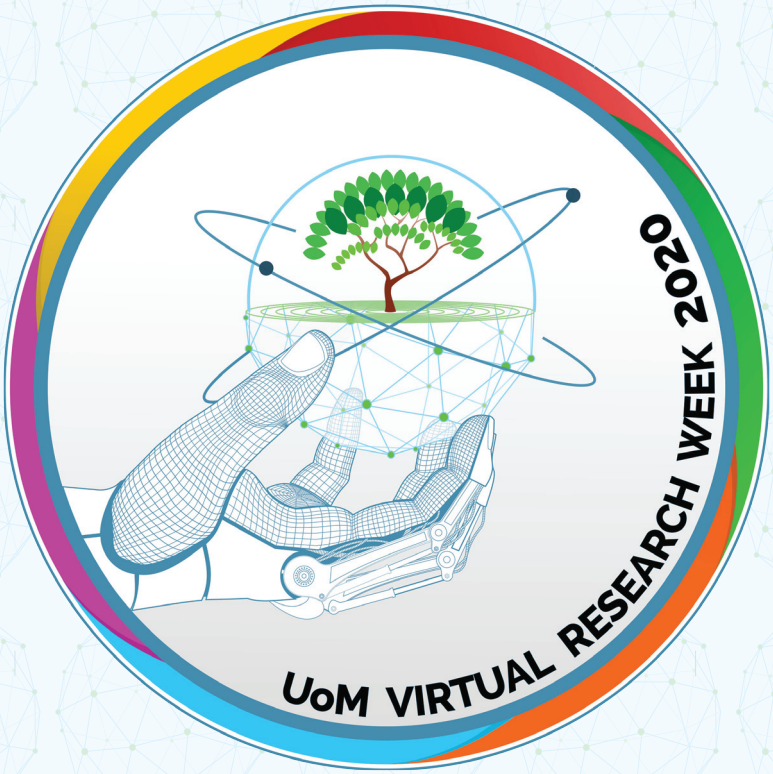
University of Mauritius

VIRTUAL RESEARCH WEEK 2020

19 – 23 October 2020



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SUSTAINABLE DEVELOPMENT GOALS

RESEARCH week 2020

UNIVERSITY OF MAURITIUS

Office of Pro-Vice-Chancellor (Academia)

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Message from the Pro-Vice-Chancellor (Academia)

The 12th Edition of the Research Week, which was initially scheduled in April this year, had to be postponed due to the lockdown. This Edition will demarcate itself significantly from previous ones in that it will be virtual and highly multidisciplinary and transdisciplinary while it will also include the best paper and poster awards.

The main focus of the 12th Edition pertains to Sustainable Development Goals (SDGs). Academics have been invited to disseminate outcomes of their research in line with the 17 SDGs adopted by the United Nations. The eco-system that characterises the SDGs is well aligned with the national and regional if not international priorities besides the advancement of knowledge. Needless to add, the chosen thrust is broad and covers a spectrum of issues that call for attention.

It is also worth noting that this research thrust also aligns itself with one of the Tasks Force that has been created at the UoM by the Vice-Chancellor relating to the SDGs while, at the same time, it adheres to the UoM's vision as a ***'Research Engaged and Entrepreneurial University'***.

By and large, the Research Week remains the most important disseminating research platform which fosters significant involvement, dedication and interaction of academics and students of the different Faculties and Centres on campus. The Call for Abstracts and Papers has been again enlarged this year to rope in researchers who have been and are still working jointly on projects or papers with UoM staff. This allows for much greater visibility of the research being undertaken by the UoM staff and students. Moreover, it is expected that interaction with varying groups of researchers will further enhance the cross-fertilisation of views and ideas and consolidate the base for more in-depth academic collaboration.

In addition, the different virtual sessions will provide excellent opportunities for researchers benefiting from different funding schemes to showcase their research commitments and achievements. Opportunities will be provided to specific research groups which have benefited from alternative sources of funding - locally and internationally – to be more visible in what they do.

