SPARC
Supporting Pastoralism and Agriculture in Recurrent and Protracted Crises

June 2024

POLICY BRIEF

CROWDSOURCING DATA CAN HELP MONITOR DROUGHT IMPACTS ON FOOD SECURITY

Kelvin Mashisia Shikuku, Vincent Alulu, Watson Lepariyo, Rupsha Banerjee

Key messages

- Many households experience food insecurity in pastoral areas, even after rainfall improves, as there is a time lag as pasture grows, animals recover, and food and income become available.
- Investments in fodder production and storage, market access and linkages, and rangeland management appear to be good options for mitigating the impacts of drought on food security.
- Crowdsourcing the collection of high-frequency data is a promising approach for addressing data gaps in drought monitoring, especially in remote pastoral environments. This could help provide early warnings of drought and inform anticipatory action.
- Including women data contributors is helpful for gathering information that male contributors might find challenging to collect.

Why high-frequency crowdsourced information?

Drought is the most significant climatic shock faced by pastoralists and agro-pastoralists in the drylands of sub-Saharan Africa (SSA). Experience from food security interventions in SSA's pastoral areas demonstrate that early warning information can help households better prepare and respond to drought (Richardson et al., 2018; Lentz et al., 2019; Banerjee et al., 2022). Researchers and policy- makers are increasingly interested in ways to cost-effectively monitor drought impacts on ecologies, markets and livelihoods (Peterson et al., 2018). However, providing precise early warning information and monitoring indicators of resilience in remote places affected by conflicts, with dispersed markets and poor infrastructure, is hampered by limited ability to gather data using conventional survey methods (Dillon, 2012).

Yet subtle changes in systems dynamics may help analysts to quantify the proximity of a tipping point and to enable interventions to avoid a looming harmful transition (Bathiany et al., 2018). Information on subtle changes in livestock productivity, household food consumption patterns, and coping strategies in pastoral systems and settings is missing, yet crucial for understanding the pathway through which drought shocks impact food security (Barrett and Headey, 2014; Macheka et al., 2022).

This paucity of information makes it difficult to target interventions and partly explains the increasing concern that adaptation measures have sometimes been ineffective and potentially create new sources of vulnerability (Eriksen et al., 2021; Malacarne and Paul, 2022). Information gaps constrain adaptation planning and further delay effective response as governments, nongovernmental organisations and other donors struggle to allocate scarce resources to mitigate hunger (Lentz et al., 2019; Shikuku et al., 2023).

Crowdsourcing has been lauded for its potential to ensure adequate representation of remote, difficult-to-reach and fragile contexts when monitoring shocks and evaluating their impacts on food security (Barrett and Headey, 2014; Chelanga et al., 2022).

We used crowdsourced data gathered with a platform called KAZNET to observe changes in food security attributable to drought. We further assessed the mechanisms by which drought impacts occur.

BOX 1: KAZNET: DRYLANDS INFORMATION CROWDSOURCING INITIATIVE

KAZNET, an International Livestock Research Institute innovation, has crowdsourced information in the drylands of Kenya and Ethiopia since 2021. Sentinel sites are places where focused monitoring and research efforts take place that enhance our understanding of rangeland condition, performance of livestock markets and household patterns of food consumption. Sentinel sites have been established in Marsabit, Samburu and Isiolo Counties in Kenya, and in Borena Zone, Meyu Muluke District and Hargelle Woreda in Ethiopia.

Every week, 11 livestock markets, 48 transect sites, and 156 households are monitored in Kenya; 23 livestock markets, 132 transect sites, and 396 households are monitored in Ethiopia. Individuals (the contributors) are selected through a participatory approach involving the communities. Contributors visit the sample households weekly to collect survey data accessed through a smartphone application.

Survey modules include questions about the household profile, food consumption, milk production, livestock mortality and strategies for coping with drought. Contributors also visit markets to collect information about prices of livestock and food, livestock volumes traded and livestock body condition.

At the rangelands level, information about forage availability and suitability is collected from transect sites. Contributors visit the transect sites once every week to take pictures at 10-metre intervals. The pictures are analysed to understand changes in forage conditions. In addition, contributors provide a subjective assessment of the forage conditions.

