovation along all stages of the value chain, which can be led by a young, dynamic workforce with the capacity and willingness to transform. In response to changing market demands, the creative power of young people can be utilized to capture higher value-added, for instance, through innovative methods to obtain high quality and novel products; through new ways to articulate stories related to the origin of the coffee, culture, and conditions of producing communities in Yemen, as well as about traditional processing and roasting techniques; and

[79] Lafley, A. and Martin, R. L. (2013), *Playing to Win: How Strategy Really Works* (1st edition, Harvard Business Review Press).

through stronger relationships with clients and better communication with consumers overseas using e-commerce and other digital platforms.

The UNDP has identified coffee as one of the five pillars of economic recovery in Yemen. In fact, it might be the most important economic development sector in the rural and agricultural areas. A few strategic recommendations have emerged from the analysis during the consultation process and the secondary research, and these are mentioned for further review by UNDP programming. Most especially, these recommendations can help the ongoing pilot project to identify additional entry points for the encouragement of the coffee subsector in Yemen.

Research and survey

- Conduct systematic studies for scientific identification of the coffee genotypes in Yemen so that we can then speak about real coffee varieties in the country.
- Continue research in the phenotype of coffee types in the different locations in Yemen and possibly producing a Yemeni coffee atlas.
- Continue the work started by SMEPS in Bura'a in 2019, and conduct a similar survey to identify the current total number of productive coffee trees in all coffee production governorates of Yemen.
- Conduct breeding research to produce new high-yielding and high-value breeds of coffee.
- In addition, targeted research should be conducted to know more about the Coffee Leaf Miner (*Perileucoptera cofeella*), coffee rust (*Hemileia vastatrix*), the Black Stem Borer (*Apate monachus*), and the White Grub Beetle (*Phyllophaga sp*.).
- Coffee diseases caused by fungus, such as coffee rust, are still not a major issue in Yemen. However, a survey and research of plant protection should be conducted parallel to the other coffee intervention activities. Crop pests and diseases are also better managed with good cultivation practices.
- Improvement of coffee breeding activities with full involvement of research institutions (faculties of agriculture in Sana'a, Aden, Ibb, Dhamar, etc.).

Rational use of water and irrigation

- Providing coffee farmers with in-kind incentives for irrigation equipment (maintenance of cisterns, building of water tanks, watering pipes, etc.).

- Constructing water tanks (water harvesting) to irrigate coffee.
- Cultivate pilot areas with coffee as an alternative cropping pattern for qat.
- Repairing damaged coffee terraces.

Legislation

- Issuing suitable legislation concerning the production and marketing of coffee to protect the small coffee producers and to encourage them to produce quality coffee.
- Support the government in developing a coffee sector strategy, specifically on the marketing, branding, and price setting.
- Support the government in providing a legal and regulatory framework for the sector (i.e., contract enforcement).

Collaboration and networking

- Organize stakeholder meetings to develop and implement a strategy to improve coordination among the smaller actors in the sector, including the development of the business support services for that segment.
- Collaboration among SMEs on key services (i.e., quality control, capacity-building, finance, marketing, IT) to improve bargaining power; increase youth employment; and improve access to high-end markets in developed countries
- Create exchanges with other countries in the region in which Yemen producers representatives and SMEs can participate, and learn from successful interventions that have resulted in improved resilience to climate change
- Promote coffee producer associations and water user association, with regard to operation and maintenance, and encourage them to work together.
- Provide training and capacity-building of coffee associations and other established coffee organizations (Coffee Cooperative Union, coffee associations in the various coffee production governorates) to allow them to provide adequate services to coffee growers, especially small farmers.

Coffee nurseries

- Provide technical support to the already existing coffee nurseries to allow them to produce and trace coffee seedlings with the exact characteristics for delivering specific the coffee verities or types.
- Establish certified coffee nurseries and extension teams in the main coffee growing governorates as well as providing technical support to the village coffee nurseries established by coffee associations and farmers.
- Support measures to improve infrastructure, post-harvest technology, the grading and characterization of coffee, as well as the institutional capacity to support coffee marketing.
- Enhance quality control by involving a third party to provide recommendations and advise during all production, harvest, and marketing stages.

Farm management

- Promote the training and capacity-building of farmers, with a focus on female coffee farmers, not only in agricultural practices (land preparation, selection of suitable coffee seedlings, ridge making, pruning, hoeing, irrigation, pest and disease control, picking/packing, etc.) but also by conducting training courses in farm and nursery management (bookkeeping, registration of all costs and benefits of the coffee farm, good storage, coffee agribusiness, etc.). This kind of training will is the first step towards the properly integrated farm management of coffee in Yemen.
- Support pilot coffee farms (Talooq in Taiz, Haraz; Bani Mater and Sa'afn in Sana'a; Bura'a in AlHudaidah; Dhey Nakheb in Lahj) for producing specialty coffee, starting with proper coffee cultivation; good agricultural practices; proper harvest, drying, cleaning, roasting, and milling; and good packing and transport.
- For financing agricultural inputs and activities, it is recommended to link the coffee farmers and other essential players in the value chain to the agricultural microfinance institutions that in recent years have emerged in several Yemeni banks and institutions (Kuraim Bank, Thadamon Bank, Azal Microfinance, National Microfinance, Nama Microfinance, etc.).

- Enhance the role of the private sector for the further establishment of coffee nurseries, processing units, quality control units, and trading auctions, and for the opening of new channels for exports.
- Support initiatives for the creation of coffee cooperative organizations in the coffee production governorates.
- The fact that the yield potential of coffee is varies by area demonstrates that different climatic conditions favour coffee production differently. Hence, the agro-ecological zonation of coffee can help identify the optimum production pockets in Yemen.

Water and irrigation

- Maintain and improve the damaged terraces of coffee as well as the traditional water harvesting sources (springs, cisterns, soil canals, small dams) for the rational use of available water.
- Enhance the efficiency of irrigation by introducing modern irrigation systems in the low lands and building water tanks and ponds for water harvesting in the high lands.
- Encourage the private sector for investment in water-saving systems such as drip irrigation technologies, and provide incentives that encourage the use of more water-efficient crops.

Marketing/Entrepreneurship

- Improve the marketing and the relations of the different actors in the value chain by their periodic meeting to emphasize the tasks under the coffee cooperative umbrella. Training workshops for the capacity-building of the essential coffee actors in the value chain are necessary.
- To guarantee sustained interest in coffee farming, it is important for the government and stakeholders to seek alternative sources for markets that offer better coffee prices. This can help to overcome challenges of price fluctuations due to reliance on traditional markets.
- Government should formulate laws that will ensure that more farmers participate in the coffee value chain, and that will help them to understand the market requirements for coffee and updated market prices. The roles of key players need to be revisited.
- The launch of 'Amal Yemen' (Hope for Yemen) is a consortium[80] to promote Yemeni coffee and culture in Western countries. To date, representatives from more than three dozen coffee-related

[80] The consortium has been led by Chicago-based Intelligentsia Coffee; the Portland, Oregon-based Alliance for Coffee Excellence; the London-based Square Mile Coffee Roasters; and the Yemen-focused green coffee trader Qima Coffee.

organizations have joined in this effort, where the end goal is to connect more consumers and roasters and baristas with Yemen and to create a different set of associations than what exists today.[81] The example needs to be replication on a regular and fair scale in all potential markets.

Women roles

- Since women are the primary instrument in coffee production, it is necessary to strengthen and ensure women's access, control, and ownership of resources such as credit, information, training, outreach, and culturally appropriate and labour-saving technologies.
- There is a need for a systematic analysis of climate change factors such as water, fuel, and energy from an environmental, developmental, and gender equity perspectives to fill any gaps in research, knowledge, and data.
- Ensure the participation and substantive inputs of women in decision and policy-making in local, community, national, regional, and international institutions, processes, negotiations, and policies related to climate change issues.
- Women should be at the centre of adaptation programmes because they are a particularly vulnerable group due to their limited access to, control over, and ownership of resources; unequal participation in decision and policy-making; lower incomes and levels of formal education; and extraordinarily high workloads.

Enabling environment

- To ensure a high return for farmers the government should approve a farm input subsidy programme, and should also ensure that the inputs are supplied to farmers in a timely manner so as to ensure their proper utilization. The MAI staff should also sensitize farmers through trainings and awareness campaigns.
- The value-added of coffee production should be promoted by investing in processing units so as to ensure they are available to the locals and in many forms. This can address issues of inequality by creating jobs for the women and youths who are left out of the coffee value chain.

Climate change adaptation

[81] See https://amalyemen.com/.

- Improve climate risk management, using tools that can analyse the impact that an increase in extreme weather events has on the production, sales, and delivery of primary products, energy, and water.

