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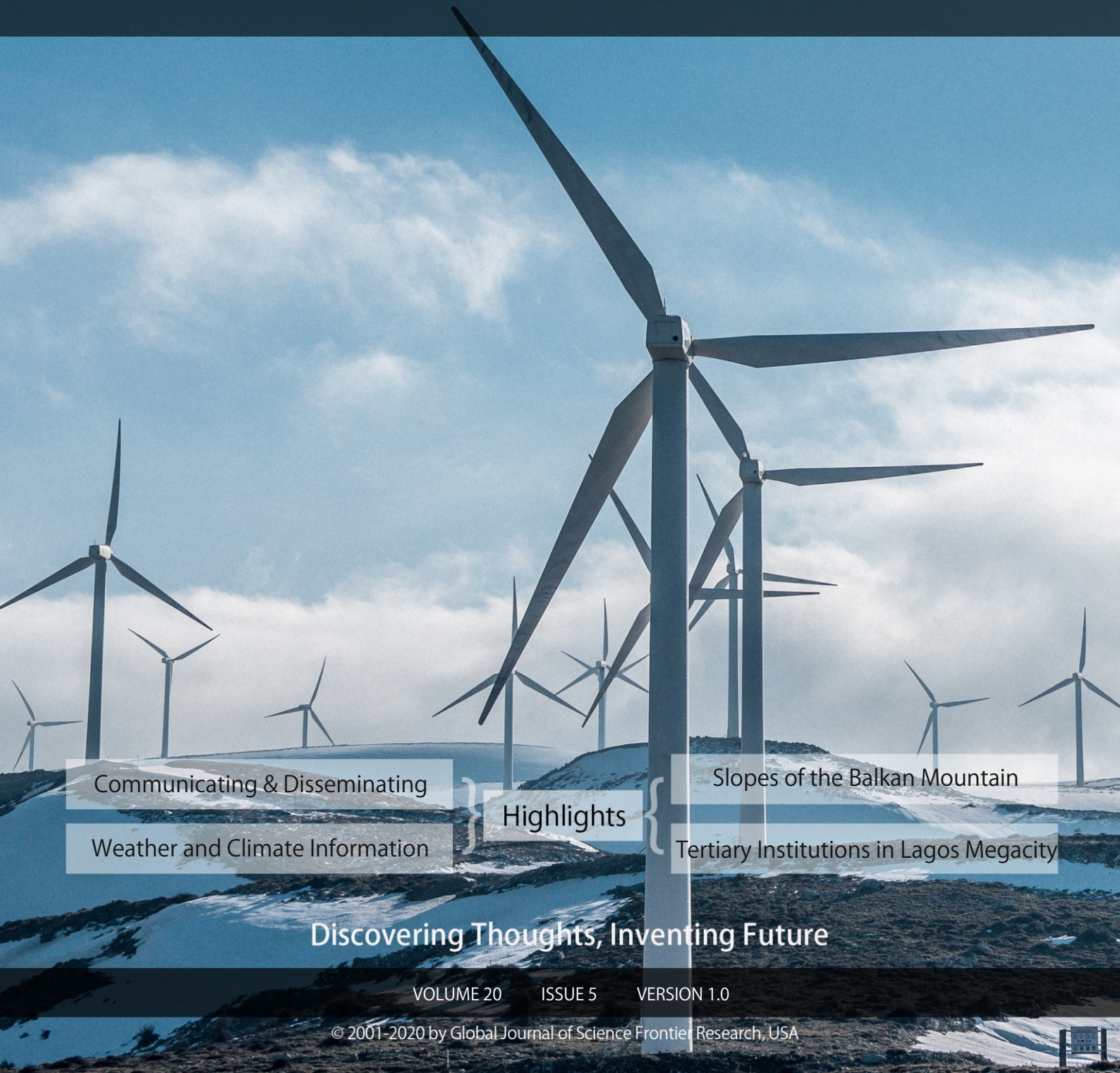

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Highlights

Slopes of the Balkan Mountain

Tertiary Institutions in Lagos Megacity

Discovering Thoughts, Inventing Future

VOLUME 20 ISSUE 5 VERSION 1.0

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Tackling Climate Change in a Changing World

By Miguel Schloss

Abstract- Economic and social development has generated unprecedented progress, overcoming widespread famines, extending life expectancy, increasing incomes in large swaths of the world.

Much of this has been propelled by technological developments, particularly the internal combustion engine, and with it increased CO2 emissions. These have triggered growing concerns on global warming, and an increasing consensus that CO2 emissions need to be curbed to prevent further global temperature increases, and constrain temperature increases to less than 2 degrees Celsius above pre-industrial levels, as set out in the 2016 Paris Agreement.

A change of this magnitude requires an overhaul of historic proportions for energy policies, and investment of the order of $16.5 trillion. Such outlays will require profound transformation in production and transportation practices, and spending on renewables and efficiency, as well as carbon capture and storage through 2030.

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A change of this magnitude requires an overhaul of historic proportions for energy policies, and investment of the order of $16.5 trillion. Such outlays will require profound transformation in production and transportation practices, and spending on renewables and efficiency, as well as carbon capture and storage through 2030.

With over 25 years since the original UN Convention, there is little tangible evidence of progress in the climate change agenda. Greater focus will be needed on policy and institutional dimensions to achieve tangible results, particularly in the power sector, which absorbs more primary energy than any other sector, and which accounts for over a third of carbonemissions.

This article is based on benchmark work to assess experiences worldwide to design policy and institutional framework for energy and environmental policies. It highlights the need for sharper attention to macroeconomic and sector policies on efficiency and effectiveness concerns, and their reconciliation with development and economic management concerns for growth and development. In the end, these have been the main stumbling blocks for progress on the subject, and capacity to adapt flexibly to emerging and changing societal demands.

Keywords: adjustments, climate change, economic development, efficiency, emissions, energy, renewables, paris agreement.

I. Introduction: Sprinting in a Treadmill'

"Madness is doing the same thing over and over again hoping to get different results". Albert Einstein.

"However beautiful the strategy, you should occasionally look at the results". Winston Churchill.

For over 25 years, since the establishment of the UN Framework Convention on Climate Change, annual summits of the parties of the Convention (known as COP meetings) have been arranged to establish binding obligations to track and ultimately reduce greenhouse gas emissions.

Yet, despite such massive and recurring efforts, public debates, agreements, myriads of strategy statements, and a multitude of institutions and special initiatives, there is little tangible evidence of progress in the climate changeagenda[1].

In a way, the regular summitry and elaborate pageantry, has tended to shape public discourse and politics focused on local audiences perceptions of people back home – rather than serious efforts to understand the underlying issues that explain the situation as it is involving, and thus how to reverse past trends.

The time has thus come to reassess the effectiveness, orientation of such efforts, their policy and institutional shortcomings to achieve better results. This paper is to point out some key aspects that this agenda is missing, and thus areas that require urgent attention and recasting [2, 3].

The fervent string of statements and public discourse oftentimes create a wall of distancing noise and headlines but not any visible progress to diagnose and understand the underlying issues -- and ultimately corrective actions and policies to "move the needle" for investors to address environmental issues on the ground. Accusations of lack of political will, vested interests and the like, while flamboyant and attention grabbing, are decidedly unhelpful to guide action for effective results.

This paper accordingly focuses on the "reachable" – i.e. getting the maximum reasonable results with the minimum actions and efforts as practical. This requires an empirical approach to diagnose the issues standing in the way of effective action, and a strategic approach to implementation and mainstreaming environmental concerns into broader policy-making. The operative aim is to achieve tangible progress – not the final word on the issue -- by emphasizing policies and institutions that help align interests and focus on economic incentives that facilitate initiatives to generate solutions without excessive bureaucracy.

This should give the necessary breathing room to work on more fundamental structural shifting solutions for longer term and sustained responses to megatrends facing the world.

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II. Hold on and Take a Deep Breath

"Ponder and deliberate before you make a move". Sun Tzu

"One must be slow in deliberation and quick in execution". Napoleon

Much of the economic and social development over the last centuries, and associated improvements in standards of living, have been propelled by massive growth of energy demand, powered by hydrocarbons that brought about increases in CO2 emissions.

Such development generated unprecedented progress, overcoming recurrent and widespread famines, extending life expectancy, increasing incomes in large swaths of the world. En recent centuries, this has been underpinned by productivity gains in agriculture, industry, advances in communications, transport and energy, never experienced in recorded history before.

Much of this has been propelled by technological changes leading to the industrial revolution, particularly the development of the internal combustion engine, which powered much of the productive progress since then. However, this has brought with it increases in CO2 emissions, whose full implications are as yet somewhat unpredictable and not fully understood.

In the past decade alone, disruptions propelled transformations in where and in the way people lived – from how we move, drive, invest, to how we generate and consume energy, how we take care or ourselves. Every single facet in our lives have been challenged or reimagined.

On the other hand, human progress is outpacing the capacity of the resource environment to keep pace with the need for a balanced development.

Whether it is economic expansion (at the expense of known resource bases, such as mining and raw materials, forests), and consequent increased emissions; institutional and policy constraints to cope with ever increasing economies; growing and widening societal demands and so many other developments are testing the limits of human knowledge to develop and settle increasingly complex and emerging discontinuities.

Admittedly, there is some controversy about the underlying science claiming the connection of such developments with climate change, particularly the impact of solar radiation and other cosmological phenomena affecting global temperatures, and thus the capacity of human beings of influencing climatic conditions[4]. Several studies reconstructing temperature changes over the last 5,000 years, essentially point to large climatic changes over the millennia, related largely to changes in sun radiation rather than other phenomena[5, 6, 7].

That said, there is an increasing consensus that CO2 emissions generated by human activity need to be curbed to prevent further global temperature increases, and constrain global average temperature increases to less than 2 degrees Celsius above pre-industrial (18th and 19th centuries) levels, and to pursue efforts to limit temperature increase even further to 1.5 degrees Celsius. This is in essence what has been set out in the 2016 Agreement reached by the 195 countries in climate talks in Paris.

However, all too often, the economic implications of the above-mentioned initiatives have tended to overlook, if not underrate -- and with it, the consequent resistance to the quest to constrain energy production and associated carbon emissions[8].

The world's climate challenge has many aspects. The most important driver of climate change is the atmospheric buildup of carbon dioxide released by fossil fuel combustion, as well as methane released from the production, distribution and use of natural gas and by agricultural activities.

The social and economic damage that will be caused by climate change are byproducts of the buildup of carbon dioxide, methane, and other greenhouse gases. This includes rising sea levels that threaten coastal and low-lying regions, increased incidence of certain weather hazards, and declining crop yields due to changes in growing seasons, diminished water supplies, and proliferation of insect pests.

Other effects include climate-induced human migrations, accelerated spread of infectious diseases, and hardship resulting from the direct effects of climate change and the economic and political disruptions that follow.

III. And What Does it Take to Chart a New Course?

"He who wishes to fight, must first count the cost" Ts'ao Kung

"When making plans, it is as well to take into account those of the enemy" Winston Churchill

Achieving the CO2 emission and temperature goals described above requires, however, an overhaul of historic proportions for energy policies, and investment of the order of $16.5 trillion, as estimated by the International Energy Agency. Such outlays will require profound changes in production and transportation practices, and spending on renewables and efficiency, as well as carbon capture and storage through 2030.

This is no small challenge, particularly when seen the issue in the context of competing claims on scarce resource surpluses. This is the case particularly in emerging economies whose development needs remain challenging and heavily dependent on hydrocarbons to fuel their economies – particularly in an

uncertain, if not fragile, international economic environment, to fuel production of energy-intensive primary commodities, which are the mainstay of exports and fiscal revenues for many emergingnations[9].

Admittedly, in the last decade, accelerating gains in energy efficiency have muted growth in energy demand; mounting expansion in renewable energy combined with successive falls in global coal consumption, have led to improvements in fuel mix.

Some progress has taken place through natural gas becoming the largest source of energy growth, boosted by a massive programmed of coal–to-gas switching in industrial and residential sectors in China[10].

But much more progress is needed to "move the needle" in a tangible manner, particularly in the power sector, which absorbs more primary energy than any other sector.

Adding all up, it accounts for over a third of carbon emissions, and despite the push away from coal and rapid expansion towards renewables, progress has been negligible over the last 20 years, with hardly any changes in CO2 emissions as evidenced below:

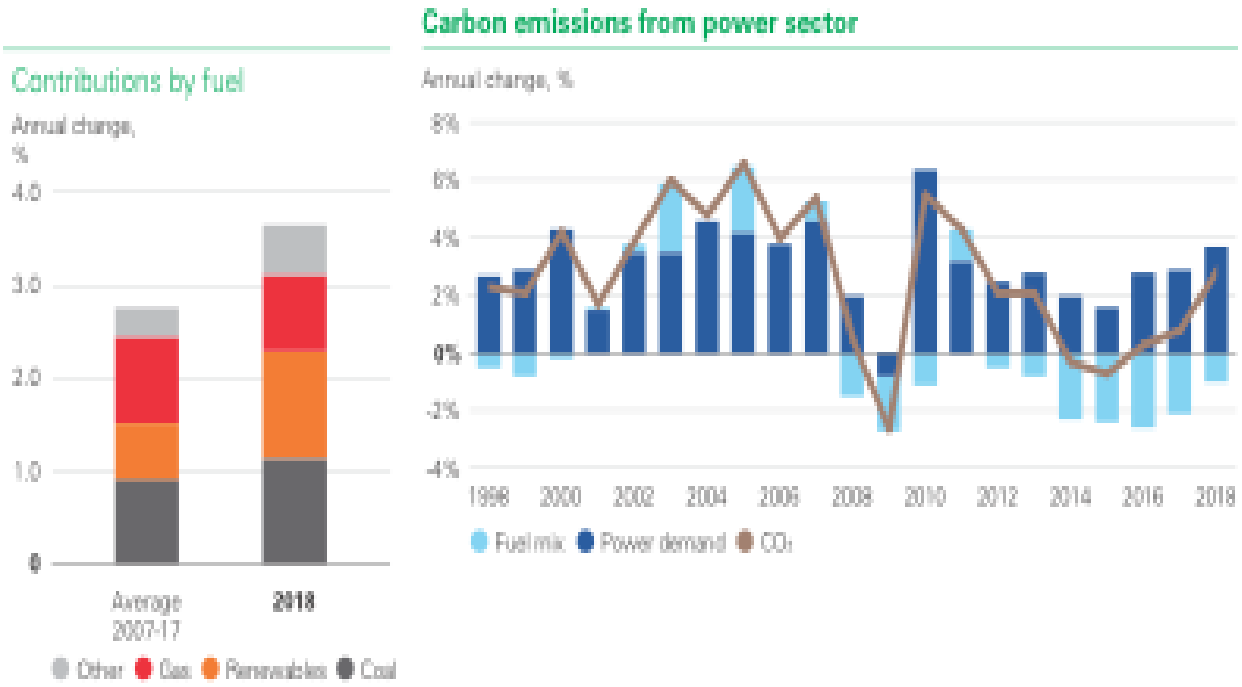


Fig. 1: British Petroleum Statistical Review of World Energy 2019: British Petroleum

Renewable energy sources, including transitional hydrocarbons such as natural gas, must become a growing part of a carbon free energy development, since they tend to have lower CO2 emissions than traditional sources[11].

For the time being, though, such sources are still more expensive, particularly when subsidies are discontinued, thereby constituting in many cases situation-specific solutions, depending on local conditions (such as wind regimes or solar radiation levels), and appropriate for limited load factor requirements.

The need to move towards a decarbonized economy, provide the conditions for enhanced R&D to develop such technologies to further reduce costs and level the playing field vis-à-vis traditional energy sources.

Some "green" technologies are closing the cost gap, and are bound to become more attractive when considering CO2 emissions.

In all, though, what the record strongly suggests is that none of the large- scale changes needed will take place in a significant manner or be politically, economically and technically easy in the near future.

Henceforth, emphasis must focus more sharply in a manner that does not affect negatively economic development – a burning concern of most, if not all emerging economies, with consequent limited incentives to make significant progress and get results in the climate change agenda[12].

IV. Poising Towards the Future – the Policy Option

"Forecasting is difficult, particularly towards the future". Popular proverb

"Forecasts may well tell you a lot about forecasters; they tell you nothing about the future". Warren Buffet

Hitherto, most attention has focused on setting top-down aggregate goals, regulations, time consuming and costly clearance arrangements for new investments, massive (at times unaffordable) public expenditures and other such administrative interventions that tended to create their share of distortions. Chief among them were the:

- Introduction of competing and duplicative institutions operating at the national, regional (EU for example) and the international levels (leading, for example, to over 15 different climate change ODA funds) with limited attention on standards and approaches;
- Establishment of distortionary subsidies, difficult to manage, or earmarked taxes on carbon trades to fund adaptation: taxing one public good (that governments want more of) to pay for another;
- Introduction of complex public environmental clearance mechanisms that were slow, cumbersome, expensive and oftentimes unresponsive to investment needs;
- Capture of regulatory entities by interest groups, undermining environmental and public good objectives, and attendant corruption.

Given the resulting poor outcomes, actions must be refocused to increase attention to efficiency and effectiveness, and clearer accountability, without adversely affecting economic development[13].