The dissemination exercise and outcomes will to a great extent shed light on research emanating from different internally funding schemes that have been introduced since 2017 and the projects carried out by Poles of Research (PoIs, PREs and PRs), Research Centres and other teams of researchers over the past few years. It is anticipated that the 12th Edition will involve more people from the industry, policy-making circles and the community at large. Undoubtedly, these deliberations will provide meaningful insights into our economy and society.

It is with immense pleasure therefore that I wish all of you well for an insightful, thought-breaking, impactful and fruitful Research Week 2020.

Prof Sanjeev K Sobhee

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Virtual Oral Presentations

Alien Plant Invasion in an Oceanic Island's Native Forests reduces Foraging Habitat Quality for a Threatened Flying Fox

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Abstract:

Conflicts between humans and wildlife constitute a growing threat to biodiversity worldwide and are set to worsen as the expanding human population comes into ever greater contact with wildlife. Culling of wild animals has been implemented in numerous situations in attempts to mitigate or resolve human-wildlife conflicts (HWC). Culling often, at a cost, leads to unwanted and unexpected outcomes, including failure to address the targeted problem, making it worst or generating novel problems. Flying foxes, typically occurring on oceanic islands, have often been considered as problematic because of inclusion of cultivated fruits in their diet. Persecution of flying foxes species has been increasing and this situation is epitomized by Mauritius which implemented four mass-culling campaigns of the Mauritian flying fox *Pteropus niger* since 2015. Consequently, the species' population was majorly reduced resulting in its International Union for Conservation of Nature Red list category to be reassessed from 'Vulnerable' to 'Endangered'. Culling campaigns did not improve commercial fruit production. In this context, research has a role to play in unravelling potential management that may truly help fruit producers while avoiding to waste resources and time on management like culling. We aimed to explore the extent to which certain recently discovered declines in native tree communities in the flying fox's native habitat that are driven by alien species, may be contributing to the HWC. In particular, we set as objective to quantify community structure of native trees (trunk diameter ≥10 cm) under contrasting degrees of alien plant invasion paying attention to native species richness, diversity, stem density and estimates of biomass (using basal area as surrogate) and focusing on trees whose fruits are known to be eaten by *P. niger*. We sampled the wet forest community of three sites, Brise Fer (550-600 m a.s.l.), Mare Longue (590-620 m a.s.l.) and Macchabé (600-650 m a.s.l.), within the Black River Gorges National Park (BRGNP) where mean annual rainfall are 2,400 mm, 2,800 mm and 2,900 mm respectively. These forests are legally protected since 1950s, were never logged and forms part of today's best preserved non-managed native forests in Mauritius (i.e. with native plants forming at least 50 % of the canopy). All areas occur on ferralitic soil, derived from 7.5 to 5.2 MY old basaltic lava and support forests with 15-20 m tall canopy trees. The density of native woody trees ≥10 cm diameter at breast height (dbh) was used to classify sampled forests into four grades, grade 1 being the least invaded and degraded by alien species and grade 4 being most invaded. The grades were defined as follows: grade 1: ≥16; grade 2: ≥8 and <16; grade 3: ≥4 and <8; grade 4: <4 trees per 100 m^2. The relationship of IAP level on native tree species richness, diversity, stem density and estimates of biomass (using basal area as surrogate) were assessed, with particular interest on species whose fruits are known to be eaten by *P. niger*. Native trees were also classified into three diameter size classes to assess and compare their frequency. Species richness of native trees foraged upon by flying foxes was 58.8 % lower and

their diversity halved at the most invaded site. Bat-used trees dominated at all forest sites with their relative density and basal area being significantly higher by 66.4 % and 78.3 % in the less invaded forests, respectively. Diameter size distribution classes of bat-used trees showed that larger individuals above 20 cm dbh, were up to 3 times more frequent than non bat-used ones. The results indicate that higher invasion level by alien plants reduced native tree species richness, diversity and stem density. The findings also indicate that bat-used trees constitute the bulk (68 %) of the basal area in forests with lower invasion level. Integrating IAP control in varyingly degraded forests has the potential to enhance flying foxes foraging opportunities and reinforce their ecological role as a result of mutualistic interaction with native trees. Using the Mauritian flying fox as an umbrella species could benefit a wider range of native biodiversity and provide non-lethal long-term solution to potentially mitigate the current human-wildlife conflict on Mauritius.