Qat value chain

Overview of the subsector

Qat (*Catha Edulis)* is a very popular hallucinogen produced in the south of the Arabian Peninsula, primarily in Yemen and East Africa (Ethiopia, Kenya, and Somalia). In 1980 the World Health Organization (WHO) designated qat as drug of abuse,[82] which make its cultivation and use more controversial across the globe. Most countries have banned its use even though it is considered a mild drug. Qat is a 10 to 20-foot flowering evergreen shrub or small tree nurtured for its fresh young leaves. It is a widely cultivated cash crop in the mountainous regions, especially at 1,000–3800 metres above sea level. The dark green leaves are chewed while small, young, and fresh for their narcotic effect. Qat is chewed to alleviate fatigue and reduce appetite, and is a favourite activity among all age groups in Yemen. As the leaves mature or dry, cathinone is converted to cathine, which significantly reduces its stimulatory properties. Cathinone is approximately 10 times more potent than cathine and is only present in fresh leaves. The consumption of qat in parts of Arabia and Africa dates back for centuries, but the last quarter of the 20th Century witnessed a major expansion of its plantations in Yemen.[83]

The cultivation of qat in Yemen has expanded significantly over the last three decades, with the plant now taking up about 15 per cent of agricultural land according to figures released by the Yemeni Ministry of Agriculture and Irrigation. Previously it was grown only on mountains and hills. The Ministry's statistics also confirm a large increase in the qat trade within the country, as Yemeni's annual spending on the addictive drug has reached about $12 billion.[84] Qat now ranks first in the list of cash crops in Yemen, with an average cultivated area of 166,557 hectares, out of a total cultivated land of approximately 1,172,000 hectares. Meanwhile, the total yield has reached nearly 190 thousand tons annually.[85]

Geographic preference of qat cultivation

The cultivation of qat has expanded to the highlands governorates, including Sana'a, Amran, Addaleh, Hajjah, Alamhweet, Lahj (with the exception of the coastal belt), Hudaidah, and Ibb. Official statistics

[82] KHAT (who.int).
[83] Gatter, Peter (2012), "Politics of Qat: The role of a drug in ruling Yemen."
[84] World Bank estimation, 2017.
[85] Khat cultivation fuels food crisis in Yemen - SciDev.Net.

report qat cultivation in 17 of the country's 21 governorates. The key informants consulted affirm that 95 per cent of Almahabeshah in Hajja; 80–90 per cent of Rada'a, Addaleh, Mawiah, and Jabal Saber; 50 per cent of Taiz; and 30 per cent of agricultural land in Sana'a is used for qat cultivation. Figure 18 shows the areas of qat concentration in Yemen and the bifurcating irrigation divide between east and west (mostly rainfall irrigated to the west and tubewell irrigated to the east).

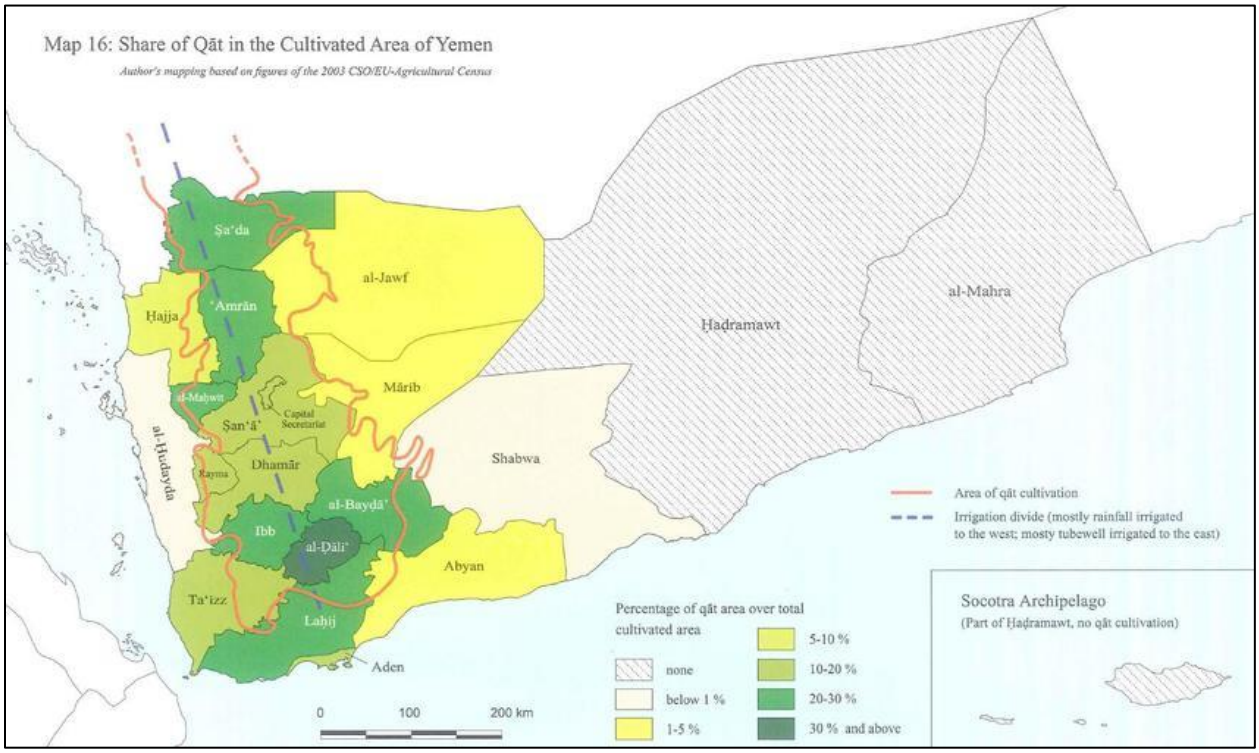


Figure 18: Qat producing areas (International Water Management Institute, 2016)

The Sarawat region was once home to some of the world's most valuable coffee, where it was historically grown as a cash crop accompanied by diverse farm production of vegetables and grains. Over the last decade, however, the monoculture production of qat has rapidly replaced much of this traditional and potentially sustainable coffee due to the potential cash return. Almost 97 per cent of qat production is consumed locally as a result of addiction, but its agricultural, industrial, and social potential have not been researched properly.

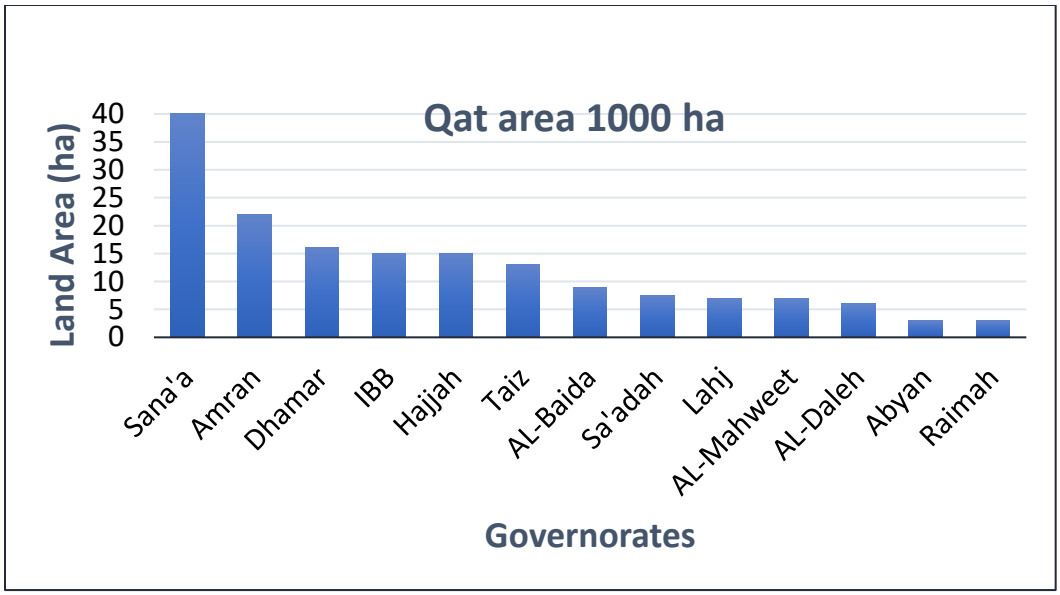


Figure 19: Qat cultivation area by governorate in Yemen (Agriculture Statistics, 2018)

A 2007 socio-economic analysis of Yemeni society highlighted the huge importance of qat usage in daily life[86]. More than a decade ago 70 per cent of all households in Yemen reported at least one qat user. The percentage intensified further as repercussions of civil war, growing frustration and fatigue, and its acceptance as a socializing factor make it a favourite pass-time. Qat consumption was reported as remarkably flat across all income groups, ages, and between rural and urban areas. It was considered a normal habit, and there was no indication at that time that its use was a substitute for food. However, there was a strong gender bias, as men were much more likely to use qat than women, but this trend is shifting and needs to be empirically tested in the current state of affairs.[87]

Value chain functions

Input supply

Qat cultivation begins by planting small cuttings (propagative growth) in the beginning of spring or summer to make use of rainwater during this time. In the first month qat needs to be irrigated once every five days, in the second month once every 10 days, and after that once or twice every month.[88] The use of pesticides and fertilizer is intensive in the qat crop since they are liberally applied to boost the

[86] Milanovic, Branko, "Qat Expenditures in Yemen and Djibouti: An Empirical Analysis" (World Bank – Development Research Group; University of Maryland, January 2007).
[87] Gatter, "Politics of Qat."
[88] Fara'a, J. and Alawi, A., "Qat and water resources." Presented to the 2002 National Conference on Qat, organized by FAO, Ministry of Agriculture and Irrigation, and Ministry of Planning. (Conference discussion materials, pp. 69–82.

vegetative growth of the green leaves and are applied right from the beginning. The agro-chemicals used are mostly leaf growth regulators and insect pest repellents.

The input providers are largely recognized as agro-chemical providers within the qat value chain. These shops are readily available at the village/hamlet/subdistrict levels. Their number and intensity have increased with the expansion of vegetable as well as qat land area. Since the agriculture sector has hardly any regulatory check, the exact number of such input providers is not known, but the requirements for domestic use are mainly met through smuggled products. The qat plant is reproduced from cuttings, and hence there is no need for establishing nurseries of the plant. Nor is there any specialized equipment used in the production, post-production, and harvesting. Finally, the plastic bags used for packing are readily available in local grocery stores, though some farmers use the leaves of the banana plant as packing material, which helps to retain the moisture level of the qat leaves.