This is particularly important in countries in their early stages of development, where basic engines, such as small pumps, mopeds or mini-tractors start replacing human and animal toil. These are for the most part powered by hydrocarbons, thereby making such countries particularly dependent on oil, as can be seen in the graph below, in effect holding their environmental condition hostage to their dependence on hydrocarbons consumption.

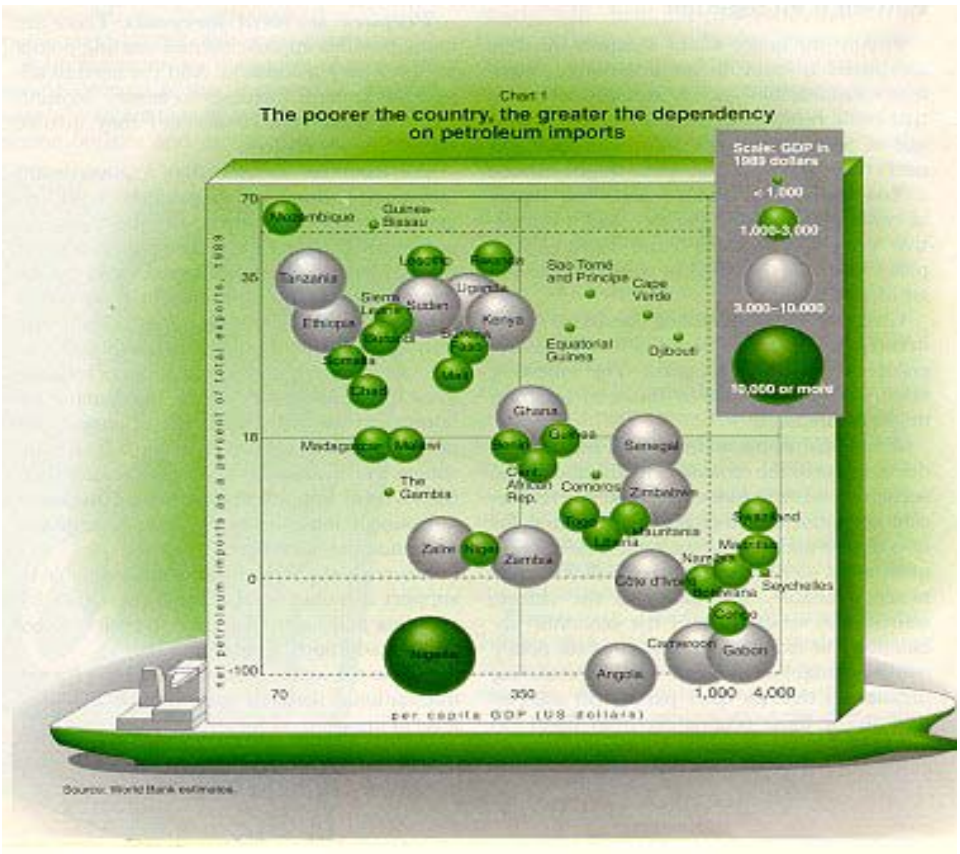


Fig. 2: Finance and Development (IMF-World Bank, Mar. 1993): Miguel Schloss -- Does Petroleum Procurement and Trade Matter?

But the secondary effects, downstream, are equally devastating though much more widespread. Petroleum products play a pivotal role in Sub-Saharan Africa's economic development. Their purchase absorbs 20-35 percent of export earnings for the bulk of the countries in the region, and generates approximately 40 percent of tax revenues – thus constituting the single largest item in the balance of payments and fiscal revenues for most countries in this region.

Although the primary energy balance is currently dominated by household consumption of fuel wood, petroleum products are the most important source of commercial energy, supplying approximately 70 percent of commercial requirements in these

countries. As things stand, they are likely to be the fastest growing portion of the region's energy balance as the continent's modernization unfolds[14].

In all though, key at least for a good many developing countries, is the need be vigilant to avoid developing institutionally-intensive arrangements in institutionally-weak conditions, since "institution-building" mentioned in the Paris Agreement is a long and difficult road.

A policy framework must enable economic actors and civil society to interact organically, without constraints and avoid moving to a complicated regulatory system (where duplication, offsetting incentives, etc. are all too common).

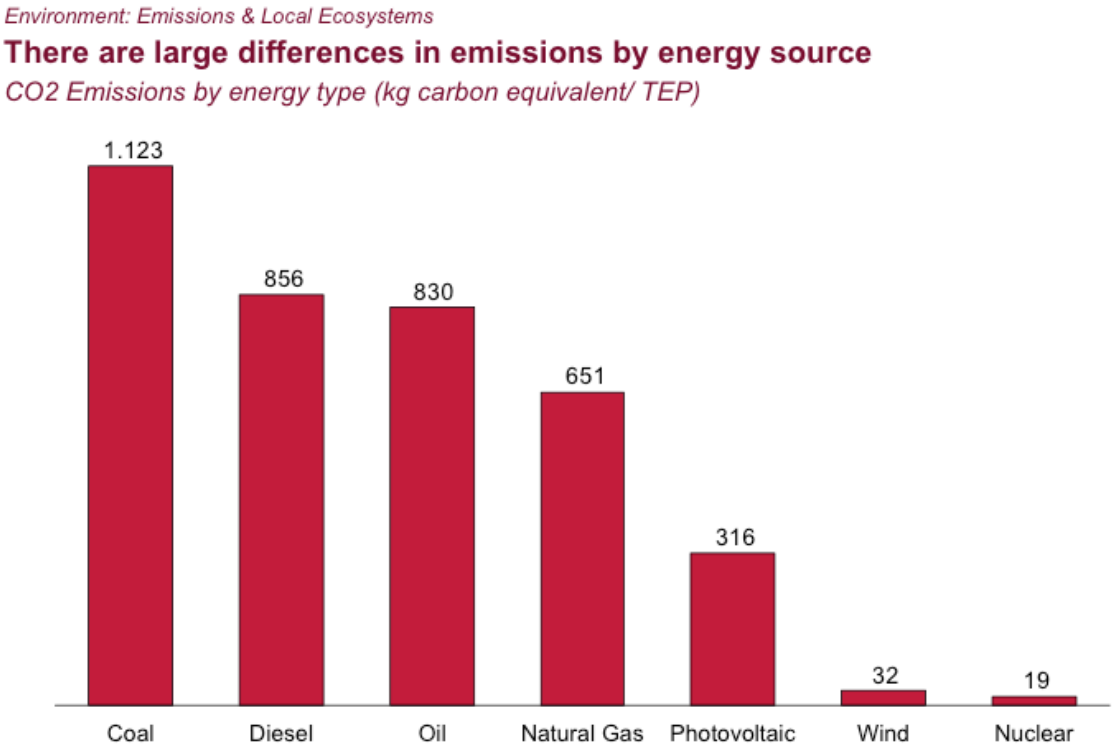
The rule should be minimize the rules, use pricing where at all possible, and allow any legitimate additional costs of externalities and of compliance to environmental standards to be recouped through output prices — thereby avoiding energy development paths that become costly and complicated.

V. Changing Course -- the Technology Option

"Energy cannot be created or destroyed, it can only be changed from one form to another". Albert Einstein

"A positive thinker sees the invisible, feels the intangible, and achieves the impossible". Winston Churchill

Renewable energy sources, including transitional hydrocarbon sources such as natural gas, must become a growing part of a carbon free energy development, since they tend to have lower CO2 emissions than traditional sources, as illustrated below:



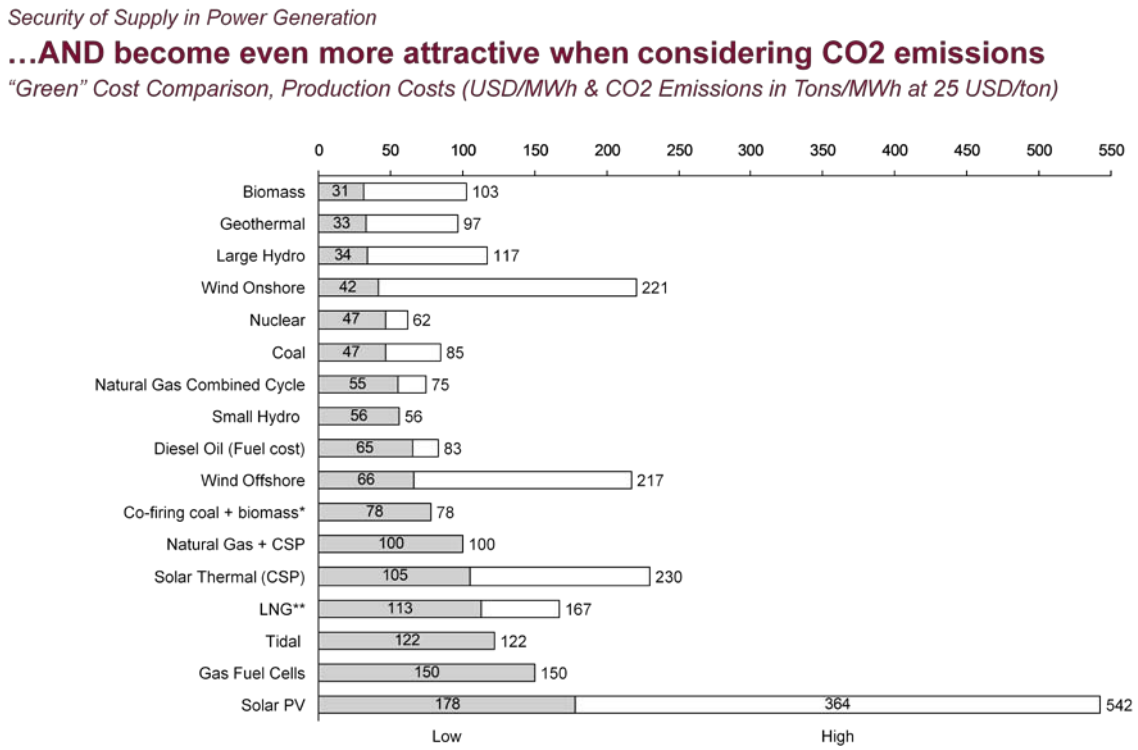
Sources: CNE (Chile Energy Commission): "Current Situation & Perspective"; M.Schloss et al "Cambio Climático y Energía", 2019; Inter-American Association of Energy Regulatory Agencies; M. Schloss et al "Design of an Energy Strategy for Chile: Context and International Lessons"

Fig. 3

For the time being, though, such sources are still more expensive, and thus constitute in many cases situation-specific solutions, depending on local conditions (such as wind regimes or solar radiation levels), and appropriate for limited load factor requirements (i.e.not appropriate for industrial or mining sector activities that require reliable energy supply 24 hours a day, irrespective of seasonality's, with sufficient reserve capacity).

The need to move towards a decarbonized economy thus requires conditions for enhanced R&D (and associated resource mobilization in advanced economies) to develop such technologies to further reduce costs, enhance reliability and level the playing field vis-à-vis traditional energy sources.

Some "green" technologies are closing the cost gap, and are bound to become more attractive when considering CO2 emissions as can be observed below:



Sources" IEA Energy Technology Perspectives; Ormat Technologies, Inc.

Fig. 4

In the meantime, a long-term energy strategy must rely on technological substitution of the current capital stock of non-liquid fossil fuels towards a greater mix of LNG based plant, geothermal and hydro electricity (particularly low head and run-of-river facilities). In such evolution, renewables can play a niche role, and eventually mainstream option in the energy mix.

In all, though, the world lacks the solutions that will be needed to achieve genuine global net-zero carbon emissions called by international agreements at reasonable economic and social cost. Nor are the solutions in hand to adapt equitably and efficiently to the climate-related risks that will occur even if mitigation goals are met.

Much can and must be achieved with existing technologies and policy approaches, but without game-changing advances in multiple fields of science, technology, and policy, the world's efforts to address the climate challenge may not succeed in the long haul.

Beyond that, the scientific foundations and implications of climate change remediation via solar radiation management ('geoengineering') and even wind-based technologies will need further development to become genuinely competitive at grid levels.

Unsolved problems include cost-competitive long-term energy storage systems (advanced batteries, fuel cells, thermal storage, and clean hydrogen systems) to enable 24-hour energy supply from renewables at competitive costs.

Similarly, technical work is needed to develop scalable low-carbon firm electricity generating technologies (e.g., advanced nuclear); low-carbon manufacturing processes for cement and steel; viable alternatives to these materials; long-distance low-carbon transportation by land and sea; low-carbon aviation; and carbon-capture, storage, and utilization.

VI. Reframing the Course – the Process Option

"Everything must be made as simple as possible. But not simpler". Albert Einstein

"Dream in a pragmatic way". Aldous Huxley

Much more progress is needed to advance in a tangible manner, particularly in the power sector, which absorbs more primary energy than any other sector. And yet, neither the policy nor the technology options referred to above, provide a clear and straightforward direction that can assure visible results. Seeing the bigger picture, a more rigorous and integrated approach is necessary to reconcile more effectively the trade-offs necessary for:

- Efficient resource allocation, emphasizing proper pricing, taxation and various forms of institutional and economic polices that provide the enabling environment and non-distortionary incentives, reflecting its scarcity value, including associated externalities, while avoiding top-down and institutionally- intensive approaches in institutionally-weak countries;
- Recasting climate change so that it no longer approached in isolation, as a goal in itself, but instead properly integrated with equally pivotal concerns of energy security, efficiency and access to low income and other societal groups.
- Revenue, cost compliance and administration affect interactions with the wider tax system, more generally, and impact both the choice of instruments and the level at which taxes a reset so that associated costs are properly recuperated in pricing.
- Competitiveness and terms of trade concerns, to confront growing fears of disadvantaging domestic producers in world markets and the cost and investment implications to meet more exacting environmental concerns;
- Fiscal considerations, particularly as hydrocarbons consume among the largest balance of payments (either in imports or exports) or fiscal revenues in most countries;

This requires aligning interests among multiple stakeholders -- each doing their part in innovating and investing in a more decarbonized economy, and leveling the playing field for emerging technologies while their costs are being reduced.

A long term energy strategy must rely on technological substitution of the current capital stock of non-liquid fossil fuels towards a greater mix of LNG based plant, geothermal and hydro electricity (particularly low head and run-of-river facilities), with renewables playing a niche role, and eventually mainstream option in the energy mix. An overhaul of existing systems will require a broader effort, with transitional arrangements that include:

- Financing adaptation programs (while underlying solutions are being worked on) through supporting investments -- e.g. storm barriers, resettlement, carbon capture, retrofitting investments to reduce energy intensity in production processes, use and storage (CCUS) that could be recognized as part of the climate change agenda.
- As tracking arrangements leave a heavy burden on countries, whose tttargetsrely on what is called nationally determined contributions, policy efforts need to balance attention towards important global factors that remain "out of the radar" from country level trackings, such as maritime and air transport, the Arctic and Antarctic continents, which have their special environmental issues. For instance, the shipping industry emits more CO2 per year than any European country.
- Similarly, the global economic context may keep conditions in a constrained growth path, with limited surplus generation prospects in developed countries for R&D for new Technologies, and fossil fuels (making them more competitive against non-traditional sources), reducing in turn surplus generation capacity of emerging economies relying on extractives, depriving them from important source of development financing.

VII. The Future of the Past

"Real knowledge is to know the extent of one's ignorance" Confucius

"The only source of knowledge is experience" Albert Einstein

This century is set to be shaped by a series of hugely demanding and closely interlocking challenges. The eradication of poverty, dealing with conflict and achieving the sustainable use of natural resources is among them. Linked to all these are difficult issues about energy – particularly having adequate and secure supplies of energy at affordable prices and consuming energy in appropriate ways to avoid environmental damages[15, 16].

A solution to either of these threats is relatively straightforward; however, a solution to both simultaneously is one of the great challenges facing the world. Linked to all these are difficult issues of managing in the midst of transitions, economic adjustments and associated discontinuities. More than ever before, this will require excellent planning as much as skillful, rapid and flexible execution to respond to emerging developments[17].

We are thus thrust in a situation of high stakes and trade-offs requiring decisions under uncertain conditions. Once we overcome current crisis conditions, global energy demand is expected to rise by over 50% over the next 30 years, and fossil fuels probably accounting more than 80% of the overall increase. Simply calling for a cut in consumption is not a sufficient solution to the challenges we face, particularly in enhancing energy security while fueling economic recovery, growth and poverty alleviation globally[18].

In the end, though, achieving tangible progress while addressing environmental issues effectively require a much better understanding than what we have at present to ground solutions on stronger and better empirical evidence of the underlying incentives at work generated by current technical, institutional and policy conditions.

Technological innovations can have a pivotal role to play in harnessing new sources energy supply. They have however their costs and time frames for their

development, as well as their policy, institutional and governance requirements to provide the enabling environment to attract resources and deliver progress.

In all, this is not a dash to renewables or curbs in energy use, but a race to reduce carbon emissions across many fronts – an endeavor that requires as much an international effort for innovation, as a series of local, down-to- earth adaptive investments compatible with economic development. This requires a hard-nosed approach distinguishing trend from fad.