Keywords: fruit bat, invasive alien plants, Mauritius, native tree community, *Pteropus niger*

A Review of Spatial Models for Count Data

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Abstract:

The recent outbreak of the coronavirus in the different provinces in China, the number of offend counts in Sheffield, England (Haining et al. 2009), vehicle burglary incidents in Texas (Chun 2014), the human West Nile virus counts in California and Colorado (Tevie et al. 2014), the sudden infant death syndrome in North Carolina (Cressie and Chan, 1989) are some among the many motivating applications that warrant the purpose to study spatial count data models.

The construction of the spatial count data models stems from the paper by Whittle (1954), where the author incorporates spatial effect or spatial autocorrelation into the spatial model by including spatial lagged dependent variables, that is, weighted observations of the neighbouring terms, as also illustrated in Anselin (2010). Besag (1974) extended the spatial model from Whittle (1954) by introducing auto-Poisson models among auto-Gaussian and auto-binomial models where the spatial lagged dependent variable conditional on its neighbours follow the Poisson distribution. However, this auto-Poisson model suffers from a major drawback: the incorporation of neighbouring observations whose range is infinite can lead to an explosive process if the weights of the neighbouring terms are strictly positive. This implies that Besag model achieves stability only under negative spatial dependence.

To overcome this shortcoming, Griffith (2006) and Kaiser and Cressie (1997) approximated the auto-Poisson by the auto-binomial model by artificially choosing a large sample size for the binomial distribution and this technique subsequently yields positive spatial auto-correlation. On the other hand, Ferrandiz et al. (1995) restricted the dependent variable to a finite range so that the auto-Poisson could model positive spatial auto-correlation. By the same token, Kaiser and Cressie (1997) used the Winsorization approach to obtain a finite range of the dependent variable. However, such truncation technique impacts on the likelihood formation and makes the likelihood estimation infeasible (Augustin et al. 2006).

An alternative approach to the modelling of the spatial count data is to consider the spatial auto-regressive analogous to the observation-driven time series of counts models described in Cox (1981), McKenzie (1985), McKenzie (1988), Al-Osh and Al-Zaid (1987). More specifically, the spatial dependent variable is related with the other lagged spatial neighbours (lattices) via the binomial thinning (Steutel and Van Harn, 1975). This type of model is written in the manner of a conventional autoregressive model, except that the thinning operation replaces multiplying the lagged endogenous variable by a parameter which ensures discreteness. In this context, Ghodsi et al. (2012) applied a thinning process spatial auto-regressive model (SINAR (1, 1)) to

yeast count data. Ghodsi et al. (2012) model is based on a unilateral spatial structure, in other words, spatial spillovers are considered to move in one direction across the lattice and assumed only Poisson errors, which restrict the application of this simple stationary spatial auto-regressive process. The model parameters are estimated using the Yule-Walker approach. In a later article, Ghodsi (2015) applied the conditional maximum likelihood (CML) estimation to the same yeast dataset which produced smaller bias and standard deviation of parameter estimates than the Yule Walker method.