Production

The preferable temperature for qat cultivation is 1–9 degree Celsius in winter and up to a maximum of 21–35 in summer months. Qat is concentrated more in the country's northern region, where the soil's pH is acidic (less than 7) and humus content more than 3 per cent.

Forty different types (shrubs) of qat are raised in various regions of the country depending on geographical distribution and altitudinal origins. And while varieties from different regions have different characteristics, they all consume a great deal of water. Qat is also known for repeated production cycles throughout the year, in some regions providing up to 10 harvests in intensive irrigation systems.[89]

Agriculture holdings are fragmented in Yemen, and the mountainous terrain does not allow for the maintenance of large farms for any crop. For instance, key informants confirm that the average holding of a qat farm is 0.25 ha in Hajjah, 0.2 ha in Sana'a, and 0.2 ha in Taiz.

The introduction of solar power for irrigation, cover sheets for the qat plant, an increase in water pumping, and the use of irrigation networks have all played an important role in the expansion of qat across Yemen. Production has increased considerably over the past 5–10 years and has been estimated to consume a third of the extracted groundwater. Irrigation requirements are extensive in qat cultivation, with most trees requiring irrigation twice a month (the *Thuhlah* type needs irrigation on every third day). Because precipitation is scattered, meeting only 20–30 per cent of the plants' needs, some farmers have to buy

[89] Qat *Mue'ely* is harvested by the first year with 6–8 additional harvests (irrigated); while qat *Balady* is harvested by the second year with 1–2 additional harvests (rain-fed).

water from water trucks at a cost of 2,000–5,000 YR a year. Others have installed water barriers and water harvesting tanks to collect water from the roofs of houses. A 2008 FAO study reported irrigation as two thirds of the annual production expense, followed by pesticide use (8–10 per cent).[90]

Qat production is lowest in the hot and arid Marib governorate (0.42 tons/ha) and Sana'a (0.59 tons/ha) where water pumping is the highest, while it is highest in Al-Baydah (3.69 tons/ha). Nationally, the average yield is 0.89 tons/ha.[91]

Qat varieties

Like coffee, there are no registered varieties of qat found in Yemen. The local types exceed more than 70, depending on origin, quality, and leaf maturity. There are a few types (e.g., Shamy, Maweyah, and Sabry) that command the major market share. Their characteristics are noted in the table below.

Table 9: Characteristics of leading qat types

Qat	Shamy	High production, market demand is high, good return. Originated in Almahabisha Hajjah governorate and recently introduced to Bani Omar and Duba'a of Alshamayateen district in Taiz governorate.
	Maweyah	Originated in Maweyah Taiz, high production, market demand is high, return is good, introduced to other districts of Taiz such as Haifan.
	Sabry	Originated in Jabal Saber Taiz, production only in certain seasons, demand is low but return is high.

Harvesting

Qat is harvested early in the morning or late in the evening depending on the lead time to market. Due care is taken that the harvest, packing, transportation, and marketing functions are completed in under 12 hours, otherwise the supply would be lost as there is no mechanism to keep qat leaves for next day marketing. The marketing functions are very efficient, however, and losses seldom occur. The post-production functions of sorting, grading, and packing are completed at the farm-gate level, since repeating these functions will return lost vigour and freshness of qat leaves. There is no further processing involved

[90] Ibid.
[91] Gutter, "Politics of Qat."

in the supply chain. Leaves are sorted, separated, and bundled, and are then sent to the wholesalers, retailers, and (ultimately) the customers.

Marketing[92]

The marketing of qat starts immediately after the leaves are harvested. Freshly cut branches are trimmed, sorted, and wrapped in bundles. Small bundles are grouped together in larger bundles, which are then covered by green banana leaves, grass, corn leaves, or even large qat leaves that are not used for chewing, to help to keep the qat fresh. Large bundles might be put in wet sacks or wrapped with plastic covers to keep them moist until they are sold.

Qat markets are mainly distinguished as local, wholesale, and retail. They are mostly specialized markets, but their scale varies according to the business they handle. The distribution of these market structures are well organized and can be found in every locality, village, or city of Yemen. Local markets deal in small quantities (not more than 5 per cent) between local farmers, traders, and consumers. The wholesale markets (central markets) are found in every governorate and link 40 per cent of the qat production on a daily basis. In Hudeidah and Taiz these wholesale markets deal exclusively with qat, while in the other governorates they also deal with other agriculture commodities. Retail markets are found everywhere in the market places of the country, and their number has been ever growing over last two decades. For instance, in Taiz alone the number increased from 3 to 97 between the 1970s and 2001.

Qat in Yemen can move through four different marketing channels: sales through wholesalers and retailers represents 75 per cent of the total sales volume; sales through commission dealers, semi-wholesalers, and retailers accounts for 15 per cent of the business; direct transactions between producers and consumers is approximately 6 per cent; and sale through local middlemen and retailers captures 3–5 per cent.

The retailing function does not distinguish between weights of qat bundles, but the bundles are given different local names (robtah, A'allagiyah, goneyah, terbal, qarn, melaf, mandeel, qawarah, qatl, or sorrah).

[92] FAO (2008), "Qat Production in Yemen: Water Use, Competitiveness and Possible Policy Options for Change" (Cairo: Regional Office for the Near East).

Enabling environment – Value chain governance (VC facilitators and regulators)

The recognition of qat as an agricultural crop remains the centre of controversy throughout the modern history of Yemen. The crop has been used as a main driver of political negotiations and for winning the confidence of tribes since 1979, when President Ali Abdullah Saleh came to power. The regime made every possible effort to legalize qat so as to appease powerful local leaders and to accelerate its integration into Yemeni society. The international ban on qat as an abusive drug (WHO, 1980) pushed back the release of Yemen's first agricultural census for a decade so as to conceal the expansion of qat farming in the country. The qat conference in 2002 and the proposed qat policy in 2002 (facilitated by FAO) was an effort to legalize the controversies around qat cultivation in Yemen, but the fear of international pressure and the need to save the country's reputation with international financial institutions worked against these developments.[93] At the same time, the government's efforts to modernize the country's agriculture sector at large actually facilitated the expansion of qat in Yemen. For instance, subsidized diesel and electricity played a major role in establishing new irrigation tube wells; and as late as 2011 the diesel subsidy remained generous in the growing region, representing 8–10 per cent of GDP according to the International Monetary Fund. Further, water extraction was used largely for converting arable land to qat production at the expanse of converting to other crops (especially coffee).

There are government initiatives to regulate the production of qat in Yemen, most notably the establishment of a Qat Research Unit within the Agriculture Extension wing of the Ministry. The unit is charged with facilitating awareness about the excessive use of qat, banning qat plantations in certain agricultural pockets, and attempting to control, regulate, and tax qat production. However, such initiatives are hardly put into practice.

The exclusion of qat from the national development and research agenda has lost Yemen decades of precious time. Consequently, even today little is known about the true effects of Yemen's most important crop on the country's economy, on the long-term health of the population, or its effect on food security, poverty, and nutrition.

Such negligence on the part of regulatory authorities led the business of qat to the helm of farming communities and the associated private sector. As a result, the qat marketing channels are well established, and the value chain functions are extremely efficient due to the ever-growing domestic demand.

[93] Gutter, "Politics of Qat."

Qat value chain cycle

The qat cycle is completed within a short span of time, keeping in view its high perishability and tenderness. Since markets are situated in every commercial hub, it takes little time for the produce to reach the final consumer levels – under 12 hours from picking to the marketplace). However, the situation in some cities such as Aden is quite different, where it is not locally produced and thus there is a need to transport the qat from production areas situated hundreds of miles away. In such instances, the lead time is necessarily stretched to 24 hours maximum to maintain the freshness/tenderness of leaves. The collectors, middlemen, or agents mostly play the roles of moderators and accompany the wholesalers to the qat fields and/or they link farming community with wholesalers and retailers. The supply and demand is fairly adjusted between farmers and traders such that no supplies are left over for another day; otherwise it is considered lost value within the qat cycle. Figure 20 reflects the qat value chain with regular relationship and irregular transactions among the various actors as well as the time required to reach the end consumer.