VIII. Conclusion: Leading through Turbulent Times

"The world as we have created is a process of our thinking. It cannot be changed without changing our thinking" Albert Einstein

"No matter if it is a white cat or a black cat, as long as it can catch mice, it is a good cat" Deng Xiaoping

Summing up, goal-setting, international agreements, awareness raising (the staple of much of environmentalists' constituencies) can be useful, but only up to a point. A top-down and muscular approach to nudge towards action and institutional compulsion, while expedient in the short term, confront binding constraints (such as institutional weaknesses, poor economic incentives difficult to overcome, etc.).

At the bottom of it all, such approach has in effect led to perfunctory and mechanistic (checking-the-box) compliance behavior, with consequent limited progress on the ground. Collective decision-making bodies, whether international agencies or publicly owned utilities, by and large tend to dilute accountabilities by making everyone responsible -- in effect leaving no one properly responsible.

Moreover, with overly inflexible and not-fit-for-purpose governance arrangements, traditional institutions and their linear planning and modeling practices are just unable to predict increasingly recurrent spikes and slumps. We must accordingly learn how to discern emerging changes in demand signals. Policies and institutional arrangements must avoid rigidities normally associated with long term investment plans and policies, manage relationships with civil society to detect and respond to emerging demands, optimizing cost performance and sustainability under volatile conditions. The challenge will be to embed new capabilities that enable flexibility while keeping an eye on effectiveness and responsiveness.

Above all, we must learn to tolerate leaving the perfect, the silver bullet, and the certainty of dealing with well-proven developments. There is no substitute than a certain level of ambiguity and, above all, learning and understanding evolving conditions. There is no alternative to reconsidering the foundations of future planning.

There is good and bad news in all this. On the one hand, the huge mass of information and crosscurrents taking place in today's world makes its sorting and evaluation extremely difficult. There are accordingly no hard-and-fast rules for policy and investment action; rather they are guides of thought processes and planning to assess evolving conditions to adjust to new conditions. On the other, this opens up opportunities for recasting existing arrangements through:

- Improved flexible planning methods, with risk and mitigation arrangements, explicit "stress-testing" to equip the energy sector with capabilities to cope with increasing disruptions;
- Newly integrated digital and tracking capabilities that include long term strategic, as well as short term tactical and operational planning horizons;
- Improved monitoring of market and economic indicators, social media and scientific feeds to offer "over the horizon" insights to detect emerging societal demands, and application of frontier knowledge in the physical, life, and social sciences or the advancement of cutting-edge technologies. In time, this should include mega environmental issues in need of better understandings, such as those affecting stability of continental ice sheets, the role of deep ocean in climate change, etc.

As the world begins to move towards planning for recovery, uncertainty is likely to remain part of life for the foreseeable future. This may well require greater participatory and collaboratory planning vehicles with stakeholders, and more flexible supply and investment chains able to withstand this volatility and enhance speed, agility, variety, or innovation to respond more effectively to unexpected changes.

In the end, the effort will require many players working independently, but coherently. This can only be achieved through proper pricing, taxation and various forms of institutional and economic polices that align interests among multiple stakeholders and provide the environment to invest and innovate in the more decarbonized economy foreseen in the Paris accord [20].

Given the unpredictable technological and other changes over time, some room for improvisation may be instrumental in coming up with new approaches, even allowing form to follow function in shaping of institutional reforms, to ensure that they respond to emerging concerns.

Accordingly, a certain amount of trial and error or learning by doing will probably be inevitable, if not helpful. A change agenda is not an option but a necessity, not only on fuels but also in strategies, structures, and leadership practices – enticing and harnessing unorthodox thinkers and their mold-breaking notions. With increasing availability of data to track outcomes and analytical capabilities, new technical

skills are bound to free the transformative forces for innovation to enhance conditions to morph fringe and exploratory ideas to mass markets.

As has happened elsewhere, the crisis is creating opportunities to respond to emerging societal demands, including better attention to sustainability of projects, their energy efficiency, their compatibility with the environment, etc. --not as marginal add-ons, but as deliberate and agile ways of designing and carrying out projects.

IX. Epilogue: Quo Vadis?

"Come now, let us reason together". Isaiah 1:18

Political (and other) debates have become increasingly divisive — the world over. So has the exchange on environment and energy policies.

At the risk of armchair psychoanalyzing complex developments, it seems that those deeply concerned with the environmental agenda have defended their beliefs bordering on the religious — casting themselves as the paragon of righteousness. Their oftentimes-abrasive postures tended to favor top-down impositions and associated policy prescriptions, irrespective of costs and complex fault-lines that run through almost any society.

All too often, such positions have generated their share of resistance, and at times been devoid of archival sources, serious diagnoses of the forces that are at play, the local policy and institutional environment and capacity, and how they affect behavior and decisions. Oftentimes proponents criticize the world (not totally unjustifiably) for their consumer culture, for despoiling their environment and maintaining antiquated power structures… failing dismally in recognizing tectonic shifts that are proving to be deeper and more seismic than had been gauged, catching everyone literally thoroughly unprepared and surprised, holding assumptions oftentimes off-base.

Instinctively, humans seek order in the universe and, in politics, a clear formula or approach for decision making. In reality, though, randomness — whims, quirks, gaffes — determine oftentimes the relations between individuals, just as it does among nations and policy response. This requires processes, open to critical reviews, time, clear-sightedness and a gravitas born from thorough experience and understandings of the underlying forces at work, their tradeoffs and economic consequences and impact.

In the process, these postures tend to dismiss contrarian views, including postures that challenge the underlying science of climate change. The paltry results of current mainstream thinking calls, if anything, for a more comprehensive consideration, including of those in the "outside the box" fringes and a revisiting of their objections. Above all, we need to keep the two halves sides of the debate together in spite of their wrangles. The world needs them together…

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The use of Twitter and Facebook Social Media in Communicating & Disseminating Weather and Climate Information by Kenya Meteorological Department

By Misiani Zachary, Lun Yin, Mwai Zacharia, Xiaohan Zhang, Yanyan Zheng, Antonine Sakwa, Collison Lore & Marta Baraibar

Southwest Forestry University

Abstract- Today, traditional media is still a significant part of disseminating weather and climate information, still they have not been able to reach out to all users of the target audience alone. On the other hand, social media platforms such as Twitter, Facebook, YouTube, Instagram, etc. are used as a tool of communicating weather and climate information to various users in a well-organized manner like never before. Using a scientific research methodology of case study, the research was designed to explore how the Kenya Meteorological Department (KMD) is using Twitter and Facebook accounts for weather and climate information dissemination to various users.

Keywords: *social media, twitter, facebook, KMD.*

GJSFR-H Classification: *FOR Code: 960399*

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The use of Twitter and Facebook Social Media in Communicating & Disseminating Weather and Climate Information by Kenya Meteorological Department

Misiani Zachary [α], Lun Yin [σ], Mwai Zacharia [ρ], Xiaohan Zhang [ω], Yanyan Zheng [¥], Antonine Sakwa [§], Collison Lore [χ] & Marta Baraibar [ν]

Abstract- Today, traditional media is still a significant part of disseminating weather and climate information, still they have not been able to reach out to all users of the target audience alone. On the other hand, social media platforms such as Twitter, Facebook, YouTube, Instagram, etc. are used as a tool of communicating weather and climate information to various users in a well-organized manner like never before. Using a scientific research methodology of case study, the research was designed to explore how the Kenya Meteorological Department (KMD) is using Twitter and Facebook accounts for weather and climate information dissemination to various users.

The researchers analyzed data for the Social Set Analysis (SSA) and Event Study Methodology (ESM), which are two components of social media analytical tools. The results found out that the majority (71%) users of weather and climate information were male in the age bracket of (25-34) who mostly are residents of Nairobi county. The study sample was made from 26,343 KMD Facebook followers with 25,597 total Facebook page likes, while Twitter Account had 22,700 followers. Hence, the conclusion that social media is a positive influence tool for sharing weather and climate information by KMD. In so doing, the study has suggested that these social media platforms should be enhanced to increase users' engagement in creating weather/climate contents according to the user needs/ and combining traditional media with social media.

Keywords: social media, twitter, facebook, KMD.

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I. Introduction

Despite a significant advance in weather forecasting and climate prediction, improvements in the accuracy of weather warnings, heavy rainfall remains a serious threat to the safety of the lives and properties of Kenyan citizens. By the end of April 2020 alone, Kenya Meteorological Department-KMD issued 4 "Heavy Rainfall Alerts" in Kenya, which were responsible for more than 164 fatalities, with more than 20,000 people left homeless, while the lucky ones seeking refuge in schools while millions of property and acres of crops damaged according to Hon. Eugene Wamalwa, the Cabinet Secretary for Devolution. (https://www.nation.co.ke/news/Heavy-rains-kill-194-Kenyans/1056-5544130-2bkd9fz/index.html)

In such a situation like the April scenario, effective communication between weather and climate providers of hazardous weather information such as meteorologist and weather users, represents a critical variable that can limit the socioeconomic of heavy rains, floods, mudslide, landslide, and lightening among other weather disasters (Severe 2002, Huang 2019). In short form, communication indicates an exchange of information among entities, organizations, or communities. In the context of weather and climate information, weather alerts represent a basic yet essential form of communication wherein KMD forecasters inform Kenyan people of the potential for or imminence of weather-related hazards.

This communication and dissemination of weather are only valuable if the targeted people are able to get this information at right time; they pay attention to it, and understands the weather information. It is fruitless if the targeted people do not receive, attend to, or understand the information being conveyed. People are unlikely to engage in the actions necessary to protect themselves from heavy rains if they do not receive, attend to, or understand information provided by KMD. Up-to-date, researchers who are interested in public responses to weather and climate information have

focused most of their efforts on the factors that influence communication reception and understanding (Macleod et al. 2020).

These endeavors have produced several significant insights. For example, existent research on reception proves that members of the public are significantly less likely to receive weather information that are conveyed during night hours (Thesis et al. 2015). Researchers have also shown that the socioeconomic position of people influences the extent by which people understand the information conveyed in warnings. Adding more complex details such as the possibility of a particular event/ or phenomenon can also impact the possibility that people will acknowledge it (Joslyn and Savelli 2010). However, this study neglects the attention part of the communication equation.

Consequence, little is known about the aspects that influence public attention to messages issued by KMD professionals. Who pays attention to weather warnings and climate information? How does it vary across space and time? Does message content and mode of delivery influence the extent to which people pay attention to information about severe weather and rainfall alerts? Scientists have yet to answer these and other vital questions about public attention to the communication of weather for several reasons, some of which involve data limitations.

In simple language, scientists have ignored public's attention because they have yet to develop acceptable measure of the concept. In an effort to get a better of option for this constraint, the research develops a new indicator of public attention to weather and climate information communication that based on the growing stream of real time data that followers of the public publish on social media platforms, which in this case, are Facebook and Twitter accounts (Management, Management, and Management 2014).

Although social media has increased its popularity as a promising channel to expand the horizon of weather and climate information, the social inequality in the usage of social media data should make us cautious about the use of these tools for such purposes (Slater, Angl, and Leung 2016).

The rationale for this study was motivated by a personal interest in social media, especially Twitter and Facebook, and also the desire to investigate the impact these two-social media has on sharing weather and climate information perspective by KMD.

In this study, we utilize Social Set Analysis (SSA) and Event Study Methodology (ESM) models to understand the social and spatial inequities in the generation of tweets and Facebook messages before, during, and after event/ weather forecast. This model goes beyond the ''digital divide'' to explain the spatial heterogeneity in the usage of social media (Odhiambo 2012).

Explicitly, this study seeks to answer the following research queries: What factors affect the number of tweets and Facebook messages generated before, during and, after event/disaster? What factors explain the spatial variation in the number of tweets and Facebook messages posted before, during and, after a disaster? This study analyzed tweets & Facebook messages generated from KMD social media official accounts to empirically test our model (Ali et al. 2016).

II. Methodology and Data

a) *Social Set Analysis-SSA*

Social Set Analysis, as employed in this research, is concerned with the mobility of social users across time and space. For mobility across time, we conduct SSA on KMD social data from the Facebook walls with an analytical focus on the set of users that interacted with KMD between 1st January 2019 to 31st March 2020 events and set-theoretical intersections of this period. Similarly, for mobility across space, we conducted set inclusions and exclusion of users who interacted with the KMD Facebook wall. SSA allows us to uncover not only the interactional dynamics over time and space but also identify user's sets that correspond to targeting segmentations such as social activists (Flesch and Vatrapu 2016).

b) *Event Study Methodology*

Event studies are methodology to assess an impact, especially on "KMD Heavy Rainfall Alerts" messages, which KMD posted on social media. Without exception structure for occurrence study methodology, at a higher level of abstraction, it contains identifying three periods. First, defining an event of interest and identifying the period over which it is active (event window), the second involves identifying the estimation period for the event (pre-event or estimation window) and the final one being identifying the post-event window (Flesch and Vatrapu 2016).

The social set analysis of a real-world event, the study has applied event study methodology to identify the three periods of user's interactions on KMD social media platforms: before (pre-event window), during (event window), and after (post-event window) (Xiao, Huang, and Wu 2015).

c) *Data Acquisition*

The study's analyses are based exclusively on primary data collected through Social Data Analytics Tool for both Facebook and Twitter accounts (Babu, S, and Harikrishnan 2019). This tool provided activity datasets that were generated as independent files and combined into one for using them as a whole data set that can be filtered or expanded on demand (Lu n.d.).

III. Research Findings and Analysis

By the time the research was conducted, the Facebook page had 26,343 followers with 25,597 total likes, while Twitter Account had 22,700 followers. To evaluate the influence of social media platforms, the day-to-day figures of followers and posts were gotten from the Facebook and Twitter accounts between 1st January 2019 to 31st March 2020. The reach of a post on Facebook was defined as the number of views each post received during the study period, as reported on Facebook analytics (Slater, Angl, and Leung 2016). They included all posts viewed by people on more than one device such as use of a desktop, computers, mobile devices or laptops. "Followers" were defined as a person or organization that 'liked' or 'followed' one of these social media accounts (Cody et al. 2015).

a) Daily Twitter Activity

To determine the temporal dynamics associated with KMD weather and climate information, the study created a set of variables that count the number of daily tweets impressions, daily tweets engagements, daily tweets media views, daily tweets retweets, daily tweets replies, and daily tweets likes on each day of our analysis.

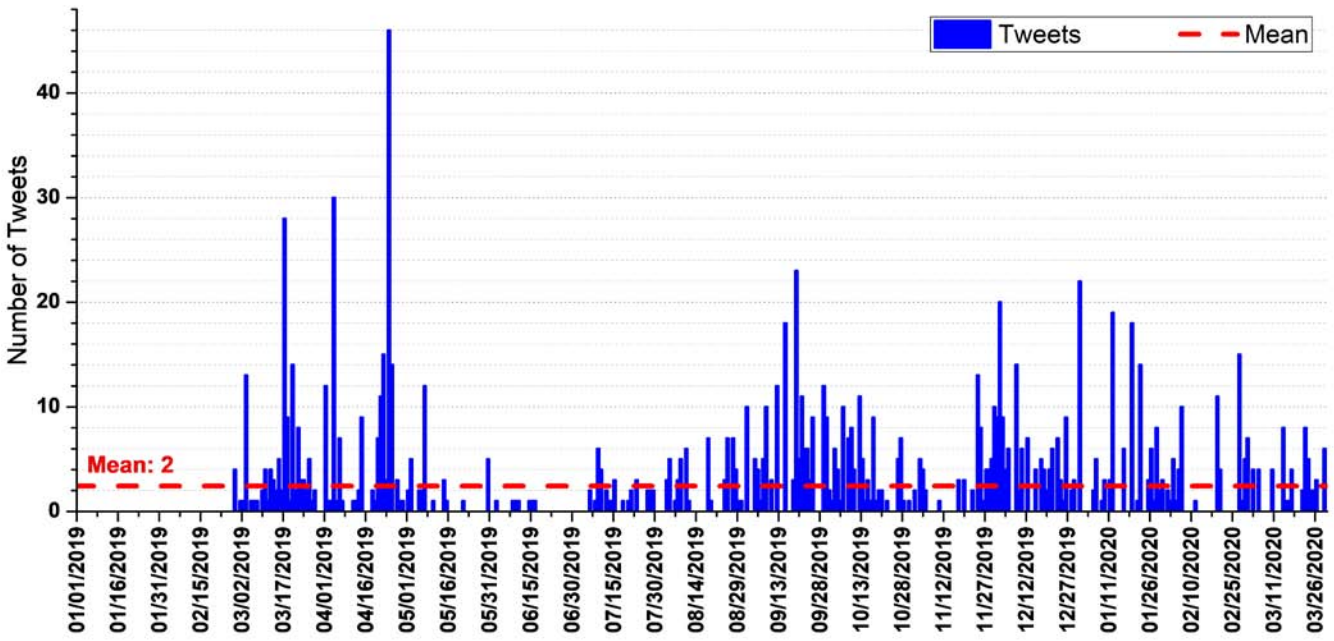

Figure 1: Daily number of Tweets (1stJan 2019-31st March 2020)

From the Figure 1, we collected and archived 1,102 tweets and associated metadata that were published by KMD from 1st January 2019to 31st March 2020. The largest number of tweets was recorded on 25th April 2019 with a record of 46 tweets in a day followed by 30 tweets on 5th April 2019. The third, fourth, and fifty tweets of 28, 23, and 22 were recorded on 18th March 2019, 20th September 2019, and 1st January 2020, respectively. As shown in Figure 1, the broken red line indicates an average of 2 tweets published per day (24-h EAT period) during this period. The inactive days were January and February 2019, where there were no published tweets.