The objective of this paper is to compare and contrast the various approaches for spatial modelling of counts data. The study investigates further on the above mentioned limitations. The aim is to propose alternative models for spatial variation and efficient estimation method. This paper explores a simple thinning based spatial autoregressive model on one-dimensional lattice followed by a more general and flexible class of spatial models based on the Queen approach on a two-dimensional lattice. In the Queen approach (Anselin et al. 2004), each observation is characterized by its position on the lattice denoted by (i, j) and all the eight rectangles around unit (i, j) are considered neighbours. The conditional maximum likelihood estimation approach is used to yield efficient parameter estimates. We investigate the effects of spatial dependence on parameter inference through simulations. The results show the bias, standard deviation and root mean square error (RMSE) of the estimated parameters using CML are all small. It is observed that the bias and RMSE values of the estimated parameters decrease when the grid size increases and the Queen model yields lower Akaike information criterion (AIC) value than the unilateral spatial model and thus can be considered a superior model.

Keywords: Spatial, Autocorrelation, Thinning, Conditional Maximum Likelihood, Simulation

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Variation phonétique chez les locuteurs mauriciens: résultats d'une pré-enquête

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Abstract:

Ce travail actuel fait partie d'une étude plus étendue dans le cadre de notre MPhil/PhD entamé en juillet 2019. En effet, l'objectif principal de notre travail est de tenter de cerner les contours d'une norme du français mauricien en utilisant la phonétique acoustique. En d'autres mots, il s'agit de repérer, dans les productions orales des Mauriciens, les différentes prononciations présentes sur le territoire pour, à terme, essayer de circonscrire une norme d'usage du français mauricien. Cela permettrait, à contrario, de repérer les variétés de français parlées à Maurice. Le travail que nous voulons présenter ici est le résultat d'une pré-enquête menée en septembre 2019 pour tester notre méthode de travail.

Pour ce faire, nous avons testé notre technique d'enquête sur une soixantaine d'étudiants de l'Université de Maurice. Ces derniers avaient pour tâche de lire un extrait et de répondre à quelques questions. Les entretiens ont été enregistrés et nous avons ensuite extrait les formants (F1 et F2) des voyelles pour analyser le mode de production de ces dernières. Ces formants permettent de caractériser chaque voyelle, le F1 correspondant à l'ouverture verticale de la bouche et le F2 à l'antériorité/postériorité (position de la langue dans la bouche).

L'analyse des valeurs des formants F1 et F2 nous a montré qu'il existe des variations dans la réalisation des voyelles du français régional de l'ile Maurice.

Dans notre pré-enquête, l'analyse de différentes voyelles a révélé différentes productions des voyelles parmi nos enquêtés. Les diagrammes (faits sur logiciel R) illustrent principalement ces différences à travers des nuages de points (scatter plots). A titre d'exemple, la voyelle /e/ indique une concentration des points, c.à.d. que le /e/ est généralement prononcé sans grande variation parmi les étudiants de l'Université de Maurice. Par contre, pour la voyelle /œ̃/, on remarque plus de variations au niveau de la réalisation car les points sont dispersés sur le diagramme.

De plus, nous avons rajouté les valeurs des formants obtenues lors d'un précédent travail effectué avec des filles de deux collèges. Le préjugé sur les filles du premier collège était qu'elles avaient une prononciation différente de la plupart des Mauriciens. Les conclusions de ce précédent travail étaient que les filles du premier collège ont une prononciation proche d'une norme usuelle, qui n'est donc pas différente de ce qu'on entend chez les Mauriciens. A l'inverse, il nous semblait que les filles du deuxième collège réalisaient des voyelles différemment des autres personnes. Nos conclusions étaient qu'il existe un accent particulier dans le deuxième collège et que ces différences de prononciation étaient probablement liées au fait que ces filles habitent principalement dans des villages de l'est de Maurice. A travers cette pré-enquête, nous avons pu confirmer notre hypothèse concernant la possibilité d'un accent spécifique pour ces étudiantes. En effet, leurs réalisations de diverses voyelles (telles que /o/, /ɛ/, /ɔ̃ / /œ̃ /) s'éloignent de celles des autres locuteurs, ce que nous souhaiterions montrer dans cette communication. Un exemple serait que le phonème /o/ est réalisé chez ces locuteurs, de façon beaucoup plus ouverte qu'ailleurs.