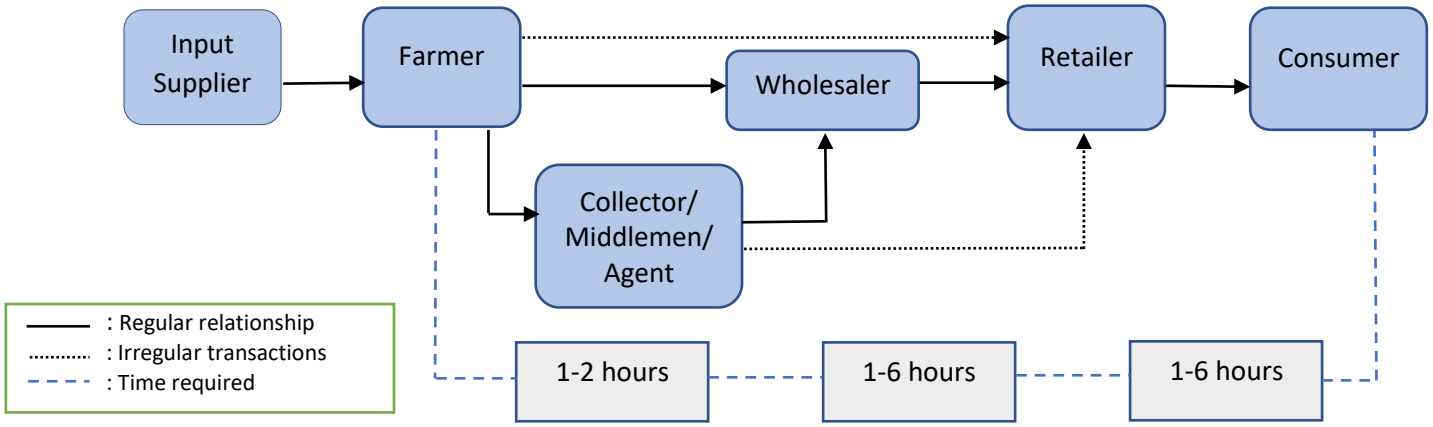


Figure 20: Qat value chain

Production costs

It is important to know the relationship between the various costs and inputs for the current qat production in Yemen. The proportions of the production costs are reflected in Figure 21. Dates are taken from an interview with a key informant in the Almwast district of Taiz governorate. Figure 21 (a) shows the proportions of the overall production cost. We can see that the agricultural inputs are the significantly highest cost compared to land lease, land preparation, labourer, or post-production costs. If we breakdown the costs of the agricultural inputs in Figure 21 (b), we can then observe that in the first line the farmer pays the greatest amount for pesticides followed by chemical fertilizers and then for water trucking. When we look to the labourer (Figure 21 c) one can also see that the farmer pays more for the

sprayers. This means that pesticides and fertilizers consume the greatest part of the qat production budget. There is no significant difference between the parameters of the post-production costs as showed in Figure 21 (d).

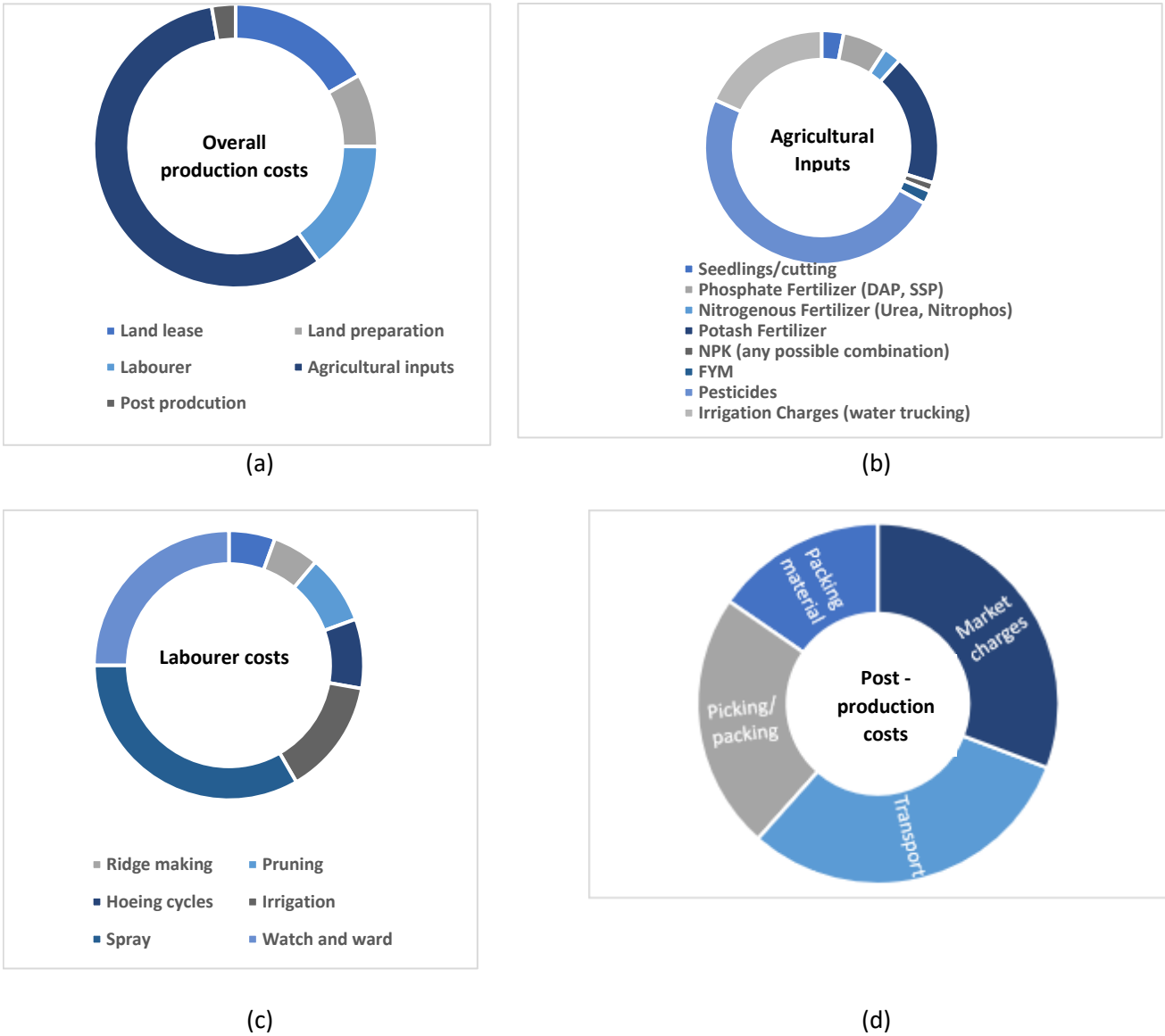


Figure 21: The proportion of production costs

Profitability margins

The economics of qat was presented at the 2002 conference, and although the data is quite old, they still accurately reflect the variable costs of qat production. Water use accounted for the largest expense in 2002, and it is thought to have been even higher in 2021, when water become even scarcer and when the cost was further inflated by the devaluation of the Yemeni Riyal due to the current crisis. The cost of

irrigation is extremely higher in some governorates (e.g., Abyan), but even the national average of 11.9 per cent of production is alarming.

Table 10: Variable cost of qat production (Qat Conference, 2002)[94]

Governorate	Gross revenue YR	Fertilizers YR	Fertilizers %	Pesticides YR	Pesticides %	Hired labour YR	Hired labour %	Water use YR	Water use %
Abyan	2,718,516	3,559	0.1	8,935	0.3	301,740	11.1	971,809	35.7
AlBeida	6,162,589	23,902	0.4	35,311	0.6	407,155	6.6	381,537	6.2
AlDalea	1,929,974	3,353	0.2	18,529	1.0	67,479	3.5	115,966	6.0
AlMahwit	2,150,803	16,584	0.8	13,276	0.6	79,169	3.7	19,302	0.9
Amran	1,314,462	18,539	1.4	55,124	4.2	220,529	16.8	189,956	14.5
Dhamar	1,097,436	8,636	0.8	85,981	7.8	235,817	21.5	87,916	8.0
Hajjah	2,644,565	103,872	3.9	61,241	2.3	601,521	22.7	532,082	20.1
Ibb	1,998,161	27,017	1.4	58,968	3.0	63,126	3.2	194,807	9.7
Lahaj	2,773,553	0	0.0	0	0.0	239,660	8.6	239,660	8.6
Sa’da	1,703,509	85,096	5.0	70,645	4.1	221,179	13.0	230,822	13.5
San'a	1,743,058	24,492	1.4	23,162	1.3	58,025	3.3	130,763	7.5
Taiz	3,668,633	85,963	2.3	127,194	3.5	126,867	3.5	579,266	15.8
Average	**2,491,747**	**35,787**	**1.4**	**52,850**	**2.1**	**188,579**	**7.6**	**297,617**	**11.9**

Value addition and gross margins

The farmer’s share in the final consumer price ranged between 55 and 65 per cent, which makes it more attractive for the generation of income as compared to other crops, such as coffee. The rest of the value added is distributed among the market players (collectors = 8–10 per cent; wholesalers = 10–15 per cent; retailers = 20–25 per cent). Figure 22 shows the diversified interactions between farmers with different layers of the market functionaries. This increases their bargaining power and can play a more transparent role in fetching market benefits.

[94] National Conference on Qat: Towards the formulation of a comprehensive Qat policy of Yemen (Technical field study), 6–7 April 2002.

The middlemen in qat marketing prefer to work for themselves rather than charging a commission for their services. The FAO study highlighted that more than 75 per cent of qat market functionaries purchase the product before selling it, which positively impacts marketing functions and subsequently improves market efficiency. The value added services include selling on credit or at deferred payment to regular customers, setting aside amounts of special species to valued customers, and even home delivery in some cases.

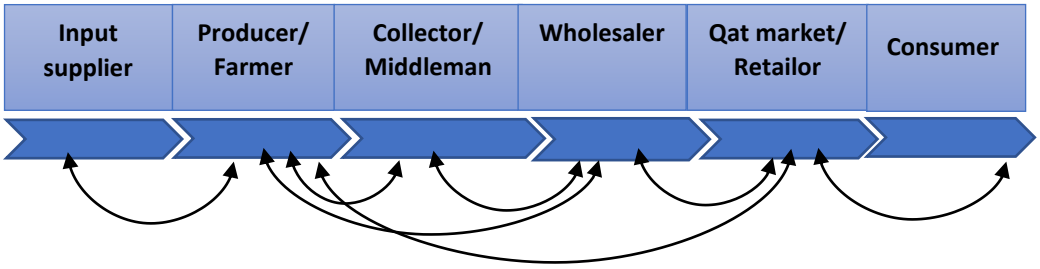


Figure 22: Interactions between value chain players of qat

Employment generation (inclusion)

Production practices are largely conducted by family members (80 per cent male; 20 per cent female). Skilled labour is also required in the production cycle, where harvesting, separating, packing, and marketing are performed by paid labourers. Women are mostly involved in land preparation, hoeing, grading, and packing. The use of mechanization is quite low, mostly limited to land preparation.