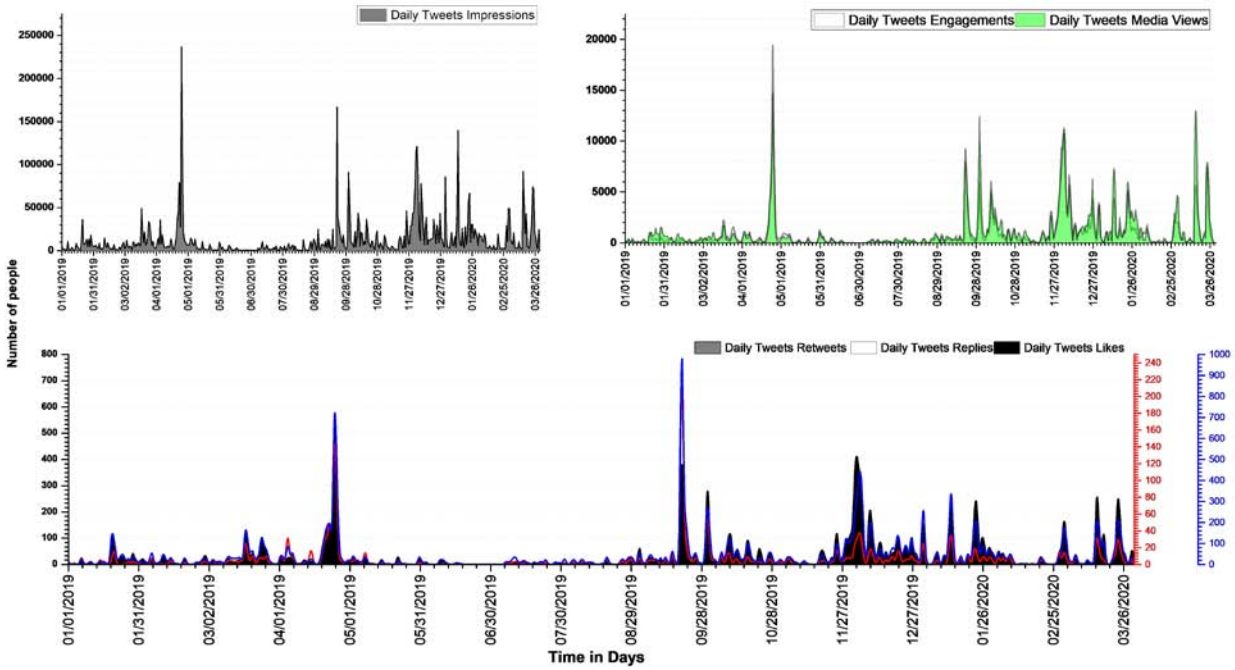

Figure 2: Temporal Comparison of Twitter Activity: Daily Tweets Impressions, Engagements, Media Views, Retweets, Replies and Likes (Jan 2019 – March 2020)

Figure 2 shows the activities on twitter account increasing according to the number of tweets with local significance and intensity of events. Figure 2(a) shows the distribution of daily tweets impression while the Figure 2(b) shows the daily tweets engagements and media views in contrast Figure 2(c) shows the daily tweets retweets, tweet replies, and tweets likes over the study period analyzed and confirms the volume effect in line with the actual timeline of tweets Figure 1. The peak of Twitter activity during the periods of (25th April-2019, 20th Aug-2019, 5th Dec-2019, and 24th March-2020) was recorded more than 10,000 online engagements, while it was also observed during (3rd Dec-2019, 6th Dec-2019, 26th April-2019, 1st Jan-2020, 13th Jan-2020, 15th March-2020, 4th Dec-2019, 25th -March-2020, 24th Jan-2020, 23rd April-2019, 9th Dec-2019, 16th March-2020, 21st Sep-2019, 1st Oct-2019, 23rd Jan-2020, 25th Nov-2019, 10th Dec-2019, and 10th Oct-2019) more than 5,000 online engagements was recorded Figure 2. This period corresponds to the number of tweets that were posted online in Figure 1. This graph indicates that, the more the tweets the more engagements between KMD and followers/users.

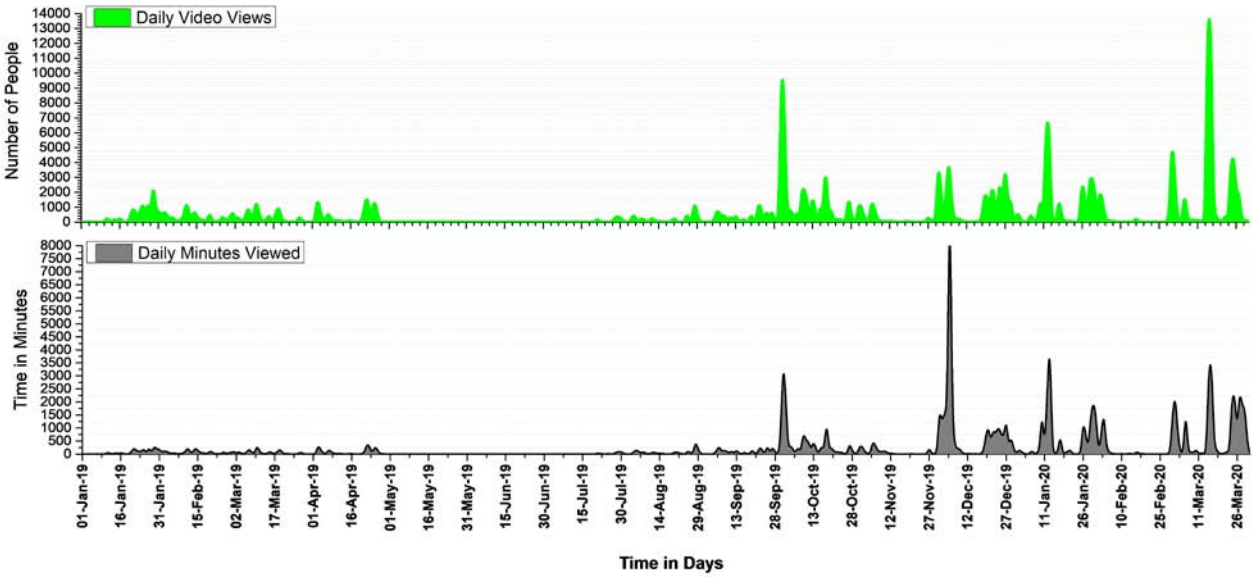

Figure 3: Temporal variation of daily video views and minutes viewed

Figure 3 plots daily video views and daily minute's views comparatively over time. These figures reveal preliminary support for the supposition that daily video views and minutes viewed counts correspond with the number of tweets issued on a given day. Although the public response from users from different categories cannot be measured in detail, if the study considers retweets Figure 2(c) and Figure 3 as an indicator of influence (Barnett, Bigdeli, and Sams 2016), it seems that factual information during posting messages had the impact.

b) Daily Facebook Page Activity

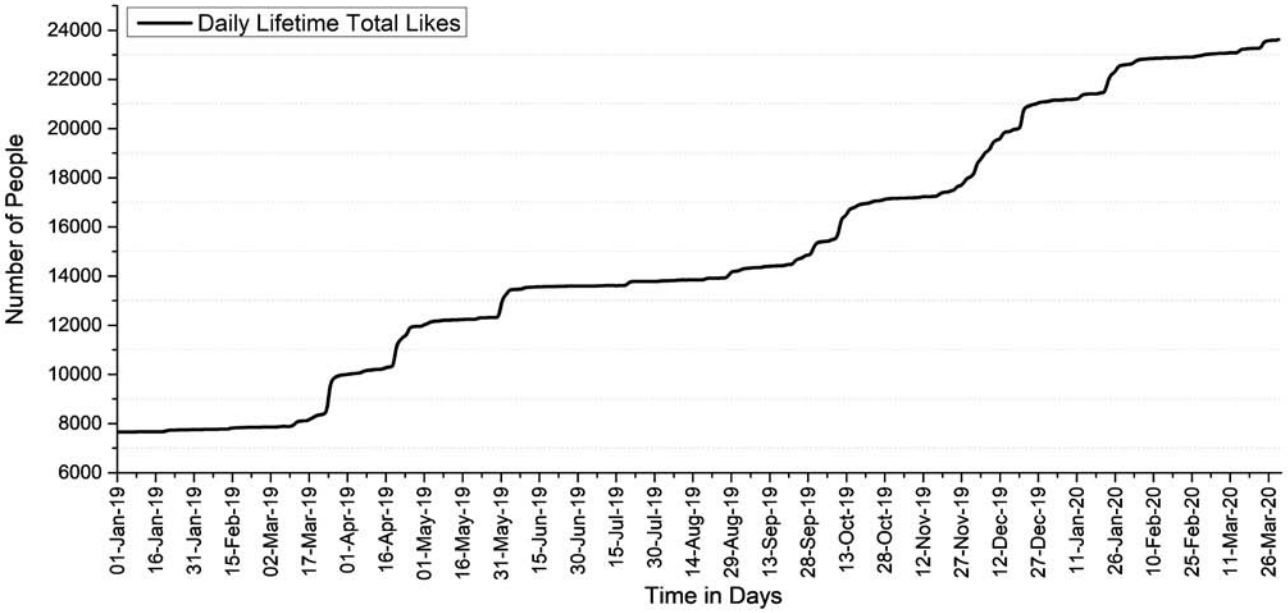

Figure 4: Number of Facebook daily lifetime total likes on the KMD account between the study periods

To assess the impact of the social media platform, the daily number of KMD Facebook page likes and posts were obtained between 1st Jan 2019 and 31st March 2020. It was noticed that there was rise in the number of likes on the KMD Facebook page account each day, as reported on Facebook analytics Figure 4.

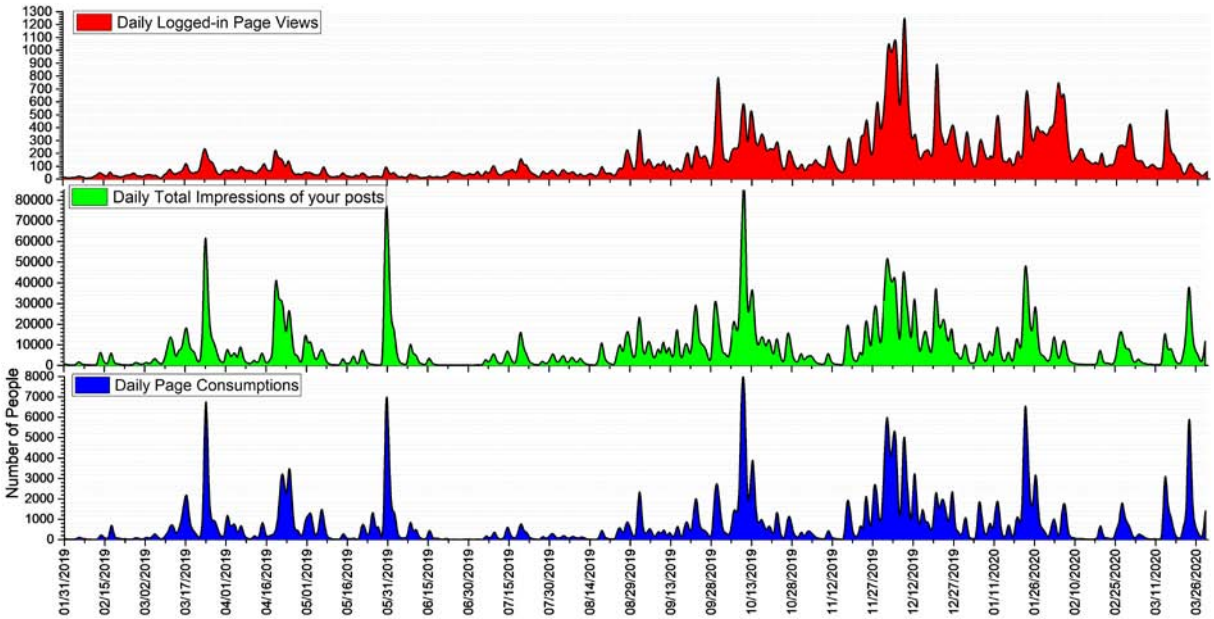

Figure 5: A temporal comparison of daily logged-in, impression, consumption counts, and the number of people who accessed the weather and climate information

Having analyzed the total daily likes on KMD Facebook page, which showed a gradual increase of followers from the beginning of the study period, the study turns now to the number of people who logged-in, these people who were impressed by KMD post and lasting the number of people who consumed the message each day. Again, Figure 5 lends preliminary, but lastly, support for the concept that the number of people who viewed weather and climate information on a given day on Facebook, provides a valid indicator of public attention corresponding with the number of messages posted that day Figure 8. It can be realized that the highest number of users who logged-in to the KMD Facebook page was on 9th Dec 2019 with 1513 people followed by 1180, 1115, 1148, and 1048 on 21st Dec 2019, 3rd Dec 2019, 06th Dec 2019, and 5th Dec 2019, respectively. The highest number of the impressed people was realized on 10th Nov 2019 with a total number of 105,461, followed by 95,296 and 81,148 on 31st May 2019 and 25th March 2019, respectively. Lastly, the highest number of people who consumed the message was on 25th March 2019 with 9310 followed by 9270 and 8622 on 31st May 2019, and 22nd Jan 2019 respectively.

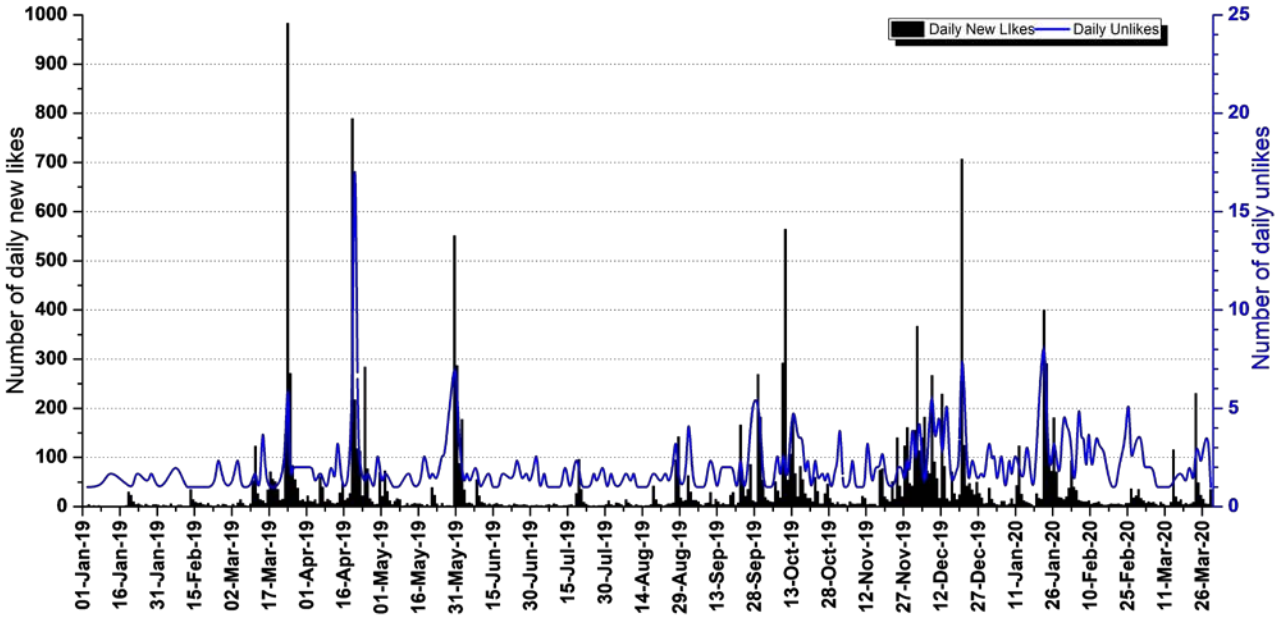

Figure 6: A temporal comparison of daily new likes and unlike counts

The Facebook account allows us to assess in detail the impact of each message or post both in real-time and from the moment it was posted to days, weeks, and months afterward. The Audience Insights from KMD Facebook were used to monitor communications. Since the simple statistical analysis of outreach was insufficient to gain a proper insight Figure 4, Figure 5 and the study needed to understand also the semantics of messages so that we can better correlate weather and climate information with environmental behavior, i.e. not just whether followers respond to a post, but how they responded Figure 5, Figure 6, Figure 7, Figure 8 and Figure 9.

From the quantitative aspects Figure 6, the number of daily new likes and unlikes was plotted. It can be realized that there was an increase of daily new likes, which was more than daily unlikes. The highest daily new likes were observed on 25th March-2019 with 983 new likes, followed by 789 on 20thApril-2019 and thirdly 707 on 21st Dec-2019. The highest number of unlikes was also considered. On 21stApril-2019 recorded the highest number of unlikes 23, followed by 10, on 21st Dec-2019 and 23rd Jan-2020 each.