Notre pré-enquête menée auprès d'une soixantaine d'étudiants nous a permis de tester notre méthodologie de recherche, qui nous semble concluante puisque nous avons déjà pu constater des différences de prononciation sur un corpus aussi restreint. Notre objectif étant d'essayer de définir une norme du français mauricien, nous pourrons alors maintenir cette méthodologie d'enquête sur un corpus plus élargi. Celui-ci, qui sera représentatif de la population mauricienne, devrait ainsi nous mener vers d'autres résultats plus précis sur la nature de la variation dans la prononciation des voyelles en français mauricien.

Mots clés: Phonétique acoustique, phonologie, français mauricien, linguistique variationniste

Virtual Poster Sessions

Data Centered PEGASIS

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Background & Objectives of Study:

A lot of energy is consumed in wireless sensor networks due to the sensor nodes being battery operated and therefore being power limited. Regular replacement of batteries is not a practical solution due to them being situated in remote inaccessible locations. Using larger batteries is also not the solution due to added constraints of cost, size and weight (Liaqat, 2016). As such, the choice of a proper routing protocol is determinant in prolonging the lifetime of the network (Ogundile, 2017). In this paper, we propose Data Centered PEGASIS (DCPG), an improved version of Power-Efficient Gathering in Sensor Information Systems (PEGASIS) (Lindsey, 2002) which is itself based on Low-Energy Adaptive Clustering Hierarchy (LEACH) (W.R.Heinzelman, 2000). In PEGASIS, each node communicates only with its nearest neighbour, instead of the CH, and is, therefore, more energy-efficient than LEACH. The aim of DCPG is to decrease energy consumption in PEGASIS (Lindsey, 2002) even further by applying conditional data transmission to the nodes.

Simulation results show that the energy consumed by a node per transmission is 3 times less in DCPG than in PEGASIS, and therefore the number of transmissions in DCPG is 3 times more than in PEGASIS, and 5 times more than in LEACH when 1%, 20%, 50% and 100% of nodes die for different network topologies.

Keywords: LEACH, PEGASIS, DCPG, clustering, routing protocols.

Approach & Methodology:

We are using a data-centric method on PEGASIS (Lindsey, 2002) to increase the lifetime of the network. We have simulated DCPG using the same radio model as in PEGASIS. All the phases in DCPG are the same as in PEGASIS with a difference in the data transmission phase. We are changing each of the following variables in turn, while keeping the other two constant:

Parameter	Description	Values used in the simulation ($1^{st}/2^{nd}$ round)	Values used in the simulation (3rd round)
n	the number of sensor nodes in the field	50, 100 and 150	100
N	the number of data points held at each node	5, 10 and 15	5
$percent_{deadnodes}$	the percentage of dead nodes as a multiple of n	1%, 20%, 50% and 100%.	1%, 20%, 50% and 100%.

In DCPG, an array of N data points will be set up at each of the nodes, where N ranges between 5 and 15. The array will be set up as a FIFO queue. On each round of operation, the data being sensed will be stored in the array, and the Confidence Interval (CI) will be computed. As we are assuming that the data values follow the normal distribution, the transmission of data from one node to the next nearest node happens only if the value lies outside the 95% CI range.

We again repeat the simulation, this time-varying n while keeping both N and $percent_{deadnodes}$ constant.

Findings/Results

It can be observed that in all three cases above, the number of transmissions for DCPG is three times more than in PEGASIS, and 5 times more than in LEACH.

Conclusion and Significance

With the PEGASIS protocol on each round, each node has to transmit data to its next nearest neighbour, in DCPG this communication between nodes happens only in cases where the node has to transmit an outlier value. As the number of transmissions between nodes is significantly reduced, much less energy is dissipated, making the network lifetime longer. This concept can also be applied to the LEACH protocol.