Although rural women are the dominant actors in terms of family livelihood and food security through their agricultural activities and livestock production, qat planting, harvesting, marketing, and sales all remain a male phenomenon. Women have limited roles in qat production, but they bundle qat leaves in preparation for market and remove the grasses that grow between the qat trees, saving these to be used as fodder for livestock. Thus, an increase in qat cultivation on land previously cultivated for grain, fruit, or vegetables indirectly results in a decline in women's agricultural role. With the exception of several female merchants in Taiz city, it is the men who market qat and pocket the proceeds of its sale.[95] Since qat is so much more lucrative than any other cash crop in Yemen and due to the traditional limitations of women in the qat markets, it is unsurprising that men keep their role in qat cultivation and production for themselves.

[95] Adra, N., "The impact of male outmigration on woman's roles in agriculture in the Yemen Arab," Prepared for the Inter-country Experts Meeting on Women in Food Production Amman, Jordan, 22–26 October 1983 (revised 2013).

Although we see that qat production has a high financial return and that its cultivation contributes to preserving the soil and protecting agricultural terraces, it nonetheless affects the economy and food security. Moreover, and apart from its health and social harms, the growing demand for qat has driven up the total cultivated area at the expense of other crops, such as coffee, and has further depleted the country's very limited water resources.

The aggregate annual expenditure on qat is estimated to be about YR 250 billion.[96] Accordingly, local and international efforts need to address the qat phenomenon objectively and freeze further expansion – even temporarily – to keep it within 10 per cent of the country's total cultivated area. This can be attained by promoting alternative and high-yield crops and by providing stimulant packages; activating the role of the Qat Research Unit establishing a qat database using information available locally and externally; encouraging scientific research on Qat and its social, economic, and health effects; and introducing appropriate social alternatives.[97]

Inefficiencies in the qat production chain

The post-harvest losses mostly occur during transport, when on average 10 per cent of the produce is lost. High temperatures also reduce the production capacity by almost 20 per cent. In recent years the increase in frost and hail has also damaged the tender leaves, though snowfall has not had a negative impact. Qat leaves are sprayed with water to keep them fresh, and are packed in plastic bags with wet cloths and banana leaves to reduce the chances of loss. Harvest is mostly done at night, which requires the use of lights; and the spit that comes from chewing qat creates a task for maintaining cleanliness.

Water use by qat[98]

Reducing qat consumption in Yemen remains a daunting task, as the regulatory environment as well as the popular perception of qat is difficult to change. In 2007 the World Bank[99] proposed a number of recommendations that are still thought to be valid if concerted and dedicated efforts are put in place. These include increasing the tax on various qat inputs; building greater public awareness; incorporating training in schools on the hazards of qat; enforcing public policies aimed at discouraging qat consumption

[96] "Agriculture in Yemen: The Key for Future Food and Social Security," https://reliefweb.int/report/yemen/yemen-socio-economic-update-issue-64-september-2021-enar.
[97] Ibid.
[98] See also FAO (2004), "Towards the Formulation of a Comprehensive Qat Policy in Yemen."
[99] Yemen : Towards Qat Demand Reduction (worldbank.org).

(e.g., extension of working hours); closing knowledge gaps; and developing viable crop diversification programmes.

Together with coffee promotion activities, awareness activities should be developed to reduce the overuse of water for qat cultivation as well as the excessive use of pesticides and other chemicals. Decreasing the overall water consumption used in Qat would result in water savings that can be allocated to growing other high-value crops, such as coffee, or for meeting the growing demand of water in other sectors. To this end, the following are recommended:

- Study the feasibility of installing water meters on diesel and solar pumps.
- Assess the effect of higher tariffs and taxes on diesel and solar pumps used for qat irrigation.
- Consider establishing groundwater use quotas for qat irrigation.
- Promote the use of green water (i.e., rainfall) for qat production where possible and assess how to reduce the use of blue water (i.e., irrigation water) in qat production.
- Promote the willingness of farmers to switch cultivation from qat to coffee with potential compensation.
- Promote modern water-saving technology to regulate the overuse of water used for qat irrigation.
- Gradually move towards full water pricing for qat cultivation.

Conclusions

The current study was commissioned to analyse the possibilities of converting qat production to coffee in the context of Yemen. The analysis of both subsectors during the span of the research reveals that the cycles of qat and coffee follow different patterns of production and post-production, and that as such the only element in the qat cycle that can be utilized in the promotion of coffee is land. Agricultural land is a limited factor in Yemen due to its unique topography. The expansion of qat is grabbing land from all agricultural crops, especially coffee cultivation, which has declined considerably over last two decades. This effort of converting qat to coffee is not the first of its kind by institutional players in Yemen who are committed to the socio-economic development of the country, especially in the face of the growing humanitarian crisis that is further exacerbating food insecurity, economic vulnerability, and devastated geo-political realities in the country. Gender disparity is common in the economy of underdeveloped countries, where the role of women is hardly recognized despite their hefty contribution in terms of labour. Gender mainstreaming and inclusion are important cross-cutting pillars of the economic sectors, and their capabilities in the agriculture sector in particular need to be streamlined to create equal opportunities and promote sustainable solutions for all segments of the economy.

Though the economy of Yemen has collapsed by all socio-economic parameters, qat production and usage has been on the rise. The profitability margins, growing market demand, and well-maintained domestic market structure help to encourage farming communities to continue to expand its production. Thus, it will be difficult for any other crop (including coffee) to replace qat. Government institutions remain reluctant to regulate its production, and there seems to be no indication of banning or eradicating the crop. Conversely, some government policies actually encourage an increase in production. There are, however, some natural anticipated barriers that might reduce the use of qat in the near future. The purchasing power of Yemeni society seems to be declining during the ongoing conflict, and dwindling earnings might restrict the usage of qat at the household level. In addition, the groundwater level is declining at an alarming rate, which might further affect the production of water-intensive crops such as qat. As a result, farming communities might think of transitioning to crops such as coffee, which has international recognition and fetches a premium price. UNDP, as a development partner, should stay connected with Yemeni farming communities to help them to facilitate an environment for coffee production through both short and long-term strategies of engagement and to provide sustainable solutions.

Although qat is an important cash crop in rural economies and contributes at the micro-level to food security by providing income to those working in the sector, at the same time it reduces the domestic food supply as it consumes more and more water and land that could be used for the cultivation of local agricultural food crops and for export commodities such as coffee. Fortunately, an increasing number of Yemeni youths, both female and male, are realizing the distinct value of their country's coffee.

Clearly, in light of Yemen's declared intent to join the World Trade Organization, the coffee sector cannot be indefinitely protected with import restrictions. However, there is ample opportunity to immediately implement targeted interventions and to improve domestic policies in order to significantly increase the competitiveness of Yemen's coffee sector. One of the most important ways is for Yemen to protect the historic and hard-earned credibility of its coffee as a 'brand name'. Potential foreign buyers are dealing with a limited number of established exporters, which limits competition.

Annex I –Details of key informants

No	Respondent	Gender	Governorate	District	Status/position
1	Ahmaed Al-Asabahy	Male	Taiz	Al-Shamayteen	Agricultural director, Al-Shamayteen district
2	Jaffar Ali Husaian	Male	Taiz	Almesrakh	Farmer
3	Fatimah Abdul Khabeer	Female	Taiz	Almesrakh	Farmer
4	Mohamed Rashed	Male	Dhamar	Jabal Alsharq	Coffee expert
5	Abdul Kareem Qasim	Male	Taiz	Almawaset	Farmer and head of community association
6	Ahamaed Al-Hajam	Male	Hudaidah	Bura'a	Coffee expert
7	Ahmad Abdul Malek	Male	Lahj	Toor Alabaha	Agr. cooperative union
8	Abdul Aleem	Male	Taiz	Taiz city	Coffee expert
9	Ismaeel Muharam	Male	Sana'a	Sana'a city	Agr. researcher
10	Mansoor Al-Dalas	Male	Sana'a	Sana'a city	Agr. researcher
11	Fuad Alsayady	Male	Sa'adah	Sa'adah city	Danish Refugee Council MEAL

12	Mohamed Abdul Bary	Male	Sana'a	Sana'a city	Director of Qat Department, MAI
13	Saleh Albure'ey	Male	Hudaidah	Bura'a	Farmer and head of coffee association
14	Wafa Nasher	Female	Sana'a	Sana'a city	Academic researcher
15	Jamal Halboob	Male	Abyan	Yafe'e Suflah	Farmer and head of coffee association
16	Ali Al-Nakheby	Male	Lahj	Yafe'e	Farmer and head of coffee association
17	Anisah Abdullh	Female	Taiz	Almesrakh	Farmer
18	Amal Abdul Kareem	Female	Sana'a	Sana'a city	Coffee establishment
19	Ameerah Abdul Bary	Female	Sana'a	Sana'a city	Sana'a University
20	Ali Mukred	Male	Taiz	Haifan	Coffee expert

Annex II – List of coffee associations and related institutions in Yemen

S.No.	Name	location	Telephone	Website	Email
1	Yemeni Quality Foundation for Specialized coffee	Sana'a	770906944 773062224	https://www.facebook.com	yemenquality@gmail.com
2	Mokhahous	Sana'a	01260555	https://Mokhahouse.com	mokhahouseye@gmail.com
3	Aljawdah Organization	Alhaimah	770906944		
4	Khawaln Yemen Coffee Association	Sa'adah	715524556 07854258		albunalkholani@gmail.com
5	Coffee producer association in Wadi Shares	Hajjah, Wadi Shares	777847787		
6	Husseini Foundation for the sale and export of Yemeni coffee	Sana'a	771288086 01470737		
7	Alewaq Association	Mankha	770411715 770945463		200taher@gmail.com
8	BACA Buraa	Buraa	772142151 777165779		abuhosamalahdal@gmail.com
9	Awamy coffee	Hajjah	777823079		