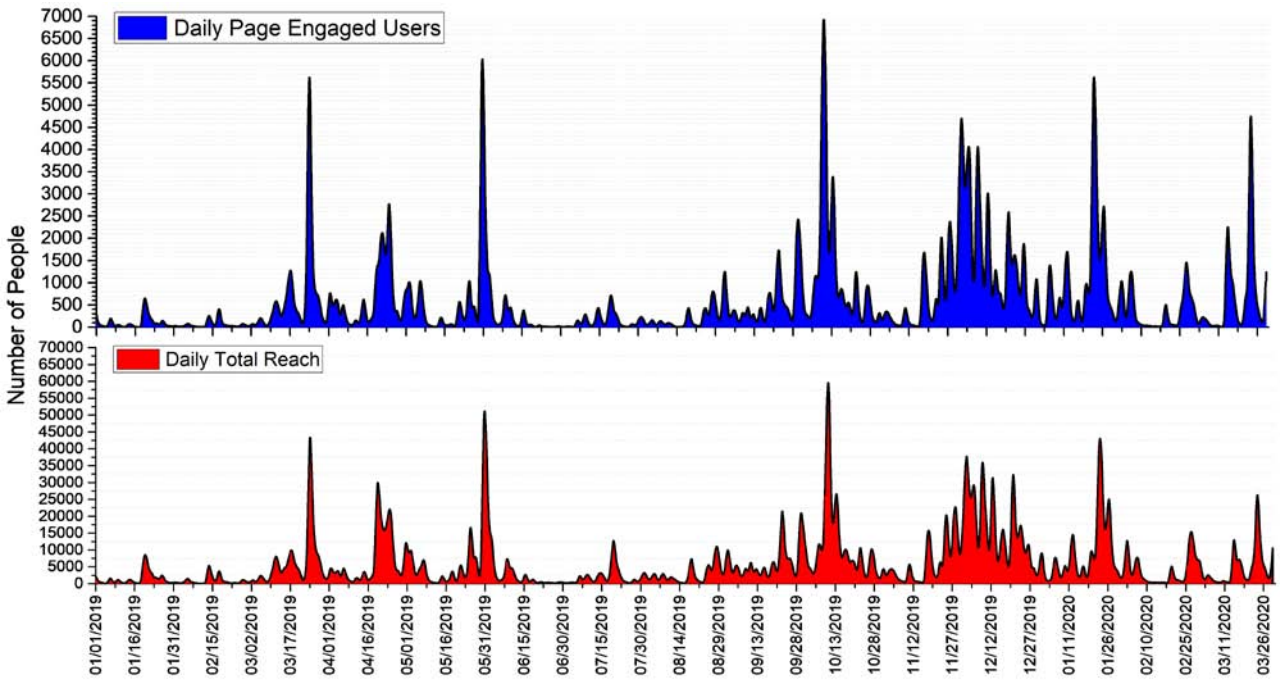

Figure 7: Daily count for KMD Facebook page engaged users and total reach

Figure 7 gives the daily Facebook engaged users and, total daily users reached over the study period. It can be noted from Figure 7 above that the highest users engaged were on 31st May-2019, 25th March-2019 and, 10th Oct-2019 with 7982, 7709, 7448 users respectively while, the highest total daily reach was on 11th Oct-2019, 31st May-19 and, 25th March-2019 with 70931, 60984, 56755 users, respectively. There is a direct relationship with the engaged users with the total reach; the more the engaged users, the more total users reached.

c) *Daily Facebook Video Activity*

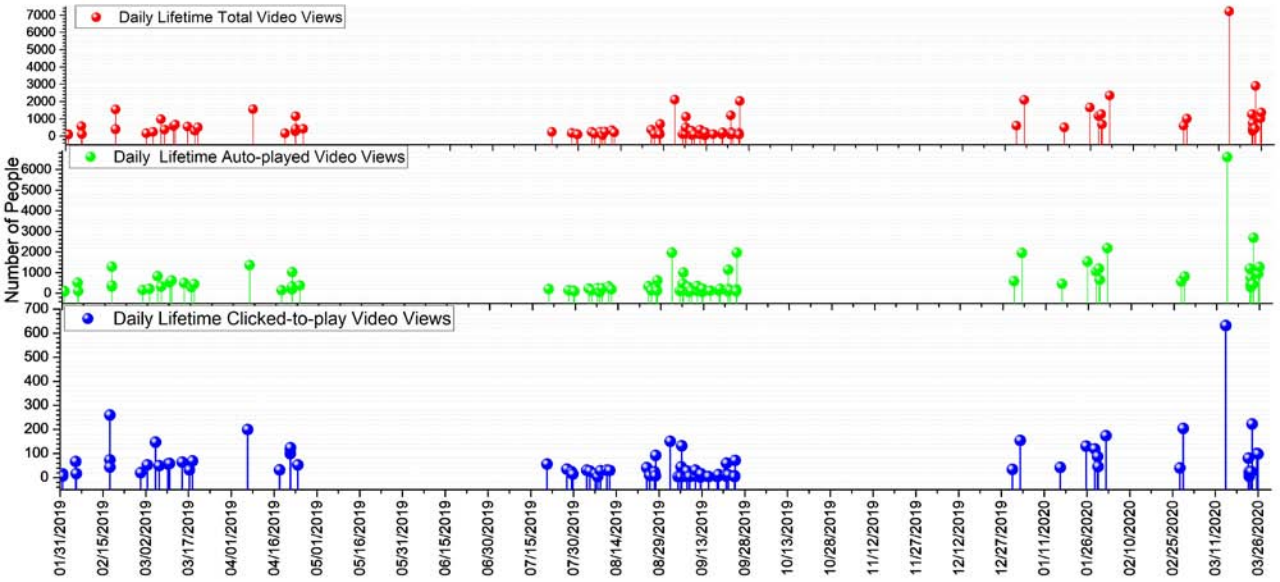

Figure 8: Daily count for KMD Facebook page Lifetime total video views, daily Auto-played video views and the daily Lifetime clicked-to-play video views reached

Figure 8 plots daily Lifetime total video views, daily Auto-played video views, and the daily Lifetime clicked-to-play video views reached. 53 weather and climate information videos were posted during the study period. The highest total video viewed was on 2nd Sep-2019 at 9:12 am followed by 25th Sep-2019 at 5:36pm, and 7th April-2019 at 6:16 pm with 2109, 2028, 1562 total video views users, and 1959, 1957 and 1363 total

Lifetime Auto-played Video Viewed respectively. Lastly, the highest total Lifetime Clicked-to-play Video Views was observed on 18th Feb-2019 at 0:09 am followed by 7th April-2019 at 6:16pm, and lastly on 2nd Sep-2019 at 9:12 pm with 260, 199, and 150 viewers respectively.

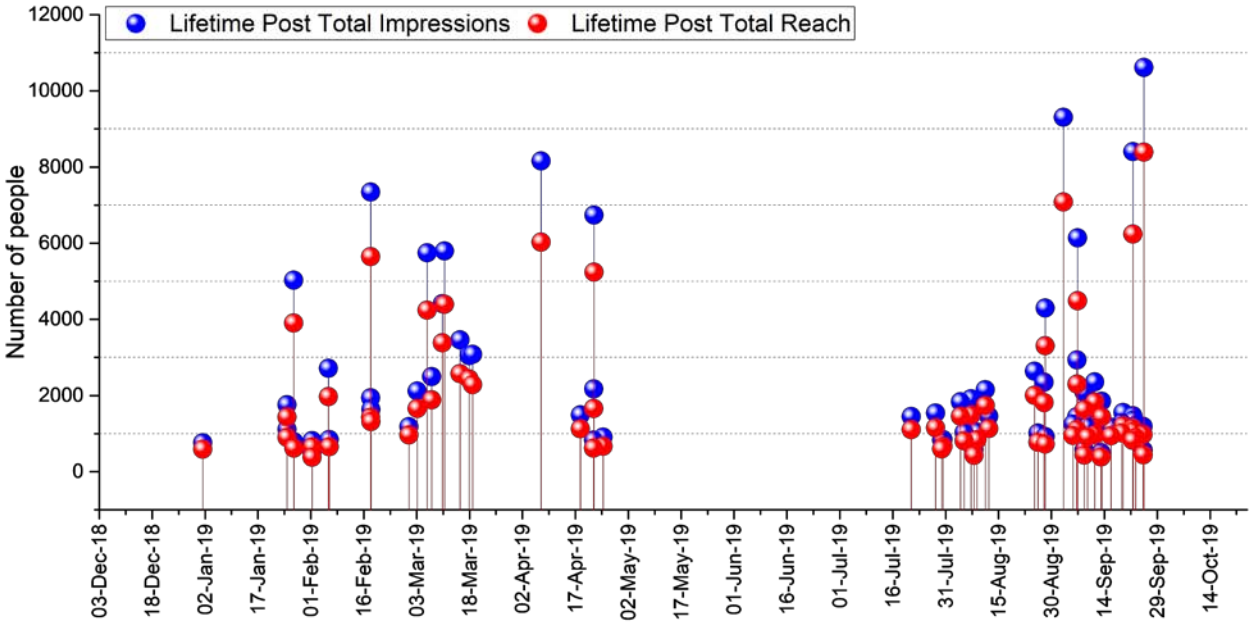

Figure 9: Number of post videos per day showing the daily video lifetime post total impressions and video lifetime post total reach

Figure 9 depicts the number of posts on a daily basis, stratified by posts by KMD. These weather and climate information video posts were infrequent throughout the study period, reaching a high of 10,617 users on 25th Sep-2019 at 5:36 pm for the lifetime post total impressions, followed by 9305, and 8402 users on 2nd Sep-2019 at 9:12 pm, and 22nd Sep-2019 at 3:12 pm respectively. It was observed that the highest number of users for the daily video lifetime pot total reach was on 25th Sep-2019 at 5:36 pm with 8388 users followed by 708, and 6238 users on 2nd Sep-2019 at 9:12pm, and 22nd Sep-2019 at 3:12 pm respectively.

Gender and Age

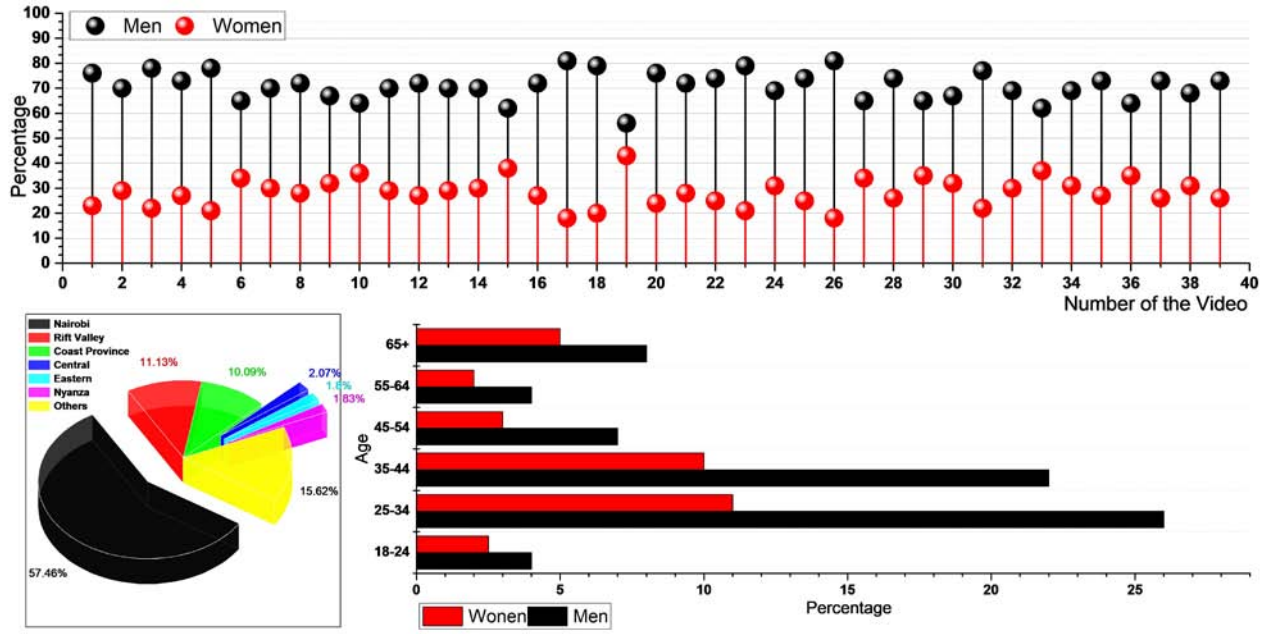

Figure 10: Socio-demographic characteristics of followers and their level of interaction on KMD social media accounts

The socio-demographic characteristics of users are shown in Figure 10. It shows that 57.46% of users were from Nairobi, followed by 11.13%, 10.09%, and 2.07% for Rift Valley, Coast, and Central Provinces respectively. While Eastern, and Nyanza Provinces accounted for 1.8% each. The remaining Provinces (Western, North Eastern, and Northwestern) accounted for 15.62%. The majority of the users were in the age group of (25-34) years, an indication the majority of them were in active age. Also, 26% of the users were male, while 11% were female. Approximately 22.2% of male, and 10% female in the age group (35-44) years accounted for the second proportion of the users using social media, followed by 65+ years, (45-54) years, (55-64) years finally, the lowest percentage was from the age group (18-24) years. In general, it was observed that the total performance ratio ~71% men: ~29% of women were accessing weather and climate information through social media.

IV. Limitations and Future Work

Weather and Climate Information are the most critical messages regarding the protection of life and property and should be prioritized in research like this. Facebook and Twitter have become a massive social network where many lifestyles interact on the same playing ground. This research aimed to identify Facebook and Twitter's place as a weather and climate information channel and continue a discussion about optimizing the use of these platforms; while it is not the top choice for weather information, it remains a choice for users.

While this study could stand to benefit from a larger user base, it was intentionally limited to only Facebook and Twitter users and followers. In this case, we aimed was to understand more about Facebook and Twitter as a weather and climate information channel. It is likely, though, that these two social media methods reached users less liable to rely on television, radio, newspapers, websites, and local/communities as an information channel. Thus, speculation about the preference for this other communication Media as a weather and climate information channel to the users may be reserved for another study with an alternate distribution method.

Earlier research recognized a necessity to understand weather communication on a variety of platforms (Rouge 2019). For example, scientists may examine when people prefer radio to a website, what type of weather information people prefer on Twitter versus Facebook, and how different segments of the users are using these channels. We also encourage similar studies on weather and climate information communication on Facebook, Twitter and other channels. So scholars should continue to work with practitioners to optimize communication on Facebook, Twitter and all other social channels available to information clients (Resource 2009).

V. Discussion and Conclusions

The aim of this study was to demonstrate the impact of social media on the dissemination of weather and climate information by KMD. From the results, it is evident that social media was impactful as a means for communicating to weather and climate information. With its massive reach and ability to convey real-time information, social media could drive weather and climate information efforts. This study also clearly shows that the majority of the users (~71%) men access weather/climate information as compared to ~29% of women. It is evident from the study that (57.48%) of users were from Nairobi, which is the capital city of Kenya. A close observation also shows that (11.13%, and 10.09%) of the users were from Nakuru and Mombasa which are also big towns in Kenya.

On Twitter, for example, messages occasionally go ''viral''-they are transmitted and retransmitted (retweeted) many times in a short period. This happens for several reasons, most of which are related to the content of the message and the significance of the user who posted the original message within an expansive and active network of other users. The study findings also confirm the difference in access or the digital divide hypothesis. From the analysis its evident that higher percentages of young (25-34) years, male-26%, and educated people are found to be more likely to receive more tweets and Facebook messages as compared to the other gender and age groups.

The study also found a bimodal relationship between the number of social media users and the age group with gender and percentage disparities. With increase in wellbeing due to employment opportunities, the users in social media initially increases, probably due to the increased access to the internet and mobile devices by age groups (25-34), and (35-44). After reaching a turning point of age group (45-64), the users; in social media decreases probably because of a lack of motivation among the wealthy class.

VI. Future Prospects

The nature of the study is exploratory, in this paper, data was gathered only from Twitter and Facebook only. It may be possible that users from different other main stream media (TV, Radio, Newspapers, websites, mobile phones, etc.) have a different response. Future research should involve this media. Social media alone cannot be effective without enlarging it with other traditional media channels like radio, newspaper, or TV even though it is widely reported that the effectiveness of traditional media and their use is sharply falling. In general, it is worth having a

social media strategy in place to manage the enormous challenges that social media brings.

This study offers interesting opportunities even though; it is not fully researched, it is however, worth replicating with Meteorological Agencies from the IGAD region to fully determine whether social media networks are effective as the finding of this study suggests.

VII. Recommendation

Since this is a very vital and new phenomenon it is suggested that further research to study this phenomenon would be appropriate. From a meteorological agency standpoint, there is a huge potential on social media, and with the resources that KMD has got, they should consider expanding their social media strategies to include daily national TV and radio live streaming weather and climate information.

KMD should measure its social media metrics; for example, if they want to measure weather and climate awareness, they would need to monitor growth, likes, subscribers and product awareness. As for loyalty, the thing to look at would be engagement and influence. Engaging users online to implore recommendations would also give the KMD insight to co-innovate. KMD can also use the power of social media to implement other vertical services that could instantly bring value to the department in terms of its services.