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An Assessment on the Potential of Blue Carbon Sequestration based on a Study on an 11-year-old and a Mature Mangrove Forest in Mauritius

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Abstract:

Coastal 'blue' carbons are carbon from atmospheric carbon dioxide (CO_2) that is sequestered in the sediment and biomass of vegetated ecosystems including mangroves, seagrass meadows and saltmarshes. Nature has its own mechanism of sequestering carbon in its reservoirs such as the mangrove biomes which are considered as the most carbon-rich forest in the tropics. There is an urgent need to protect them as blue carbon emission from deforestation has become a crucial cause for climate change. The purpose of the study is to assess the organic carbon content in the soil and above ground biomass (AGB) and also to determine the potential of carbon sequestration in a young forest of about 11-year-old and a mature natural mangrove stand.

The field studies were conducted from October 2019 to December 2019 in two regions in Le Morne, characterized by *Rhizophora mucronata* dominating mangrove forest stands each having an area of 0.0225 ha. Transects parallel to the shore were laid in the seaward, middle ward and landward zones and three 5 m x 5 m quadrats were set up on each transect. The forest structure was assessed with the help of structural attributes to know the forest maturity and tree density. Measurements of height for categorizing plants into seedlings, saplings and adults, and the diameter at breast height (DBH) of mangrove plants for above ground biomass were taken. A total of 405 core subsamples were taken from soil depths (0-10 cm, 10-20 cm, 20-30 cm), oven dried at 60°C, homogenized and organic carbon was analyzed using the Loss on Ignition method at 450°C. Soil carbon density at the three depths was also determined at different inundation zones for the two studied regions. The soil organic carbon and the above ground biomass were used to compute the total carbon stock of the forest.

The mean density was $6.80 \times 10^4 \pm 6.91 \times 10^1$ plants per hectare in the mature forest and $2.63 \times 10^4 \pm 2.40 \times 10^1$ plants per hectare in the 11-year-old forest. The mature forest had a maximum tree height of 5.00 m with a mean diameter at breast height of 4.12 cm and the other site had a maximum height of 3.50 m with a mean diameter at breast height of 2.12 cm. The mature forest had an above ground biomass of 261.42 t ha^{-1} and for the other forest, it was 19.42 t ha^{-1}. The soil organic carbon for the mature forest was 383.69 t ha^{-1} and for the 11-year-old forest, it was 331.33 t ha^{-1}. From analysis of variance (ANOVA), a statistically significant ($p < 0.05$) relationship was observed between soil organic carbon and the seaward, middle ward and landward zones in the young forest. The results indicate a decrease in soil carbon density when depth increases. There is no significant difference of soil carbon density in different depths in both regions ($p > 0.05$). Mangrove forests can store high quantities of carbon both in their soil and biomass but according to results obtained, the soil has the capacity to sequester more carbon than the above ground biomass. The highest amount of carbon was found in the surface layer of the soil.

The carbon sequestration potential increased with the increase in age of plants, therefore the data obtained from the present study shows that the mature forest stores more carbon than the young one, but both of the Mauritian mangrove forests have better carbon sequestration capacity than other countries. Thus, they can be used to formulate conservation and management strategies for mangrove ecosystem as they are important components for climate change mitigation. This study is an important contribution to understand the mangrove ecosystem as blue carbon sinks in Mauritius.

Keywords: Above ground biomass, Blue carbon, *Rhizophora mucronata*, Soil organic carbon, Total carbon stock

Grouped Theme ‘Economic Growth and Development Policies’

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Work and Economic Growth

Virtual Oral Presentations

The Corporate Rescue Culture in Mauritius; A Comparative Study with the UK and the US

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Abstract:

Background and Purposes

In the realm of corporate law, whenever a company is in financial distress, there exist a number of options which are primarily designed to protect the interests of creditors and the company as well. In this respect, across most insolvency jurisdictions, a historical shift in policy terms insolvency proceedings as a terminal ending for businesses in liquidation while recognising the corporate rescue culture as a gateway to business continuation. Corporate rescue can thus be described as a major intervention that goes beyond the normal managerial responses which is imperative to avert the looming failure of a company. While corporate rescue may operate through informal mechanisms as well as formal legal processes, the legal measures seek to investigate the company affairs in depth and take the form of voluntary administration and compromise with creditors under the laws of Mauritius.