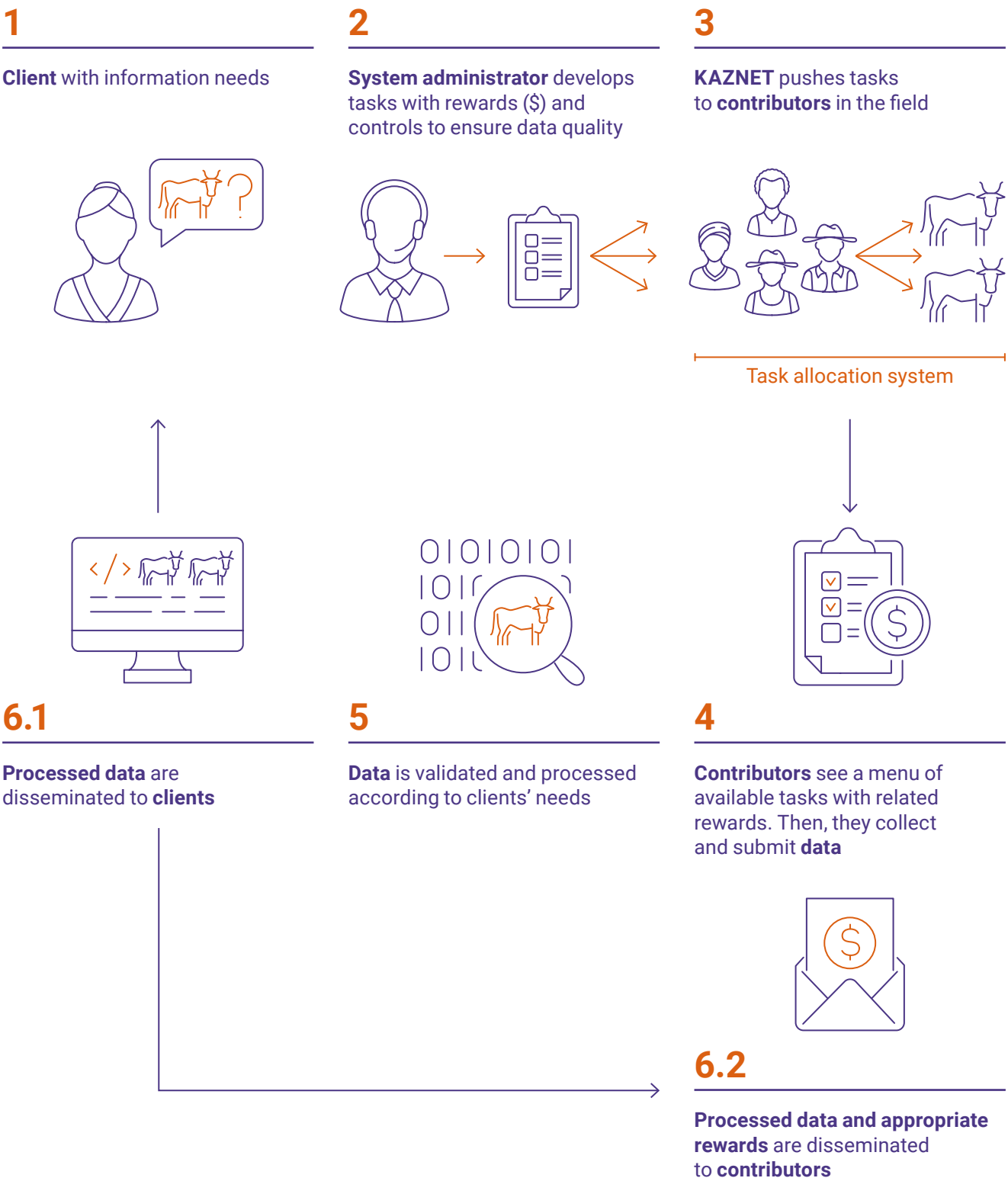
Weather data is sourced from TerraClimate, a dataset of monthly climate and climatic water balance for global terrestrial surfaces (www.climatologylab.org/terraclimate.html). Ground-truthing data on forage conditions, collected by the contributors, is complemented by the remotely sensed normalised difference vegetation index (NDVI).

Source: authors.

Uncovering these mechanisms can guide policy-makers to develop strategies to enhance resilience and improve productivity in drought, thereby mitigating food insecurity. Such knowledge can help provide early warning and inform anticipatory action when dealing with shocks.

Box 1 describes KAZNET's drylands information crowdsourcing, while Figure 1 presents the process flow in six steps.

FIGURE 1: THE KAZNET PROCESS



Source: authors.