Author Contributions: The research was conceptualized and written by MISIANI Zachary and LUN Yin The study design and data analyses were undertaken by MISIANI Zachary under the supervision of LUN Yin Additionally, Mwai, Lorez, Marta, Antonine, Xiaohan and Yanyan provided project oversight and supervision.

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Conflict of interest: The authors have no conflict of interest to declare.

Notes: As at 31st March 2020, Kenya Meteorological Department (@MeteoKenya) had 22, 700 followers while KMD Facebook page (www.facebook.com/KenyaMeteorologicalDepartment/) has more than 26, 343 followers with 25, 597 total likes.

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Behaviour of Some Grasslands on the Slopes of the Balkan Mountain

By Dimitar Mitev

Abstract- The study includes results of a 20-year (1994-2013) period of use of a number of artificial grasses. They have been established with seeds of local origin and are located in the region of the Central Balkan Mountain. Habitats have different exposure of the slopes to the main cardinal points of the world and a variety of soil gleying.

When the grasslands are located on different habitats, the presence of a certain rhythm in the formation of the fodder mass is established. The yields were higher in the odd years (1995, 1997, 1999, 2001) in comparison with the even ones (1996, 1998, 2000). The sequence changed in 2002, 2004, 2006, 2008, 2010. The yields were again higher in the odd years (2011, 2013) than 2012.

The behaviour of the grasslands, located on slightly gleyed soils with eastern and southeastern exposure, follow the sequence mentioned above more clearly. Those in other habitats were accompanied by too much variety in their behaviour over the years and variants.

New elements are added to the various views and hypotheses on the origin of species, about their evolution and the causes of the behaviour of the grasslands.

Keywords: productivity, meadow grasses, slopes, balkan mountain, hypotheses.

GJSFR-H Classification: FOR Code: 961405

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I. Introduction

Certain concepts have caused the import and wide use of foreign meadow species in Bulgaria (Mihovski and Yancheva, 1998; Stoeva 2001; Churkova, 2014, etc.). The grasslands that have been established do not meet the local habitat requirements, which results in their rapid degradation. A number of studies conducted in Bulgaria show the impossibility of creating quality and long-lasting meadow grasslands by imported seeds (Totev, 1984; Mitev, 1997; Stoeva 2001, etc.). That imposed the need to conduct a wide selection program for the creation of cultivars of local origin meeting the habitat conditions. Species of local origin are a considerable source of creation of new cultivars (Goranova-Naydenova, 2002; Mitev, 1997; Nedelnik et al. 2015). Many regions of the Balkan Peninsula in general, and Bulgaria in particular, include a number of secondary centers of formation, directly related to the main one of the Alps (Kozhukharov, 1986). This leads to the formation in Bulgaria of some of the richest natural and semi-natural communities in the world (Martinkova et al., 2018). The meadow species must correspond to the specifics of the habitat of the Central Balkan Mountain. Soils can be of heavy mechanical composition, with the presence of microelements, especially aluminum, in toxic concentrations, and subjected to erosion with carbonates on the surface (Palaveev and Totev, 1983).

The aim of the present study is to establish the persistence of some artificial meadow grasslands, located on the slopes of the Central Balkan Mountains, with different exposure to the main cardinal points of the world, characterized by slight and high degree of soil gleying.

II. Material and Methods

The experiment was conducted under the conditions of the foothill part of the Central Balkan Mountain, in the region of the town Troyan.

Picture 1: A panoramic view of the region – photo credit Peter Savov

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The grasslands are located on pseudopodzolic soils with slight and high degree of soil gleying, at high and low part of the mountain slopes, respectively (Penkov, 1998). The exposure to the cardinal points of the world is eastern, southeastern, northeastern, western, and northern. A scheme for ecological testing of local cultivars and populations of meadow grasses created in the region has been formed (Mitev and Belperchinov, 2000). The soils with a slight degree of gleying are characterized with $pH_{/KCl/}$ - 4.7; exchange cations in meqv/100 g soil: Al – 0.6-1.0; Mn-0.3-0.8; Ca + Mg – 0.9-11.1. The soils with a high degree of gleying are characterized with $pH_{/KCl/}$ - 3.9 - 4.0; exchange cations in meqv/100 g soil: Al – 1.3-1.6; Mn – 0.6-1.3; Ca+Mg – 3.6-4.5.

The experiment was set up in the spring of 1994, by the blocking method, in 4 replications, with the size of the experimental plot of 4 m^2. 800 germinable seeds per 1 m^2 were sown in soil that was brought to a garden state. The components in the mixed grasslands took up 1/2; 1/3; 1/4 of the seeding rates for a pure crop according to the variants. They were scattered by hand. Fertilizing was conducted in every other year with P80 $kg.ha^{-1}$ and K80 $kg.ha^{-1}$ since 1995, before the beginning of the vegetation of grasses in the area. The soil was fertilized on yearly basis with N80 $kg.ha^{-1}$ since 1995 in the beginning of vegetation period of grasses. The grasslands were cut off when entering the phase of full tasseling - beginning of flowering for grasses and bud-formation - beginning of flowering for legumes. Dry matter yield was registered. Under circumstances beyond the control of the author, some of the habitats were harvested for a shorter period than indicated. The following types of grasslands were studied: 1 var. - red fescue - pure crop; 2 var. - red fescue + tall fescue; 3 var. - red fescue + Kenthucky bluegrass; 4 var. - red fescue + bird's-foot-trefoil; 5 var. red fescue + tall fescue + bird's-foot-trefoil; 6 var. - red fescue + Kenthucky bluegrass + bird's-foot-trefoil; 7 var. red fescue + Kenthucky bluegrass + alfalfa; 8 var. - red fescue + cock's foot + red clover + bird's-foot-trefoil. The seeds are of local origin with the exception of red clover ('Viola' cultivar) and cock's foot ('Dabrava' cultivar), which is Bulgarian (Mitev and Belperchinov, 2000).

A significant part of the results obtained over the years have been published periodically, using a different sequence and point of view of their interpretation (Mitev and Naydenova, 2014; Mitev and Naydenova 2015a; b; c; Naydenova and Mitev 2017; etc.)

The precipitation regime of the region has a continental character, but is strongly influenced by the Balkan Mountains. For a 35-year period (1965-1994), the average annual precipitation amount was 737.3 mm. In 1994, 1995, 1998 it was equal to the average for that region. In 1996, 1997, 1999, 2001, 2003, 2008, 2011, 2012, the precipitation amount was less compared to the average for the region. In 2002, 2004, 2006, 2007, 2009, 2010, 2013, it was higher. Significant differences were registered in 2000, when the precipitation was much less (520.3 mm) than the average for the region. In 2005, it was almost twice (1394.1mm). In spring, the precipitation amount was higher than in autumn. For the vegetation period (March-October), it was on average 599.7 mm. It should be noted that in 2000, precipitation was extremely small in the period March-October - respectively 244.4 mm.

The average annual temperature (1964-1994) for the region was $+9.7^0$C. During the vegetation period March-October it was $+13.6^0$C.

III. Results and Discussion

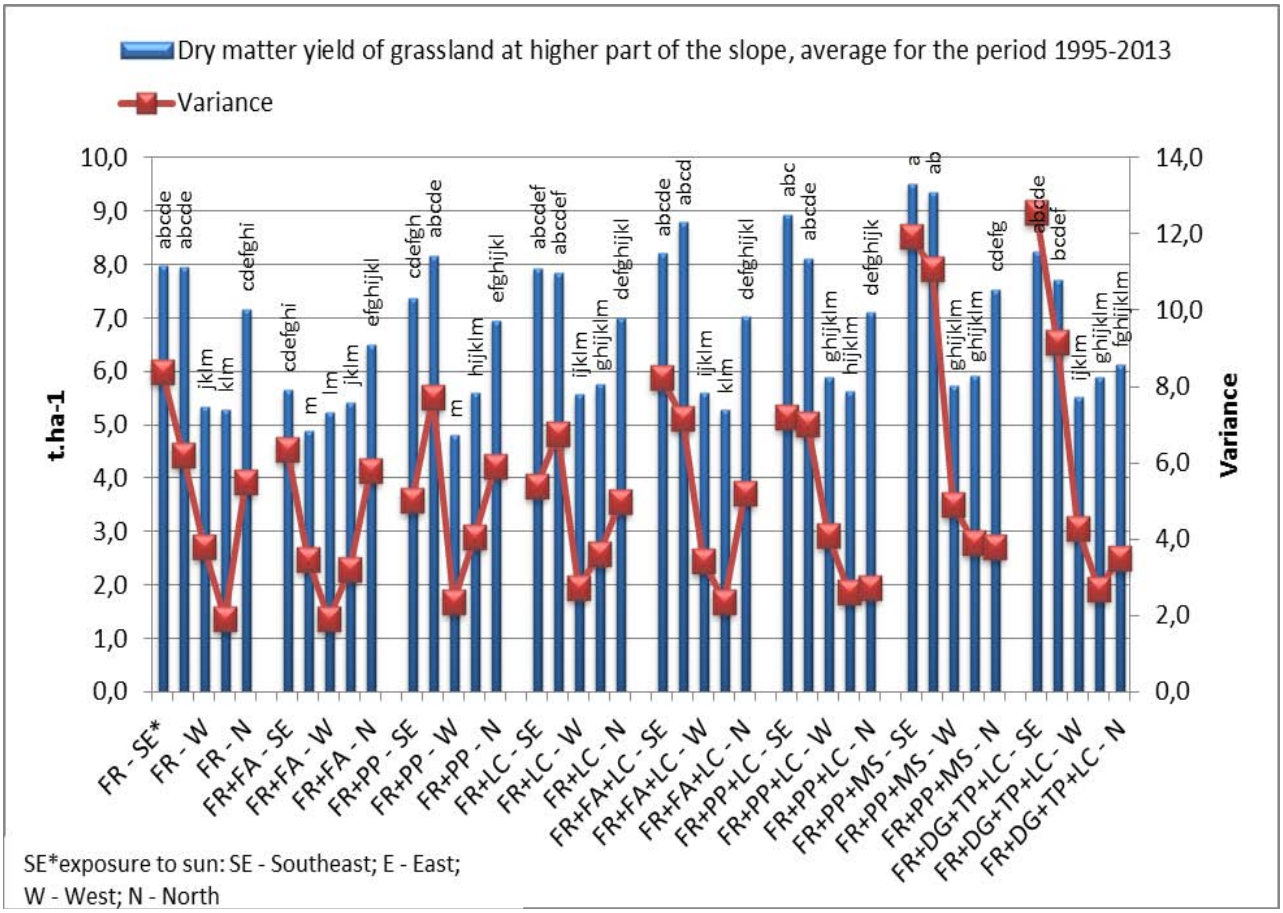
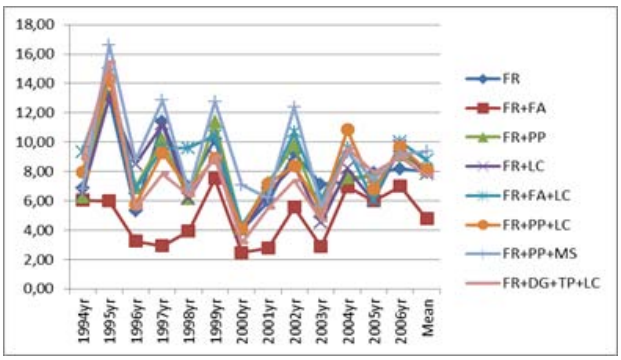


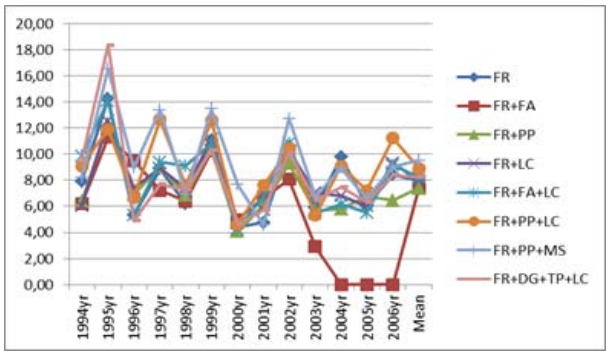
Figure 1: Dry matter yield of the grassland, slightly gleyed soils, high part of the slope, t.ha^{-1}, average for the period 1994 – 2013

On soils with a slight degree of soil gleying, high part of the slope, there were significant differences in productivity ($P < 0.05$) on average for the period depending on the exposure to the Sun (Figure 1).

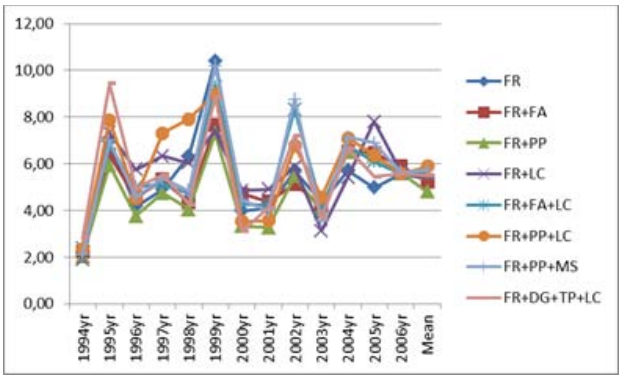
The highest average yields, but combined with a very high degree of variation over the years, were obtained by mixing red fescue with Kenthucky bluegrass and alfalfa, eastern and southeastern exposure of the slope. This mixture is most productive in the western exposure of the slope, slightly gleyed soils Slightly gleyed soils provide double mixtures of red fescue with bird's-foot-trefoil or Kenthucky bluegrass, a combination of high productivity with relatively high yield stability. On the western slope, eroded soils, the studied variants do not differ significantly in productivity. Under these conditions, the most stable yield was gathered from a pure crop of red fescue.



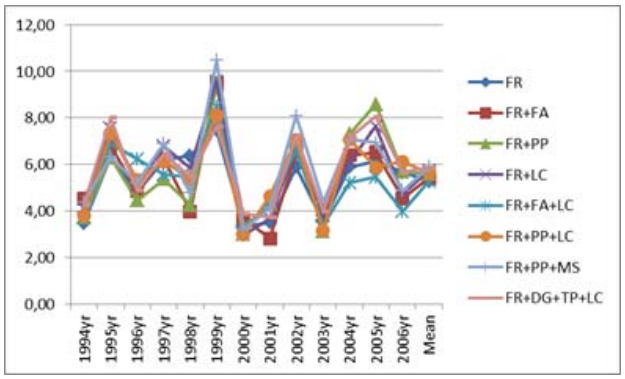
A) Eastern exposure, slightly gleyed soils (t.ha^{-1})



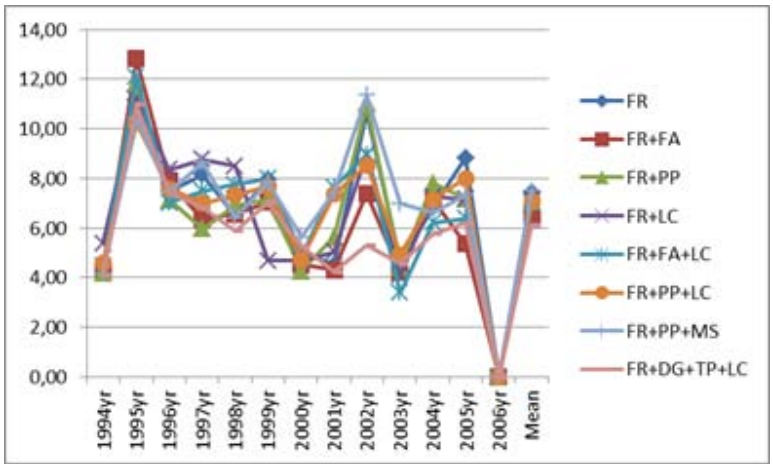
B) Southeastern exposure, slightly gleyed soils (t.ha^{-1})



C) Western exposure, slightly gleyed soils (t.ha^{-1})



D) Western exposure, eroded soils (t.ha^{-1})



E) Northern exposure, slightly gleyed soils (t.ha-^{1})

Figure 2: Dry matter yield of the grassland, slightly gleyed soils, high part of the slope, t.ha-1, by years in the period 1994 – 2013

The highest productivity was registered in the second year (1995) at eastern and southeastern exposure on slightly gleyed soils as it decreased gradually. A certain rhythm in the formation of fodder mass by variants over the years was found (Figure 2 a; b). The yields were higher in the odd years (1995, 1997, 1999, 2001) in comparison with the even ones (1996, 1998, 2000). The sequence of the rhythm of productivity changed. It was higher in the even 2002; 2004; 2006; 2008; 2010, compared to the odd 2003; 2005; 2007; 2009. The yields were again higher in the odd years (2011, 2013) than 2012. An example for that is the yield of red fescue, cock's foot, red clover and bird's-foot-trefoil (8th variant), at eastern exposure. The yield in 1995 exceeded that of 1996 2.8 times (Figure 2a). The excess in productivity at eastern exposure, of grassland of red fescue, tall fescue and bird's-foot-trefoil in 2001 (8th vegetation) compared to 2000 was 2.53 times. Occasionally, small deviations in trends are found in some grasslands during the years of study At the southeastern exposure (Figure 2b), the yield from the mixed grassland of red fescue, Kenthucky bluegrass and bird's-foot-trefoil in 2000 (7th vegetation) was 7.64t.ha^{-1} and exceeded 2001 (4.57 t.ha^{-1}) At eastern exposure, the grassland of red fescue and Kenthucky bluegrass exceeded 2.6 times the productivity in the even 2008 compared to the odd 2007 (Figure 2a). On average over a 20-year-period (1994–2013), the productivity of pure crop of red fescue, at southeastern exposure, slightly gleyed soils was equal to that of mixed grassland of red fescue and Kenthucky bluegrass, as well as red fescue, tall fescue fescue and bird's-foot-trefoil (Figure 1).