Accordingly, this research aims at assessing the efficiency of legal measures for corporate rescue available to Mauritius companies in financial difficulties. Hence, the legal mechanisms for corporate rescue under the laws of Mauritius will be compared against the corresponding provisions of the UK and the US laws. This comparative analysis will be conducted so as to highlight any loophole under the current Mauritius insolvency law framework with the view of suggesting some recommendation that may be inspired from the UK and US to improve the existing related laws.

This research topic is connected to the United Nations Sustainable Development Goal (**SDG**) 9 which aims at building resilient infrastructure, promoting inclusive and sustainable industrialisation and fostering innovation. In particular, in contrast to entail a corporate body in insolvency which would bring unemployment issues and economic downturn, this research aims at improving the capacity of a corporate body in financial difficulty to resort to means and ways to improve its situation through legal measures.

Methodology

The methodologies for the research are in essence comprised of the black letter approach which will analyse the legal provisions relating to the insolvency laws in Mauritius. A comparative analysis will also be performed to find out the legal provisions relating to the corporate rescue culture in the UK and the US each. Thereafter, some recommendations will be suggested based on the comparative study conducted to enhance and strengthen the rescue culture existing framework of Mauritius.

Findings

This paper aims at responding to the research objectives set out above. In particular, it is found that the existing corporate rescue culture under Mauritius laws is obsolete and need

amendments. As such, the study calls for granting the right to formulate a rescue plan to the debtor since for the moment, this right is restricted only to creditors and administrators under Mauritius laws. The research also recommends the concept of "wrongful trading" to be incorporated in Mauritius laws and the establishment of a "Debtor-in-Possession financing" mechanism similar to the laws of the US.

Significance/Originality/Value

At present, there are few literature on the researched topic and this study will be amongst the first studies conducted on corporate rescue mechanisms in Mauritius. The study is carried out with the aim of combining a large amount of empirical, theoretical and factual information that can be of use to various stakeholders and not only to academics.

Keywords: Corporate rescue in Mauritius, Insolvency Act of Mauritius, Voluntary Administration, Compromise with creditors

The Challenges of Teleworking in the Mauritian Society

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Abstract:

Background and objectives of the study

Teleworking means working from home using a workstation that connects to the business where a person is expected to work. By working from home, the employee feels freer to undertake his activities without the need to travel and face the threat of absenteeism. Very often, this idea has cropped up both in public and private organisations in Mauritius but its application has been negligible. It is believed that commuting applies to large communities facing the difficulties of connecting people to their place of work. The Mauritian situation might be broadly similar in that traffic congestion affects productivity and attendance at work. The fact that there are more than 500,000 vehicles in the country makes the ratio of users to cars nearly 2:1. Traffic congestion has been a major cause for bottlenecks and lateness at work.

Contrary to traditional work, commuting might have been a good alternative in that employees could spend lesser time at work physically but be more productive while they work from home. This term is mentioned in the Pay Research Bureau Report* (Section 18.5) but is application has been infinitesimal or never put to practice. This paper examines the subtleties of commuting and its potential of contributing to the country's economic growth.

Approach and methodology

The study deals with employees actually working and assesses the advantages and disadvantages of being physically present at work. It is seen that lateness and absences are seriously dealt with regards to productivity but this really undermines it when the employee could undertake activities at home. The issue looks more like taboo because working from home might make the employee feel isolated from the workplace and the relations built over there. A questionnaire method based on interviews with working students following a part-time course at the Université des Mascareignes is carried out. Interviews are also conducted with a view to getting more insightful comments from respondents.