Crowdsourced data reveals trends in vegetation condition, milk production and food security

Understanding the correlation between forage availability and milk production helps identify when to intervene to arrest declining trends. Average daily total household milk production is generally low (Figure 2). Forage conditions are more volatile than milk production. While there is no clear correlation between forage condition and milk production in Ethiopia, improvement in forage conditions correlated with increased milk production in Kenya. The scale of measurement (Earth Observation vs household) may also obfuscate the correlation between forage condition and milk production. In both countries (Kenya and Ethiopia), milk production is low and the proportion of households experiencing food insecurity remains high even in periods when precipitation seemed to have improved, possibly indicating lags between the time when rainfall starts and when food security improves (Figure 3).

Crowdsourced data is important to understand drought impacts on food security

Drought increases food insecurity mainly through two channels: reduced livestock productivity and higher food prices. The study found that an improvement in forage conditions reduced food insecurity significantly. Specifically, an increase in the values of the normalised difference vegetation index by 10% reduced the likelihood of a household experiencing food insecurity by 11 percentage points.

We construct and classify household food security status by household dietary diversity score (HDDS) (Swindale and Bilinsky, 2006). The HDDS is based on 12 categories of food. Specifically, we consider cereals, roots and tubers, vegetables, fruits, legumes and nuts, milk and dairy products, meat (including organ and flesh), eggs, fish and seafood, sugar and honey, oil and fats, and miscellaneous foods. Each group is scored one if a household member consumed the food during the 24 hours preceding the survey, and zero otherwise. The diet diversity score is summed across the 12 food groups, and ranges from 0 to 12. We follow the literature to construct a measure of food insecurity using the resulting HDDSs (ibid.). Specifically, we take the average HDDS of the 33% of households with the highest diversity (ibid.). A household with HDDS below this average is regarded as food insecure.

Results further showed that an improvement in forage conditions by 10% led to an 8% reduction in the duration in a week when a household experienced a food deficit.

The study examined pathways by which drought impacts food security. Starting with the productivity channel, the study found that daily milk production increased by 23% when forage conditions improved by 10%. The price of livestock (measured in tropical livestock units) increased by about 15% when forage conditions improved by 10%. Looking at the prices of food commodities, results showed that an improvement in the forage conditions by 10% significantly reduced the buying price per kilogramme of maize and beans by 2% and 1%, respectively.

Policy implications

This study has not only demonstrated that forage availability influences food security, but also identified the channels by which drought impacts household food security.

The results highlight priorities that may be considered by policy-makers to address drought-induced food insecurity. We highlight two priorities.

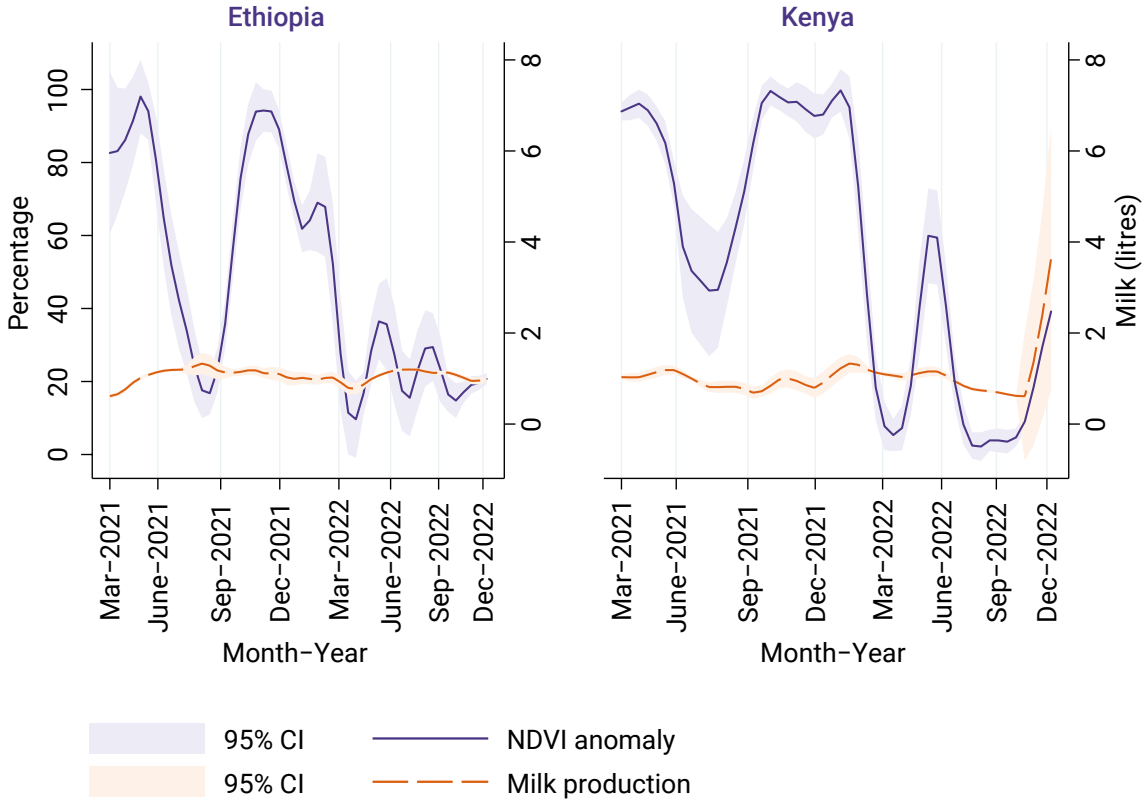
First, improved forage availability reduces food insecurity and increases the prices of livestock. This finding calls for efforts and investments in:

1. infrastructure to enable storage of higher-quality biomass from favourable periods
2. better feeding systems that plan for drought
3. management of animal health and breeding cycles to cope with and avoid periods of low pasture availability
4. strengthening of market linkages.

Second, high-frequency data is valuable for analysing impacts of drought. Such data is particularly relevant in remote, difficult-to-reach areas that tend to be under-represented in national surveys. While collecting such data can be expensive, investing in digital-based monitoring systems that cut costs by crowdsourcing data is helpful. Furthermore, the inclusion of women contributors is helpful for gathering information (such as the mid-upper-arm circumference of primary caregivers, mostly women) that male contributors might find challenging to collect.

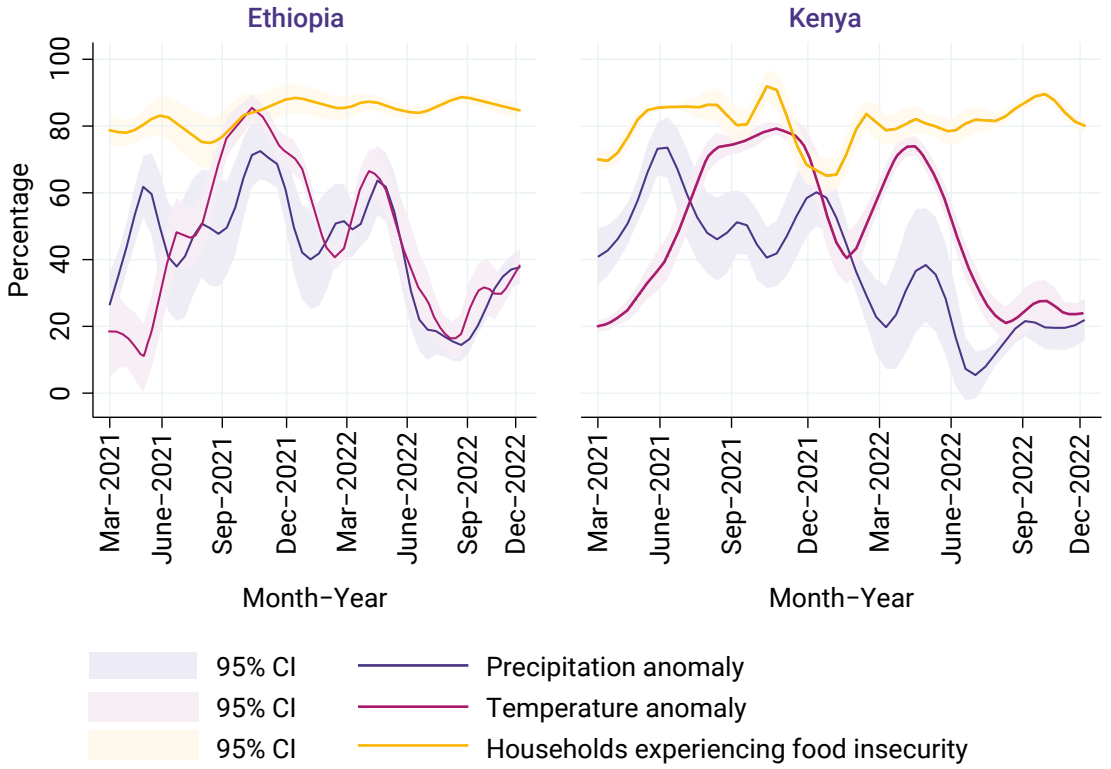
The two messages are inter-related. It is therefore envisaged that the knowledge co-produced in this assessment, as well as its policy recommendations, will contribute to the development and implementation of strategies and plans towards land restoration options in the drylands.

FIGURE 2: TRENDS IN FORAGE CONDITIONS AND MILK PRODUCTION



Source: authors.