10	Altumooh Association for coffee production	Alhaymah Aaldakhelyiah	772541197 775945657		
11	Bani Fadhl Association for coffee production and marketing	Ashat Shaq	776662083 770735356		
12	Bani Murrah Association	Haraz	777415637 777269020		
13	Al-Nomoo Association	Alhaimah Alkharejiah	777003126		
14	Al -Nukhubah Association	Alhaimah Aldakhiliah	777446696 775394107		
15	Yemen Food Bank	Sana'a	01441291	https://Yemenfoodbank.org	info@yemenfoodbank.org
16	Aden Association	Raimah	777720150 770012621		
17	Altatawoor		770200759 776567796 777602981		
18	Alhaiam Association	Alhaimah Aldakhiliah	770777944 777485888		Alhyama7m@gmail.com
19	Coffee cooperative union	Sana'a	770753544	https://Cuycpa.com	info@cuycpa.com

			777269020 01562853		
20	Bani Sinan Association	Taiz	777861606 772232235		Banisinan2030@gmail.com
21	Alekleel Association	Mankha	777294950		
22	AlHamdani (Bon Yamani Fakher)	Sana;a	771119089	https://Mochaseeds.com	

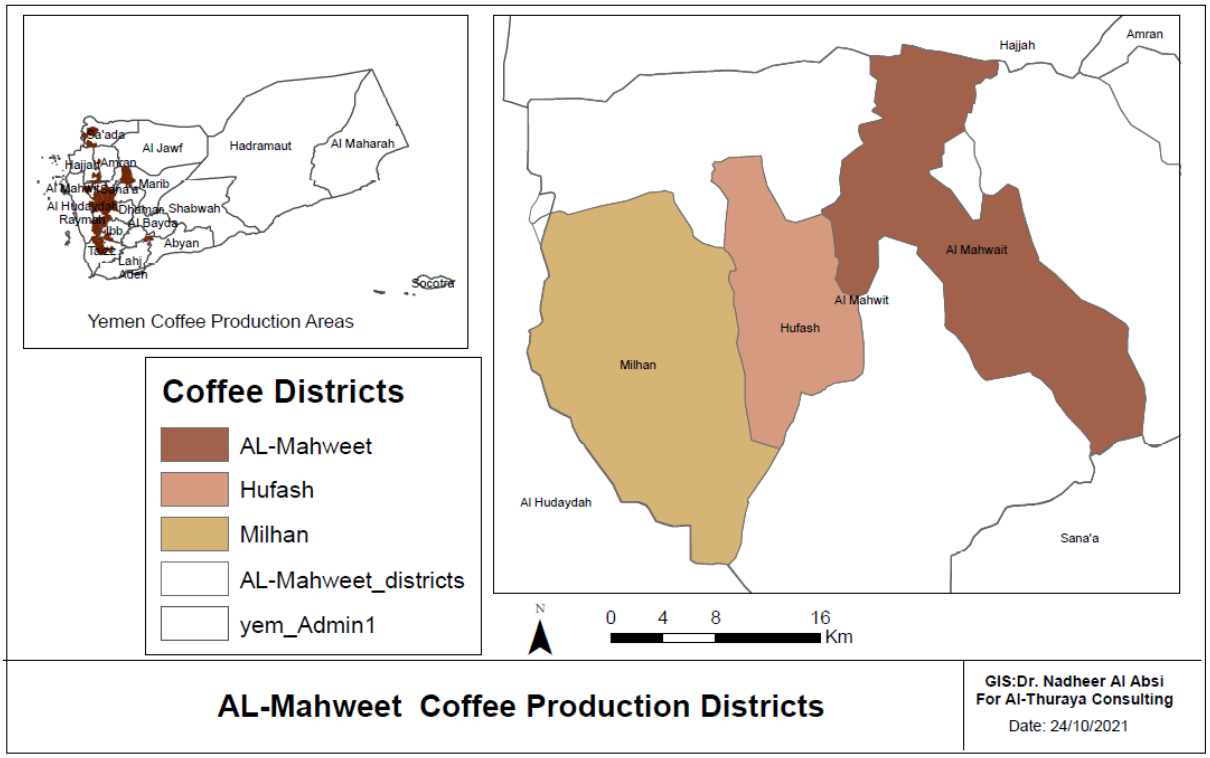
Annex III – List of coffee processing institutions

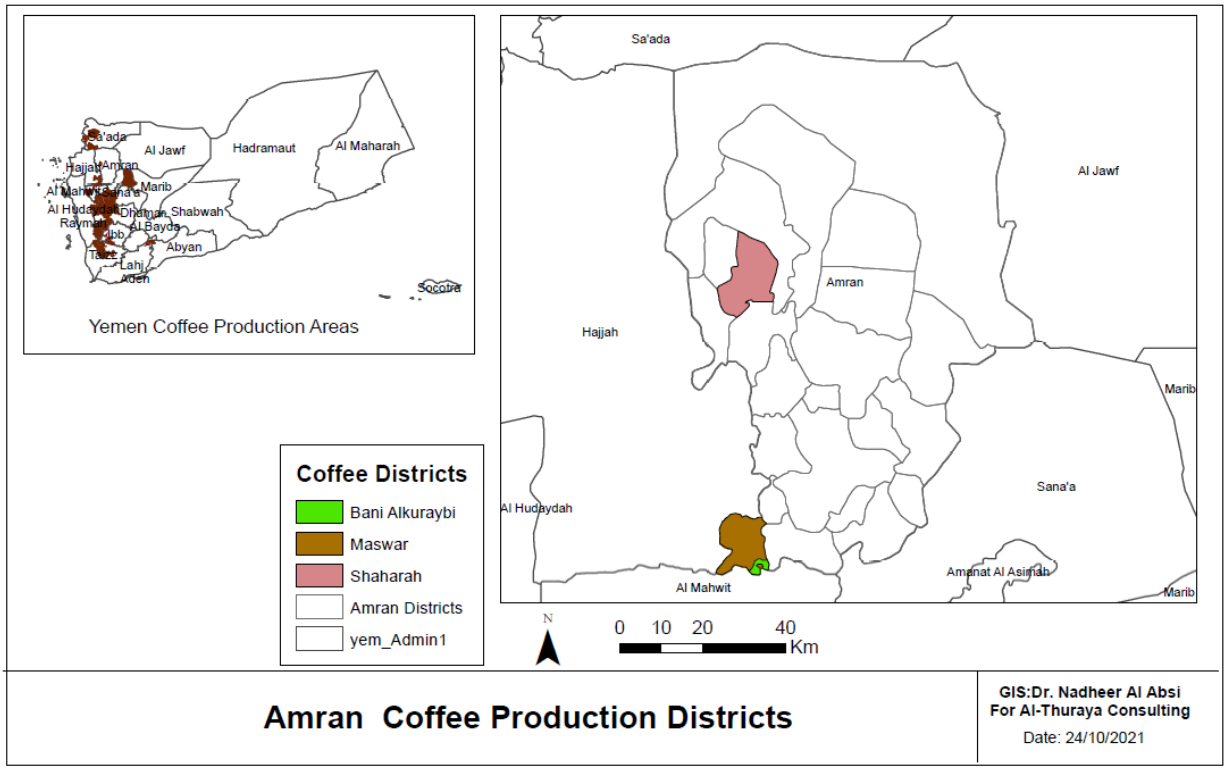
Institution	Governorate	Website	Email/ telephone
Al-Ezzi Industries Co. Ltd.	Sana'a	https://www.al-ezzi.com/	info@al-ezzi.com
Al-Kabous Group	Sana'a	http://www.al-kbous.com/ar/coffee-and-tea/coffee/	commercial@alkbousgroup.com trading@alkbousgroup.com
Qimacoffee	Sana'a	https://www.qimacoffee.com/	
Al-hamdani-family	Sana'a	http://www.familybusinessarabia.com/al-hamdani-family-mocha-coffee/	
Al-Hussini Company	Sana'a		+ 967 771 235 672
Humasy Coffee	Sana'a	https://haraz-mocha.business.site/	+ 967 777 000 052
Alborai Trading Crop -BO Mocha (Salah Alborai)	Sana'a	http://www.bomocha.com	+ 967 777 371 118
Al-Emadi for Trading &Export	Sana'a	www.emdcoffee.com	+ 967 777 120 424
Sabcomeed	Sana'a	http://sabcomeed.com/ https://producerroasterforum.com/qa-sabcomeed/	info@sabcomeed.com