The highest productivity was registered after 2000 at western exposure of the slope, slightly gleyed soils, in comparison with the previous period (1994-1999) (Figure 2b).

An exception is found in the grassland of red fescue, cock's foot, red clover and bird's-foot-trefoil. It reached the highest productivity (9.45 t.ha^{-1}) in the second year since the beginning of the experiment (1995). In the period 2004-2006, the productivity was significantly equal in this habitat.

At western exposure, eroded soils, the difference in productivity between even and odd years was less pronounced in the period up to 2000-2001 than in the following years (Figure 2d). In 2005 – 2006 a significant closeness was found in the productivity of grasslands.

The comparison of the productivity obtained from the grasslands at western exposure, located on slightly gleyed soils (Figure 2c) with those subjected to erosion (Figure 2d) shows a peculiar specific behaviour. On eroded terrains the conditions for growing grasses are significantly more unfavourable. It is expected that their productivity will be lower than that obtained at the same exposure, but on poorly gleyed soils. In the latter, the soil layer is significantly more powerful, with greater moisture capacity and moisture retention, and nutrients are more. At the western exposure discussed here, the largest excess in the productivity was registered in the mixed grassland of red fescue and Kenthucky bluegrass on eroded soils, in comparison with the slightly gleyed ones. In a single year (2000), their yields were equal for both habitats. Similar behaviour was found in the grassland of red fescue, cock's foot, red clover and bird's-foot-trefoil. Over the years, the productivity of a pure crop of red fescue; red and tall fescue; red fescue and bird's-foot-trefoil; red fescue, tall fescue and bird's-foot-trefoil, located on eroded soils was greater than that on poorly gleyed ones. The highest productivity was gathered from the grassland of red fescue and bird's-foot-trefoil at both habitats with western exposure (Figure 2 c; d). On poorly gleyed soils it (7.81 t.ha^{-1}) was obtained in 2005 (12th harvest year). On eroded soils (7.57 t.ha^{-1}), it was in the 6th year since the beginning of the experiment. The average productivity (Figure 1) of grassland of red fescue, Kenthucky bluegrass and bird's-foot-trefoil was higher on the western slope, slightly gleyed soils, compared to that on eroded soils. The productivity of red fescue, Kenthucky bluegrass and alfalfa over the greater number of years of the study was higher on eroded soils, western slope (Figure 2d) compared to slightly gleyed, at the same exposure (Figure 2c). Their average productivity for the period is absolutely equal (Figure 1).

At northern exposure, slightly gleyed soils (Figure 2e), the highest productivity was in the second year (1995) since the establishment of the grasslands. In the following years, a relative similarity in productivity was established by variants. There are some exceptions: Yields from the mixed grassland of red fescue and Kenthucky bluegrass in 1995 (2nd vegetation) and those in 2002 (9th vegetation) were close (11.79 t.ha^{-1} and 11.02 t.ha^{-1}). The highest productivity (11.35 t.ha^{-1}) of the mixed grassland of red fescue, Kenthucky bluegrass and alfalfa was found in the 9th vegetation (2002) since its creation.

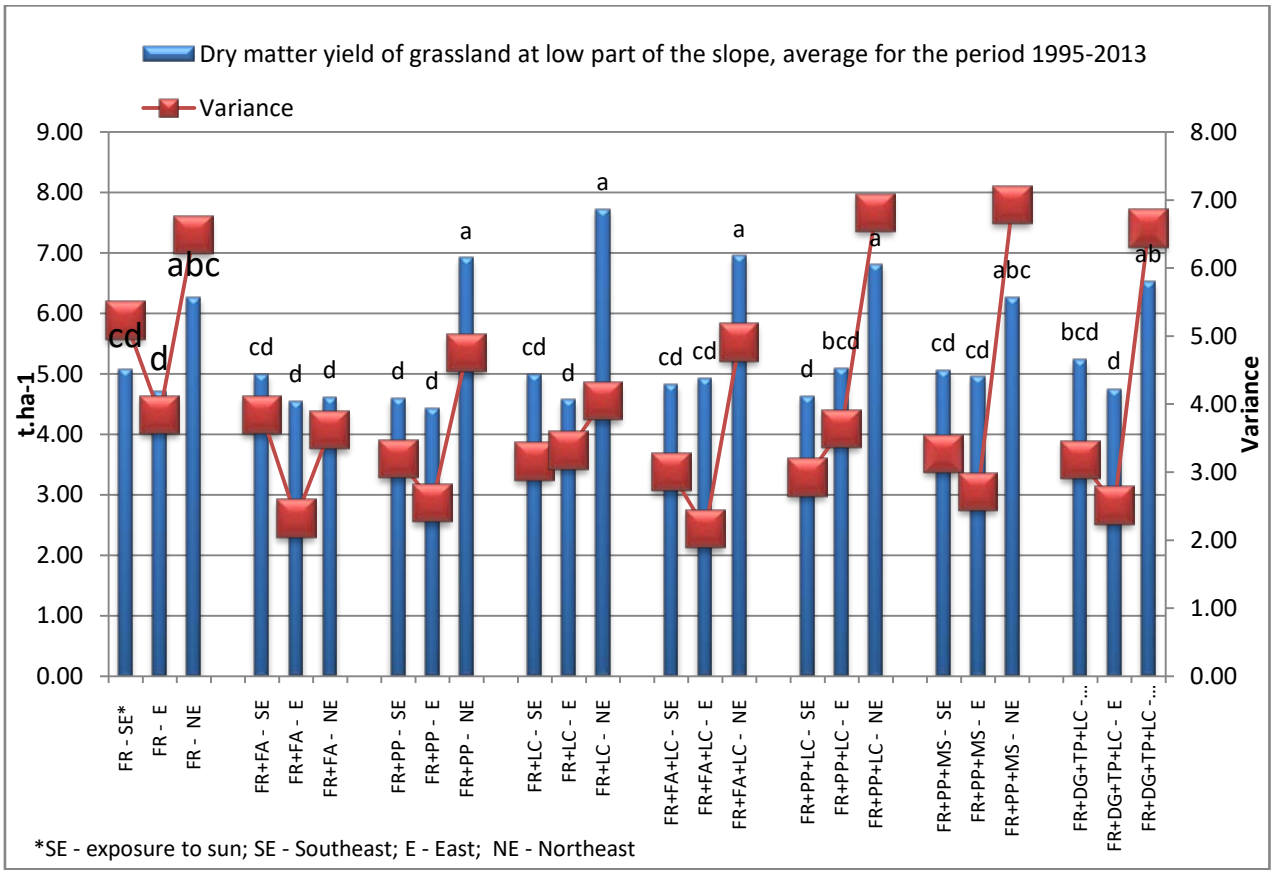
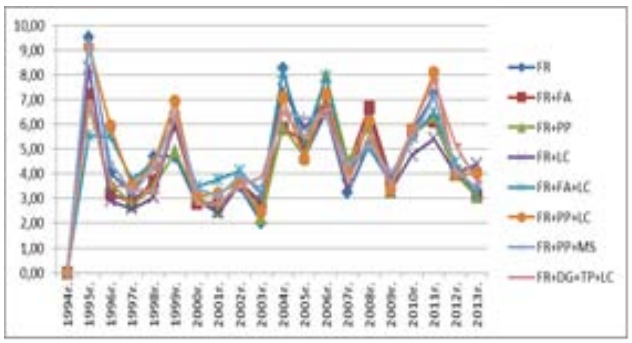


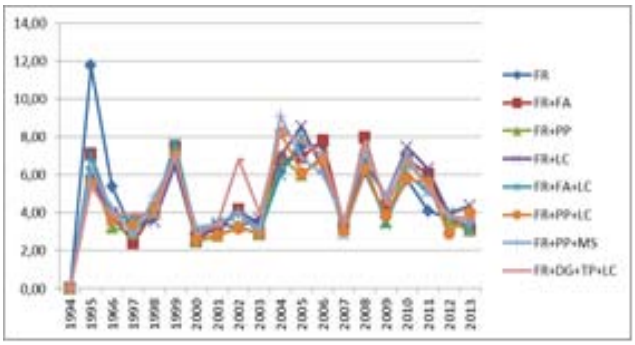
Figure 3: Dry matter yield of grasslands, highly gleyed soils, low part of the slope, t.ha^{-1}, average for the period 1994-2013

The average productivity of grasslads located on highly gleyed soils (Figure 3) was lower (P <0.05) compared to soils with a low degree of soil gleying (Figure 1). An exception was found in the mixed cultivation of red fescue with tall fescue. The location of grasslands, containing Kenthucky bluegrass and bird's-foot-trefoil on highly gleyed soils, low part of the slope has a significant impact on productivity, depending on its exposure to the Sun (Figure 3).

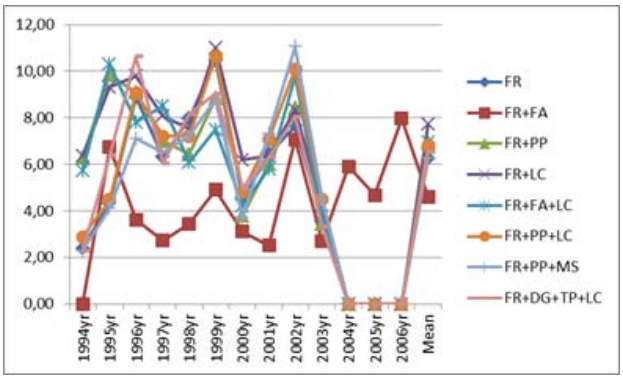
The yields of grasslands on highly gleyed soils, at northeastern exposure, are significantly higher than at eastern and southeastern locations, with the same level of soil gleying (P <0.05) - (Figure 3). At the same time, the highest variation under the influence of different conditions over the years was at the northeastern exposure. The double mixture between red fescue and bird's-foot-trefoil combine high productivity and relatively high yield stability. With a high degree of gleying, a low part of the slope, the increase in the number of components in the grassland, as well as the use of other legumes (red clover or alfalfa) did not contribute to yield stability over the years. It can be considered that under these conditions the variation in productivity over the years can be significantly reduced by growing red fescue in mixtures.



A) Eastern exposure, highly gleyed soils (t.ha^{-1})



B) Southeastern exposure, highly gleyed soils (t.ha^{-1})



C) Northeastern exposure, highly gleyed soils (t.ha^{-1})

Figure 4: Dry matter yield, t.ha^{-1}, highly gleyed soils, low part of the slope, by years in the period 1994-2013

The sequence in the behaviour of grasslands in highly gleyed soils at lower part of the slope (Figure 4), in terms of alternating the level of productivity in even-odd years, was better expressed after the year 2000. There is a certain variety of variants and years, different from the established one, especially in soils with low gleying, eastern and southeastern exposure (Figure 1).

At the eastern exposure, highly gleyed soils productivity in 1997 was lower than in even 1996 and 1998 (Figure 4a). The pure crop of red fescue was most productive (9.5 t.ha^{-1}) in 1995 (2nd vegetation). The same is found for the grassland with red fescue and tall fescue (7.18 t.ha^{-1}), as well as for red fescue and bird's-foot-trefoil (8.29 t.ha^{-1}); redi fescue, Kenthucky bluegrass and bird's-foot-trefoil (9.13 t.ha^{-1}); red fescue, Kenthucky bluegrass and alfalfa (9.26 t.ha^{-1}). The mixed grassland of red fescue and Kenthucky bluegrass was the most productive (7.97 t.ha^{-1}) in 2006 (13th vegetation), while that one with red fescue, tall fescue and bird's-foot-trefoil (8.10 t.ha^{-1}) in 2004 (11th vegetation). In the seven-year period (1994-2000), the pure crop with red fescue had lower average productivity in comparison with the grassland with red fescue, Kenthucky bluegrass and bird's-foot-trefoil, as well as the one with red fescue, Kenthucky bluegrass and alfalfa. In the period 1994-2006 (13 years), the pure crop of red fescue was compared to the grasslands of red fescue, Kenthucky bluegrass and bird's-foot-trefoil on the one hand, red fescue, tall fescue and bird's-foot-trefoil on the other, as well as red fescue, Kenthucky bluegrass and alfalfa.

Compared to other grasslands, its productivity was higher. The pure crop of red fescue, at eastern exposure, highly gleyed soils (Figure 3), formed more dry matter on average for the period 1994-2013 (20 years) compared to the mixed grasslands with tall fescue, Kenthucky bluegrass or bird's-foot-trefoil. Similar behaviour was found in the grassland of red fescue, cock's foot, red clover and bird's-foot-trefoil.

At southeastern exposure, highly gleyed soils, in most of the variants, the highest productivity was reached in the period 2004–2008 (11^{th}-15^{th} vegetation) (Figure 4b). Over the years 1996-1998 the productivity was very low, and in 1997 was the lowest. The pure crop of red fescue was most productive (11.74 $t.ha^{-1}$) in 1995 (2^{nd} vegetation). The highest productivity was gathered (7.50 $t.ha^{-1}$) from the mixture of red fescue and Kenthucky bluegrass in 1999 (6^{th} vegetation). Grasslands of red fescue, Kenthucky bluegrass and bird's-foot-trefoil; red fescue, Kenthucky bluegrass and alfalfa; red fescue, cock's foot, red clover and bird's-foot-trefoil were the most productive (respectively 8.26 $t.ha^{-1}$, 9.09 $t.ha^{-1}$, 8.31 $t.ha^{-1}$) in 2004 (11^{th} vegetation). The grasslands of red fescue and bird's-foot-trefoil, as well as of red fescue, tall fescue and bird's-foot-trefoil were most productive (respectively 8.53 t.ha-1, 7.96 $t.ha^{-1}$) in 2005 (12^{th} vegetation). The mixed grassland of red and tall fescue reached its maximum productivity (7.97 $t.ha^{-1}$) for the habitat conditions in 2008 (15^{th} vegetation). At this exposure of the slope, the pure crop of red fescue gave on average for the period 1994–2000 (7 years) and for 1994–2006 (13 years) more dry matter than all other grasslands included in the study. In the period 1994-2013 (20 years), the mixed grassland of red fescue, cock's foot, red clover and bird's-foot-trefoil gave (average) the highest yield of dry matter (Figure 3).

At the northeastern exposure, highly gleyed soils, low part of the slope, the predominant part of the variants realized their maximum productivity in the first half of the period covered in the study (Figure 4c). The mixed grasslands of red fescue and Kenthucky bluegrass, as well as of red fescue, Kenthucky bluegrass and bird's-foot-trefoil were the most productive (respectively 9.85 $t.ha^{-1}$, 10.31 $t.ha^{-1}$) in 1995 (2^{nd} vegetation). The one of red fescue, cock's foot, red clover and bird's-foot-trefoil (10.65 $t.ha^{-1}$) in 1996 (3^{rd} vegetation). The pure crop of red fescue (10.48 $t.ha^{-1}$), also the mixed grasslands of red fescue and bird's-foot-trefoil (11.01 $t.ha^{-1}$), as well as of red fescue, Kenthucky bluegrass and bird's-foot-trefoil (10.6 $t.h^{a-1}$) reached its maximum production in 1999 (6^{th} vegetation). In 2002 (9^{th} vegetation), it was found in the mixed grassland of red fescue and tall fescue (7.07 $t.ha^{-1}$), as well as in red fescue, Kenthucky bluegrass and alfalfa (11.06 $t.ha^{-1}$).

When located on a northeastern slope, highly gleyed soils, the pure crop of red fescue exceeded the average productivity of mixed grassland of red fescue and tall fescue, as well as red fescue, Kenthucky bluegrass and alfalfa for the period 1994-2000 (7 years). For the period 1994-2006 (13 years), the excess was only in the mixed grassland of red and tall fescue (Figure 4c).

The Earth as part of the system of the Universe is subjected to a constant energy impact, with a certain rhythm (Wong, 1997; Baggot, 2000; Madzharov et al, 2002, etc.). It could be assumed that the components of the environment, in this case soil differences with the respective biotic and abiotic part, diversity in sunshine, moisture irregularity, etc. treat this impact accordingly. Tracking the results in the present experiment, as well as those described in our other publications (Mitev and Naydenova, 2016; Mitev and Yasheva 1998; Naydenova and Mitev 2010 a; b, etc.) creates the impression of a kind of "pulsation of the systems". It is different, as a manifestation over the years, for each of the variants and is probably caused by the synchrony or lack of such with the rhythm in Nature, with its energy essence. This topic is discussed in a previous publication (Mitev and Naydenova, 2016). There is a certain interest in connection with the established change in the rhythm of productivity, especially in eastern and southeastern exposure, slightly gleyed soils. It is within a ten-year period, which coincides with that of the calendar. Unfortunately, the available results are very limited, but they are a great challenge.