FIGURE 3: TRENDS IN FOOD INSECURITY, TEMPERATURE, AND PRECIPITATION



Source: authors.

Acknowledgements

This work was implemented as part of the Supporting Pastoralism and Agriculture in Recurrent and Protracted Crises (SPARC) Programme funded by the Foreign, Commonwealth, and Development Office of the Government of the United Kingdom and the Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) project. Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) is a project that helps deliver a climate-smart African future driven by science and innovation in agriculture. It is supported by a grant from the International Development Association (IDA) of the World Bank. Explore our work at https://aiccra.cgiar.org

Additional financial support was provided by the CGIAR Research Initiative on Livestock and Climate. Our thanks to all donors that contribute to the CGIAR Trust Fund (www.cgiar.org/funders/). The authors would like to thank Guy Jobbins and Steve Wiggins from SPARC, and Anthony Whitbread, Kindu Mekonnen, and Million Gebreyes from ILRI, for their reviews and inputs for this brief. We also thank Ambica Paliwal, Diba Galgallo and Wako Gobu who are co-authors of the paper 'The impact of drought on household food security in northern Kenya and southern Ethiopia', from which this brief is derived (Alulu et al., forthcoming). We thank all the contributors and households participating in the DIRISHA project.

References

Alulu, V.H., Shikuku, K.M., Lepariyo, W.S., Paliwal, A., Galgallo, D., Gobu, W. and Banerjee, R. (forthcoming) 'The impact of drought on household food security in northern Kenya and southern Ethiopia' *Food Security* (accepted)

Banerjee, R.R., Barry, B., Jaquez, C., Meakin, N., Wiggins, S. and Yussuf, M. (2022) 'The state of finance in the drylands: formal and informal finance in Kenya, Mali and Somalia'. SPARC Scoping Paper

Barrett, C.B. and Headey, D. (2014) *Measuring resilience in a risky world: why, where, how and who?* (vol. 1). International Food Policy Research Institute

Bathiany, S., Dakos, V., Scheffer, M. and Lenton, T.M. (2018) 'Climate models predict increasing temperature variability in poor countries' *Science Advances* 4(5) (eaar5809)

Chelanga, P., Gobu, W., Galgallo, D., Alulu, V., Taye, M., Jensen, N. and Fava, F. (2022) *Implementation manual for launching and maintaining sentinel zones*. ILRI Manual

Dillon, B. (2012) 'Using mobile phones to collect panel data in developing countries' *Journal of International Development* 24(4): 518–552

Eriksen, S., Schipper, E.L.F., Scoville-Simonds, M., Vincent, K., Adam, H.N., Brooks, N., ... and West, J.J. (2021) 'Adaptation interventions and their effect on vulnerability in developing countries: Help, hindrance or irrelevance?' *World Development* 141 (105383)

Lentz, E.C., Michelson, H., Baylis, K. and Zhou, Y. (2019) 'A data-driven approach improves food insecurity crisis prediction' *World Development* 122: 399–409

Macheka, L., Mudiwa, T., Chopera, P., Nyamwanza, A. and Jacobs, P. (2022) 'Linking climate change adaptation strategies and nutrition outcomes: a conceptual framework' *Food and Nutrition Bulletin* 43(2): 201–212

Malacarne, J. and Paul, L. (2022) 'Do the benefits of improved management practices to nutritional outcomes "dry up" in the presence of drought? Evidence from East Africa' *Food Policy* 113 (102332)

Peterson, C.A., Eviner, V.T. and Gaudin, A.C. (2018) 'Ways forward for resilience research in agroecosystems' *Agricultural Systems* 162: 19–27

Richardson, K.J., Lewis, K.H., Krishnamurthy, P.K., Kent, C., Wiltshire, A.J. and Hanlon, H.M. (2018) 'Food security outcomes under a changing climate: impacts of mitigation and adaptation on vulnerability to food insecurity' *Climatic Change* 147: 327–341

Shikuku, K.M., Ochenje, I., Lepariyo, W. and Banerjee, R.R. (2023) *Facilitating knowledge management for adaptation planning in Africa: inventory of adaptation planning tools and frameworks*. ILRI Research Report

Swindale, A. and Bilinsky, P. (2006) *Household dietary diversity score (HDDS) for measurement of household food access: indicator guide*. Washington, DC: Food and Nutrition Technical Assistance Project, Academy for Educational Development

Funded by

UKaid
from the British people

This material has been funded by UK aid from the UK government; however the views expressed do not necessarily reflect the UK government's official policies.