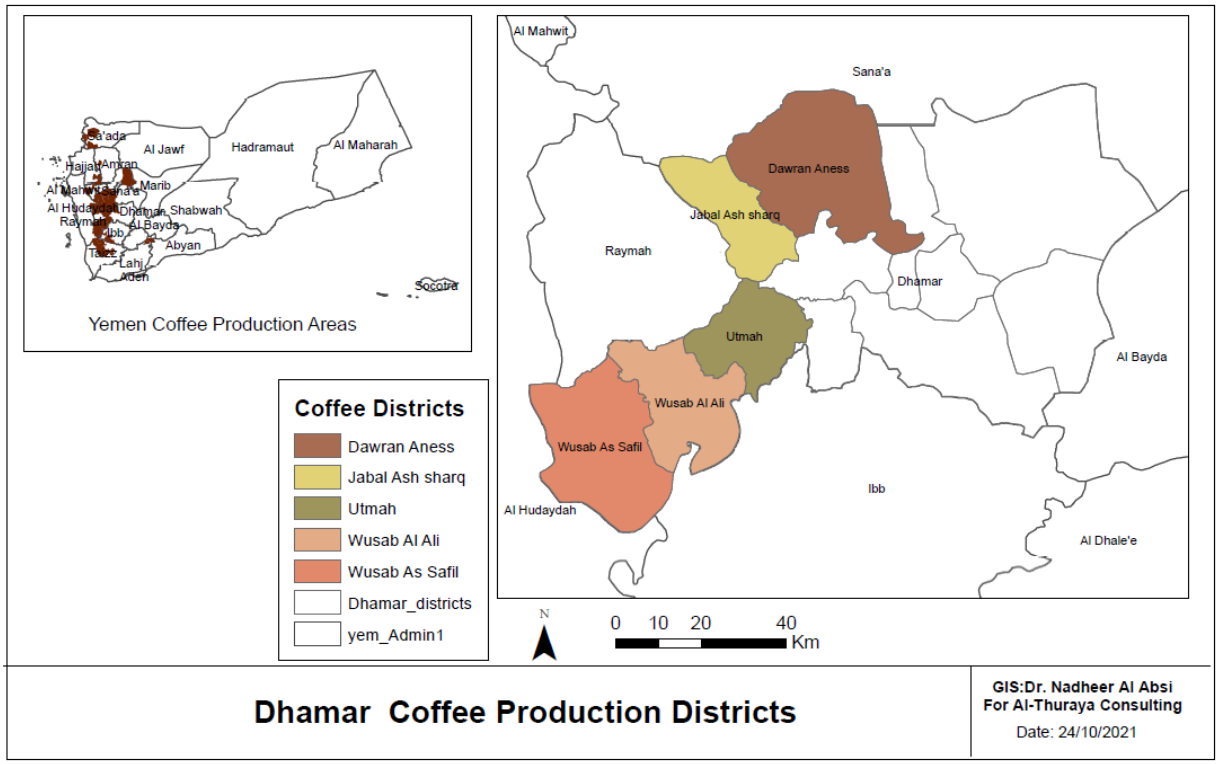
There are also some cooperative organizations equipped by donors with processing machines, including the following:

Institution	**Governorate**
Bani Sinan	Sana'a
Talok Women's Coffee Association	Taiz
Dhe Nakheb	Lahj
Hasban Association	Sana'a

Annex IV – Coffee producing governorates in Yemen



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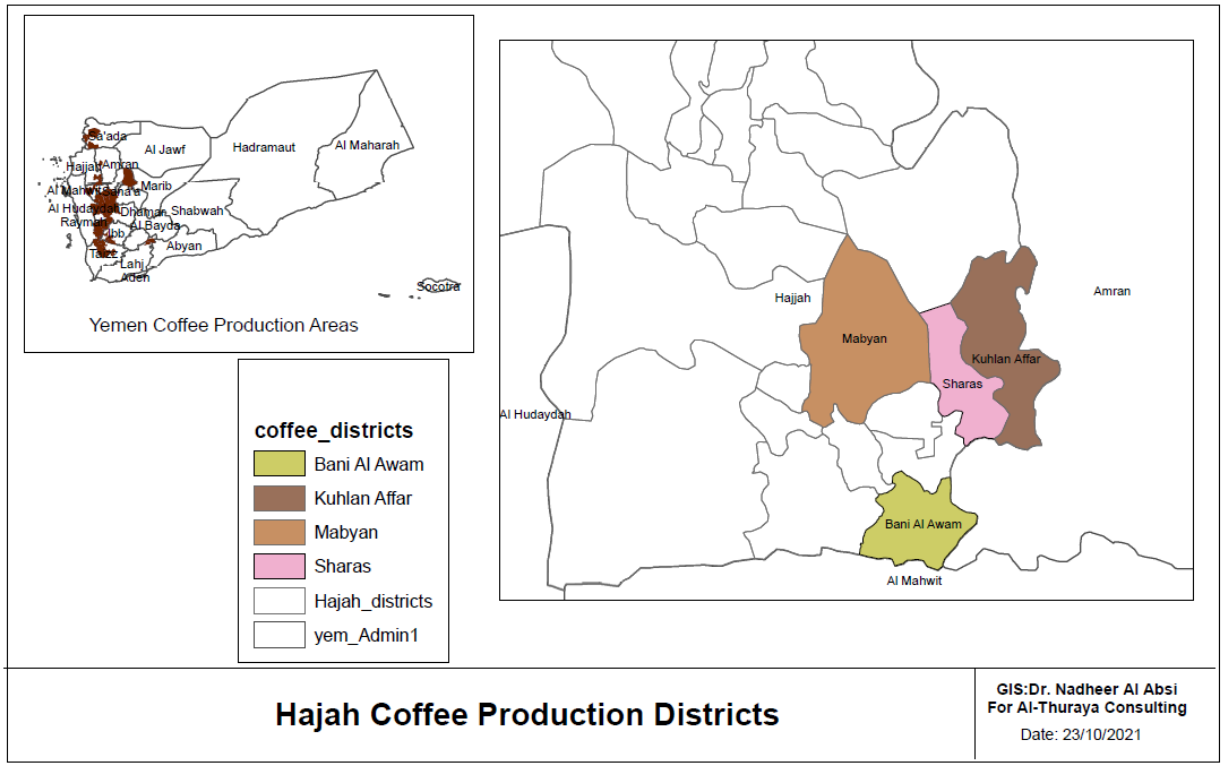
For Al-Thuraya Consulting
Date: 24/10/2021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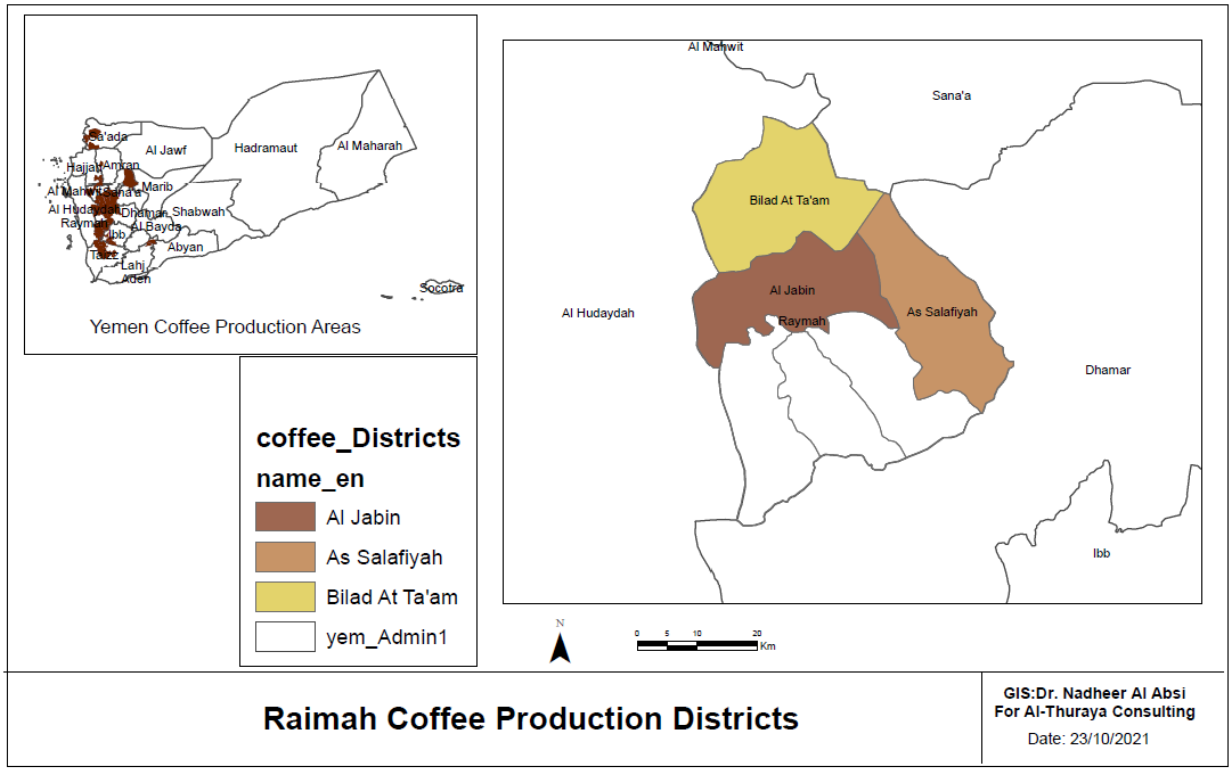
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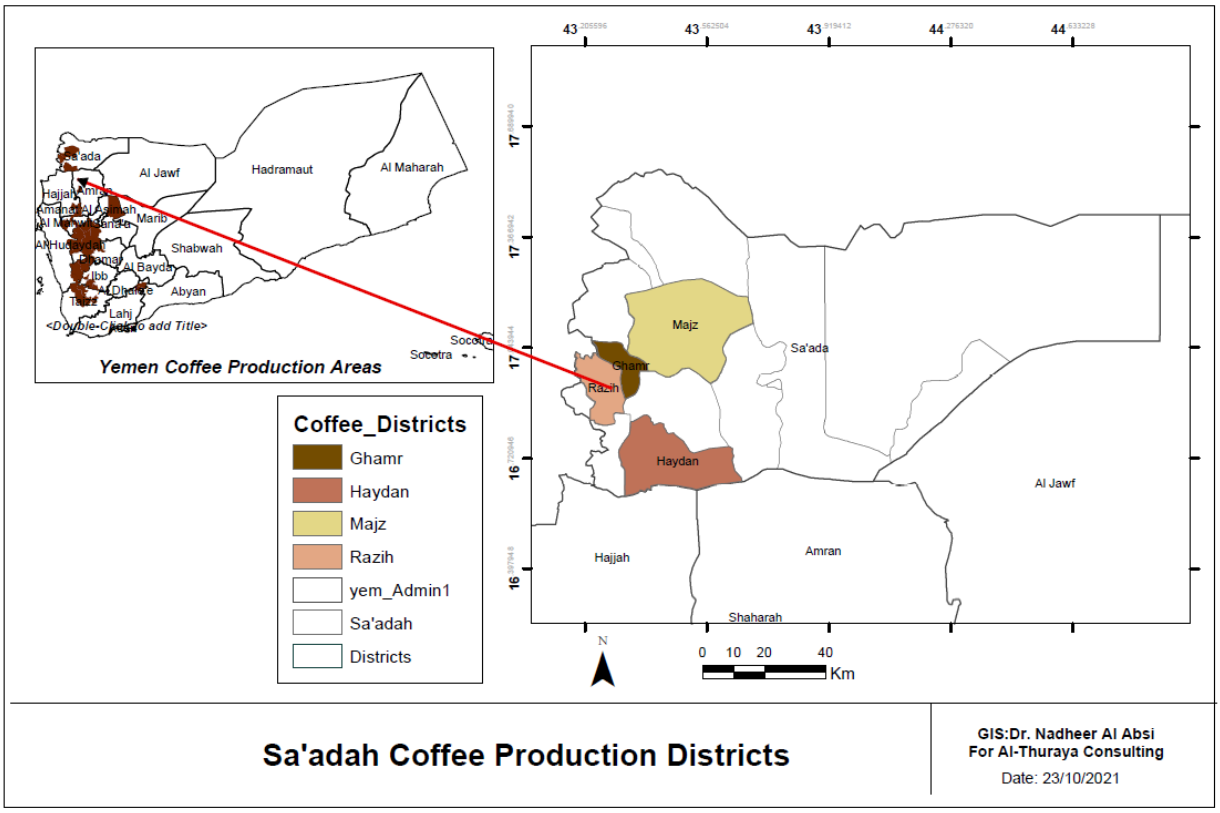
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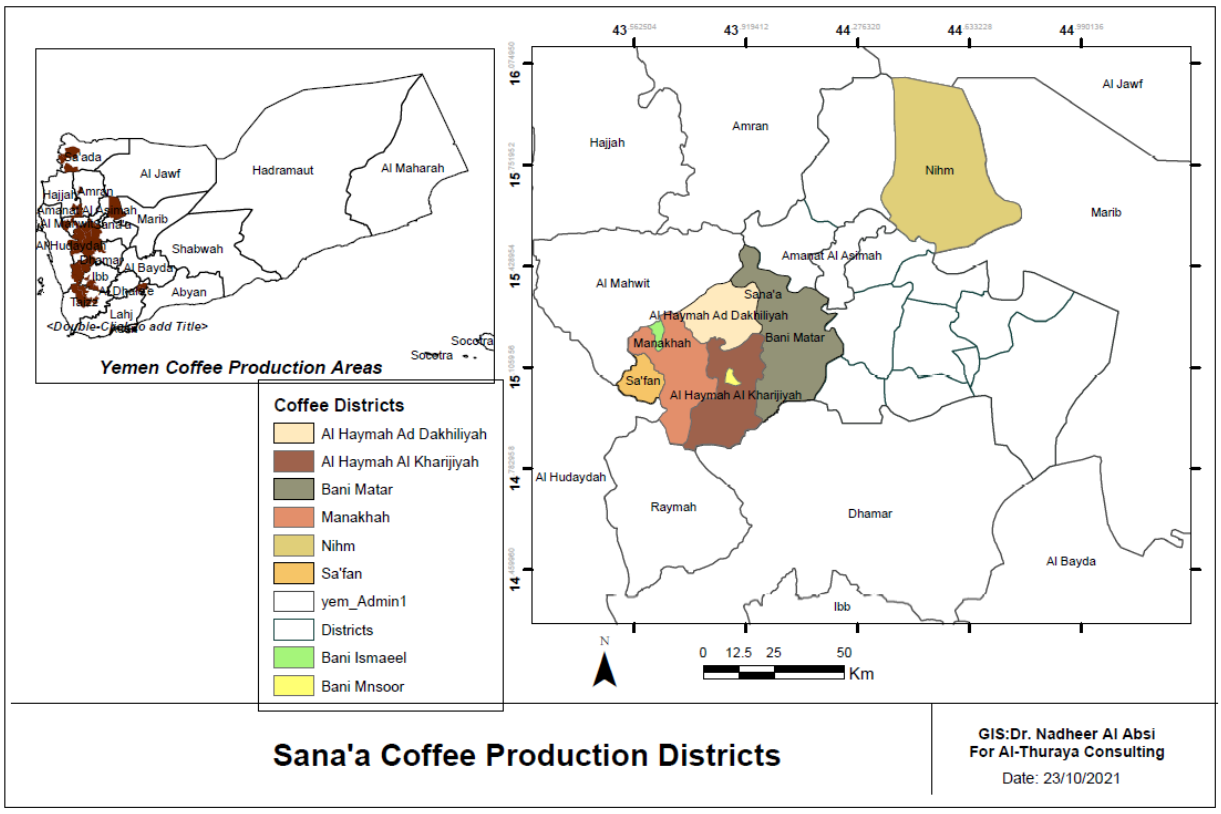
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For Al-Thuraya Consulting
Date: 23/10/2021