Of particular interest are the results obtained at the southeastern exposure of the slope, highly gleyed soils for a 20-year period (1994–2013). Pure crop of red fescue was superior in productivity than a large part of the variants covered in the study. Only the grassland of red fescue, cock's foot, red clover and bird's-foot-trefoil surpassed that. The discussion on the advantages and disadvantages of simple (Mitev and Petrov, 1999) and complex (Hector, 1998) mixed grasslands and their comparison with pure crops has had a long history (Darwin, 1872; Mitev and Petrov, 1999; Naydenova and Mitev 2010a etc.). It has continued over the years with unceasing power (Sanderson et al., 2004). In this case, the species composition at the period of sowing the grassland is observed, and not the actual during the years of study. In the initial period of the study (1998-1999) cock's foot and red clover fell out of the grassland. The forage mass predominantly consists mainly of red fescue, self-sown bird's-foot-trefoil and some other meadow grasses of local origin (Mitev and Naydenova 2015b). In line with our previously developed hypothesis, some of the environmental factors may remain inaccessible for use by plants conditionally forever. Under specific conditions, this access could be increased. This determines productivity, grassland composition, development sustainability, self-recovery, etc. (Mitev, 2004; Mitev and Naydenova, 2012). It is supposed that the comparison in productivity of grasslands, especially in the behaviour of the mixed one of red fescue, cock's foot, red clover and bird's-foot-

trefoil, verifies the hypothesis above. The reasoning in this regard can be supplemented by the understandings of Hensel, (1892) on the specifics of mineral nutrition in plants. The factors of impact (soil, climate, space, ...) on the plants definitely differ depending on the exposure and the location on the slope. Within each specific habitat, they are the same. What then forms the variety of behaviour by variants? We assume that the results discussed here are indicative of how species relationships affect the behaviour of grasslands (Schmid, 2002). A point of discussion is what is decisive in this case: Do the relationships between plants affect the consumption of environmental resources (Bostan et al. 2012; Virteiu, Ana Maria, 2015, etc.), or their consumption shapes them (Luo et al. 1995). Synthesis of allelopathic compounds requires the availability of sufficient energy and nutrients in plants. If these by-products can change the conditions for competition and those of the environment, they are obviously of evolutionary importance. Luo, 2005). There are authors who categorically reject the role of allelopathy in the relationship between plants (Delgado et al., 2014). One-sided research plays an important role in this case. There are many researchers who focus only on allelopathy, others on the struggle for environmental resources, etc. The complexity of the processes requires the combined efforts of biochemists, ecologists, molecular biologists, microbiologists, soil scientists and others. researchers. The nature of the study will determine the type of cooperation required (Romeo, 2000; Inderjit and Callaway, 2003).

We could refer in our reasoning to our hypothesis that each “structural unit” (... species, population, variety, ...) is a “unique projection in Time” (Mitev, 2004; Mitev and Naydenova, 2012). We definitely believe that the diversity in the behavior of plant material is due to differences in this regard. It is perfectly acceptable for the interaction between them to take place on a “time level”, with all the ensuing consequences (Mitev and Naydenova, 2014; 2015b).The "time resource" available to the "structural units" probably determines their behavior in the specific habitat, the consumption of environmental factors, the exchange of biologically active compounds, the result of their physiological activity, etc. We believe that time in the organismic world is relative and differs from its physical size. The change in its "configuration" causes an adequate response in the genome of organisms and their corresponding state. In this way, the realization of a kind of "guided natural selection" could be influenced. This idea has been discussed in some publications (Borza and Coste, 2002 – as quoted by Bostan et al. 2012); Evans et al., 1989; Mitev and Yasheva, 1998), but now receives a specific interpretation. The emergence of “a barely noticeable force of selection with regard to the specificity of the neighbours” (Turkington et al., 1977) is probably in line with this idea. Each community can only be composed on the basis of interacting coexistently selected individuals (Borza and Coste, 2002 – as quoted by Bostan et al. 2012). Probably this is an opportunity to get an answer to the question "how and what hereditary information is transmitted in time." (Mitev and Yasheva 1998).

In the meadow communities there are others besides the desired grass species. In the experiment described here at eastern and southeastern exposure, slight soil gleying, *Centaurea jacea* L. became widespread. In highly gleyed soils, on slopes with this exposure, *Pilosella alpicola* (Steud. & Hochst.) F.W. Schultz & Sch.Bip.) was spread. With regard to both species, we could add that in the period 2015-2016 Pilosella alpicola fell out of the grasslands. In the period 2018-2019, *Centaurea jacea* L. significantly reduced its share in the total fodder mass (Mitev [(1)] unpublished). It is known that under the influence of biologically active compounds isolated from other species belonging to the genus *Centaurea* (*Centaurea maculosa* Lam.; *Centaurea diffusa* Lam.), there was a change in the genome of the neighboring meadow species receiving them. In this way, their basic life processes are blocked. Thus Bais et al. (2003) argued against the traditional understanding of the role of allelopathy mainly in the field of competition for environmental resources. It could be assumed that the same occurs in the interaction between the individual meadow species, as a result of the biologically active compounds they release with allelopathic effect. The influence of weeds on cultivated species is usually studied (Ali Zohaib et al., 2014) and less often the opposite (Georgieva and Kirilov, 2016). We could refer to the author's understanding that each "structural unit" is a kind of "energy information system" (Mitev and Naydenova 2015b), which in the conditions of formed communities enters into certain interactions with others, according to the rhythm in Nature, which determines the general status.

There are some interesting arguments of Borza and Coste (2002) (as quoted by Bostan et al. 2012), that the interactions among plants can be achieved at least in three aspects: substantial, energy, and informational. The most important aspect seems to be the substantial for two reasons: 1) because substances in the developing interaction can provide energy and information; 2) because in any case, at a certain moment of information impact, each signal is transformed into a changed molecular structure of life. We could focus on the understanding of the energy information impact of DNA on the state of higher organisms (Garyaev, 1997). It is believed that the strength of energy information fields exceeds that of the genetic code (Lazarev, 1996). Information, in a slightly broader sense, passing into matter gives birth to energy. Energy becomes a substance that strives to accumulate energy and information. All this is within a natural cyclic sequence (Lazarev, 1997). Information, similarly in

another aspect, as an enigma is not matter, it is not energy, but it is a carrier of matter and energy. In deeper terms, it is a quantum-elative self-carrier of matter and energy (Mateev, 2004). Water receives, preserves and transmits information (Emoto, 2006). It is well known that it prevails in the cells (in this case) of plants. It is believed that its chemical formula (H_2O) contains and exhibits only part of a number of its specific properties (Danov, 1940, quoted by Mihailov, 2002). It can be focused on the idea of the energy information impact of DNA (Garyaev, 1997), and then that the energy information fields are inherent in biological beings (Lazarev, 1996). "The manifestations of Time and Space are mutually determining and are an inseparable relation within them. In order to understand the essence of the biofield, it is necessary to establish the difference between living space and non-living space. It turns out that it is possible to approach their study as a phenomenon that has a structure (Vernadsky, 1975). The essence is that "all living beings form a thin biological layer in which they interact." In addition to what has just been presented, the understanding can be formed that their biofield contains information about Evolution that took place in Time. Thus, a more comprehensible form is presented about the understanding shared in a previous publication that "(theoretically) Evolution can be repeated" (Mitev and Naydenova, 2012). On a more general (universal) level, existing information could materialize again under certain circumstances.

We suggest the reader, taking into account one's own understanding of the essence of Nature, to reflect on the thesis of Borza and Coste, (2002) (quoted in Bostan et al. 2012), enriched with that of Bais et al., (2003) and added by Garyaev, (1997); Lazarev, (1996; 1997); Mateev, (2004), including the discussion moment in this publication.

IV. Conclusions

When locating grasslands on habitats with different exposure of mountain slopes to the main cardinal points of the world and a variety of soil gleying, the presence of a certain rhythm in the formation of the fodder mass is found. The yields were higher in the odd years (1995, 1997, 1999, 2001) in comparison with the even ones (1996, 1998, 2000). The sequence changed in 2002, 2004, 2006, 2008, 2010. The yields were again higher in the odd years (2011, 2013) than 2012.

The behaviour of the grasslands, located on slightly gleyed soils with eastern and southeastern exposure, follow the sequence mentioned above more clearly. Those in other habitats were accompanied by too much variety in their behaviour over the years and variants.

New elements are added to the various standpoints and hypothesis on the origin of species, about their evolution and the causes of the behaviour of the grasslands.

If each "structural unit" (…, species, population, variety, …) is a "kind of projection in Time", then it is perfectly permissible for the interaction between them to take place at the "time level", with all the ensuing consequences. It is supposed that it allows to realize "a guided natural selection"? The "time resource" available to the "structural units" probably determines their behavior in the specific habitat, the consumption of environmental factors, the exchange of biologically active compounds, the result of their physiological activity, etc. We believe that time in the organismic world is relative and differs from its physical size. The change in its "configuration" causes an adequate response in the genome of organisms and their corresponding state.

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Professional Perception of Factors Militating Against Building Services Maintenance among Tertiary Institutions in Lagos Megacity

By Ogungbemi, A.O., Adeleke, A.O., Akingbade, King, O.R. & Kosoko, R.A

Abstract- The call for sustainability in all spheres of life is more noticeable in the construction industry. To avoid this, the study examines the professional perception of factors militating against building services maintenance among tertiary institutions in Lagos megacity of Nigeria, with a view of providing pertinent information to the policies makers and general public. To achieve this, two hundred and fifty (250) questionnaires were systematically administered among built environment professionals across the institution in the study area. The result of the findings revealed that among the factors militating against building service maintenance within the study area, non-development of potential risks and contingency plan, inadequate storage facilities and altitude of workers, and underutilization and non-utilization of available resources were the highest militating factors against building services maintenance in the study. Based on this, the study recommends the needs for adequate provision of storage space for workers, and sustainable utilization of available resources in a way that will yield maximum output.

Keywords: *professional perception, building maintenance, building waste, tertiary institutions, sustainability.*

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Professional Perception of Factors Militating Against Building Services Maintenance among Tertiary Institutions in Lagos Megacity

Ogungbemi, A.O.[α], Adeleke, A.O.[σ], Akingbade, King, O.R.[ρ] & Kosoko, R.A[ω]

Abstract- The call for sustainability in all spheres of life is more noticeable in the construction industry. To avoid this, the study examines the professional perception of factors militating against building services maintenance among tertiary institutions in Lagos megacity of Nigeria, with a view of providing pertinent information to the policies makers and general public. To achieve this, two hundred and fifty (250) questionnaires were systematically administered among built environment professionals across the institution in the study area. The result of the findings revealed that among the factors militating against building service maintenance within the study area, non-development of potential risks and contingency plan, inadequate storage facilities and altitude of workers, and underutilization and non-utilization of available resources were the highest militating factors against building services maintenance in the study. Based on this, the study recommends the needs for adequate provision of storage space for workers, and sustainable utilization of available resources in a way that will yield maximum output.

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I. Introduction

Most public and private buildings in Nigeria are faced with maintenance challenges resulting in deteriorations and ultimate defects of various degrees (Olanrewaju, Babatunde, & a Anifowose, 2015). Building maintenance is the combination of technical and administrative actions to ensure the items and elements of a building in an acceptable standard to perform its required function (Nyayiemi, 2013). Several studies had argued that many people do not understand the importance or significance of building maintenance and its management, in particular the realization that the efficiency of a building maintenance system contributes to the income of the company's owning or renting the building (Emma and Syahrul, 2009).

The building maintenance was significant to the economy not only because of the scale of expenditure involved, but also to ensure the nation's stock of buildings (Seeley, 1987 and Nyayiemi, 2013). From a Nigerian situation, the responsiveness on repair and maintenance works come to be more important as the development plan allocation for repair and maintenance works increased speedily Adejimi, 2005 and Adenuga, 1999).

Seeley (1987) documented that building maintenance is imperative with the prime aim, to reserve a building in its initial state. Also, the implementation of building maintenance permits the building to function its purpose efficiently and effectively. There are several main purposes to maintain buildings as stated below: retaining investment value; maintaining the building in an acceptable condition and required standard; presenting a good appearance of the building; generating income for building owner and surrounding activities; and conserving historical and architectural values of the building.

The Quality of maintenance activities often affects the overall status of the buildings (Nyayiemi, 2013). The quality is subjective by the amount of budget for each task. Appropriate resources particularly finance is required for maintenance work to have good maintenance actions and to sustain the required standards of buildings services. The poor maintenance practices are neither cost-effective nor optimum, and often cause a lot of problems, such as defective buildings, poor buildings functionality and others.

Review of works of the literature shows that several studies have been conducted on the maintenance of residential buildings across Nigeria (Olanrewaju, et al, 2015; Siyanbola, et al, 2013; Odediran, et al, 2012; Sani, 2012; Adejimi, 2005; Adenuga, 1999; Faniran, 1999). But little or no literature has been documented on the factors affecting maintenance management of tertiary institution buildings in Lagos megacity. Most of the institutional housing (buildings') have been in bad shapes, lack maintenance and refurbishment. While others have been obsolete. The study, therefore, sought to establish the factors militating against building maintenance across tertiary institutions in Lagos from a professional point of view.

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II. Method of Data Collection

The data for this study were collected from all these tertiary institutions in Lagos State namely, University of Lagos, Akoka, Lagos State University, Ojo, Yaba College of Technology, Lagos State Polytechnic, Ikorodu, Caleb University, Imota, Adeniran Ogunsanya College of Education, and Michael Otedola College of Primary Education, Epe, to identity rank factors militating against building services maintenance within the study area. Two hundred and fifty (250) questionnaires were randomly administered among professionals' staff in works and service, Technology, Science and Environmental related courses in all the selected institutions. The rank and percentage tool generator were used to generates an output table containing a ranking of each value in the dataset.

III. Discussion of Finding

The professional perception factors militating against building services maintenance among tertiary institutions were determined using rank and percentile tool generator. The result of the output table containing ordinal and a percentage ranking of each value in the dataset. The rank and percentile tool on a show the orderly arrangement of the observations from largest to the smallest and generate the percentile values.

The rank parameter identified as the challenges militating against sustainable building services maintenance in the study area in the following rank order of importance, very highly severe (1), strongly severe (2), very severe (3), mostly severe (4), Severe (5).The result of percentile and ranking presented on table 3.1 established that amongst the parameter militating against sustainable services maintenance management in the campus, non-development of potential risks and contingency plan, inadequate storage facilities and altitude of workers and underutilization of available resources were ranked highest with 87.50% concurrently, next to this are issues on non-implementation of an effective maintenance programme to make equipment more reliable and non-availability of proper tools to maintenance personnel to repair the faulty equipment which ranked 75.00% respectively.

IV. Conclusion and Recommendations

Building maintenance factors like non-development of potential risks and contingency plan, inadequate storage facilities and altitude of workers, and underutilization and non-utilization of available resources were found as the highest and leading factors militating against building service maintenance among tertiary institutions in Lagos megacity. Based on this, the following recommendations were proposed:

1. Construction industry professional's builders, Civil engineers, Architects etc. must be included in all the stages of the planning, design, construction and, management processes.
2. The materials to be used for construction must be tested, retested and confirmed authentic by qualified professional.
3. Provisions of adequate storage for workers,
4. Sustainable utilization of available resources in a way that will yield maximum output.

Table 3.1: Respondents' Ranking of Factors Militating Against Sustainable Building Services Maintenance

S/N	Challenges Militating	Means	Rank	Percent
1	Non-development of potential risks and contingency plan	3.33	1	87.50%
2	Inadequate storage facilities and altitude of workers	3.33	1	87.50%
3	Underutilization and non-utilization of available resources.	3.33	1	87.50%
4	Non implementation of effective maintenance programme to make equipment more reliable	3.11	4	75.00%
5	Non-availability of proper tools to maintenance personnel to repair the faulty equipment	3.11	4	75.00%
6	Lack of engagement of maintenance personnel with necessary skills knowledge and technical experience to execute work maintenance ethics	3.01	6	56.20%
7	Lack of record keeping of installation and maintenance system	3.01	6	56.20%
8	Lack of allocation of maintenance budgetary resources to aid adequate planning	3.01	6	56.20%
9	Non implementation health and safety regulation in relation to maintenance of building services amenities	2.79	9	50.00%
10	Non consideration of technological and financial perspective	2.77	10	37.50%
11	Lack of financial training and support of technical and operational staff	2.77	10	37.50%
12	Lack of relationship between planned preventive and the institution objectives on maintenance	2.77	12	31.20%

13	Non-interpretation of acceptable maintenance standard by personnel and top managerial at the strategic level for harmonization	2.77	13	25.00%
14	Lack of planned preventive maintenance in order to optimized maintenance resources	2.67	14	18.70%
15	Lack of computerized maintenance management system for improving maintenance operation process (CMMS)	1.56	15	0.00%
16	Non-adoption of detailed design of maintenance cycle for life cycle of building and its services	1.56	15	0.00%
17	Lack of time based and future driven policy of maintenance	1.56	15	0.00%

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6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

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Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

Index

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