Annex V – National Yemen Coffee Auction

The National Yemen Coffee Auction

A new auction programme for Yemeni coffees – the National Yemen Coffee Auction – was inaugurated in Sana'a on 14 November 2021 and is scheduled to debut in May 2022. The programme is being led by The Mokha Institute (TMI), co-based in California and Yemen. TMI was appointed to lead the auction by a multi-stakeholder group that includes government and private entities in the Yemen coffee sector under the name Cooperative Union of Yemeni Coffee Procurers Association. This National Yemen Coffee Auction is the latest in a series of independent efforts to promote Yemeni coffee to international markets, and the specialty coffee market in particular.

Coffee lots will go through qualification rounds, leading to representative samples of specialty lots, which will be inspected and cupped in a coffee laboratory in Yemen's capital, Sana'a, after which further testing and tasting will be done in an international lab. Comprehensive data will be collected about the geographic origin of the coffees, the history of the producers and their communities, the varieties and applied processing protocols, and other relevant quality data.

The auction event will be held through an electronic Internet-based platform that will list the coffee lots for sale and where buyers from around the world can submit their bids.

Annex VI – Obstacles and suggestions to improve coffee production in two governorates in the north and two in the south (according to key informants)

Sana'a		Lahj		Hudaidah		Taiz	
Obstacles	Suggestions	Obstacles	Suggestions	Obstacles	Suggestions	Obstacles	Suggestions
High price of fuel	Fuel subsidies	Low prices of coffee	Improve production specification; Create new channels for marketing; Issue legalization to protect local coffee	Low prices of coffee; Droughts and lack of water; Absence of roles for government officials; Pests and diseases; Farmers' lack of knowledge regarding modern production, harvest, and post-harvest techniques; High prices of production inputs	Farmers should receive fair prices; Supplement irrigation by building water tanks; Restrict coffee imports; Provide training and awareness-building of coffee farmers and associations	Absence of support especially in supplementary irrigation Price of coffee in Talook is high due to higher price of agricultural inputs	
Poor stores and poor	Training and capacity-building on	Droughts and low rains;	Supplement irrigation by building water			Lack of rains and water availability	Building of water tanks and dams for

marketing	good storage and market management	High price of labour; Absence of roles for government officials	tanks, cisterns, ponds, and dams			Deterioration of coffee trees due to old, short inter distance and droughts Pest and diseases Concurrence of Qat and other crops Low return High loses during harvest and post harvest Absence of clear specification of Coffee verities	supplementary irrigation Introducing the fam bookkeeping Integrated farm management Support the coffee organizations by introducing the village coffee nurseries Production according to precontracts between farmers and traders
Water shortages	Supplementary irrigation	Lack of extension services and of clear relationships among the various coffee actors	Fair sharing of costs and benefits among farmers, intermediaries, and traders				
Lack of marketing information	Improvement in the marketing information system						

High price of agricultural inputs for coffee production	Subsidies for coffee inputs						
Unfair profits among the coffee actors	Regulate the relationship of the various coffee actors for fairer profits						
Traders give unfair prices to framers	Regulate the relationship of the various coffee actors for fairer profits						
Limitation of coffee markets and low prices	Open new channels for coffee marketing; Coffee auctions should be regulated and improved						
Land ownership	Regulate the relationship between land owners and farmers						
Low productivity	Improve field practices and						

	introduce highly productive varieties and productivity inputs (fertilizers, pest control, clear production planes)						
Limitation of coffee production areas	Expand coffee production areas and deliver highly productive seedlings at low cost to farmers						
Lack of maintenance of coffee terraces due to high price of maintenance	Provide subsidies to farmers for the rebuilding and maintenance of coffee terraces						
Absence of real official in-kind support, and lack of awareness and training	Conduct national campaigns for coffee production and fair prices; Search for new marketing channels; Promote a 'One Day Without						

	Qat' campaign						