Major findings of the research work

Although the research is still ongoing at the present stage, certain findings are expected but will be drafted once results are obtained and assessed.

Teleworking is viewed positively as employees can connect directly to the workplace with their computers and undertake the tasks as required.

There is a high level of flexibility for the employee as time might be better managed independently by him/her.

Teleworking is viewed as economical and a contributing factor to growth.

Teleworking is not applied because of the traditional nature of bureaucratic management.

Teleworking could complement flexi time but is still in its infancy although 'working from home' is accepted (PRB report 2016).

Conclusion and significance

It still remains a challenge to implement teleworking in the Mauritian society especially in the highly organised and structured public service. This might mean staying at home and away from work. Apart from this perceptual bias, teleworking has a genuine contribution in enhancing productivity and reducing inefficiencies. This will depend on how applicable it might be in the future. For a country aiming to become a high-income economy with a greater need for flexible jobs, teleworking remains a useful contributor despite the fact that its application remains still tough in a traditional workplace.

Keywords: Teleworking, flexible work, Mauritian society, benefits, challenges

*Article: 18.5, 42

There is nothing new about working from home. But the advent of new computer and telecommunications technology has witnessed the development of another type of remote working known as teleworking. Teleworking is the same as homeworking, except that the job is performed using information and communication technologies.

Historical & Major Developments in Mauritian Employment Law: Some Important Legal Issues

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Abstract:

Background of the Study. Our Labour and Industrial Relations Law has been amended on several occasions and some sections have been repealed. The *Labour Act 1975* was repealed and replaced by the *Employment Rights Act 2008 (Act 33/2008),* which in turn was amended by the *Employment Rights (Amendment) Act 2013 (Act 6/2013).* The *Employment Rights Act 2008 (Act 33/2008),* as the principal Act, and as amended was repealed and replaced by the *Workers' Rights Act 2013(Act 18/2019),* which has been passed by Parliament and will enter into force soon. In the same line, the *Industrial Relations Act 1973* was repealed by the *Employment Relations Act 2008 (Act 32/ 2008),* which in turn was amended by the *Employment Relations (Amendment) Act 2013 (Act 5/2013),* which in turn has been recently amended by the *Employment Relations (Amendment) Act 2019 (Act 19/2019).* The two principals Acts in force in Mauritius remain the *Employment Rights Act* 2008 and the *Employment Relations Act 2008.* They cater for employment law in Mauritius both for individual and industrial relations. Prior to dismissal, the suspended worker is now on full pay. Recent development in our law reflects to what extent the legislator was concerned with such situations such that, henceforth, the DC is chaired by a person who has not been involved in the investigation and who is able to make an independent decision, second the worker and the employer may, during the oral hearing negotiate for the payment of compensation with a view to promoting a settlement, and third a worker may now join the Workfare Program in case a settlement has not been reached for payment of compensation and a Transition Unemployment Benefit (s.75 EReAct). If for a long time and once a worker has been suspended and dismissed for misconduct henceforth a worker may be reinstated (section 2 of the *ERe(Amendment) Act 2019*).

Methodology. Employment law legislations, regulations and the Constitution coupled with relevant precedents shall enlighten the development of labour in line with the achievement of sustainable goals to create employment and to poverty eradication.

Major Findings. Despite major changes on our labour law there is still much work to be done to create employment and to enhance human rights. In brief, a worker enjoys a certain amount of rights (discrimination in employment, equal pay for equal work, holidays and leaves, a protective order before a judge in chambers for failure to remuneration by the employer, transport of workers just to name a few) as per relevant sections of the *Workers' Rights Act (Act 18/2019*) which repealed the ERiAct 2008 (s.120 WRA). In practically the same line, the *Employment Relations Act 2008* and *Employment Relations (Amendment) Act 2019* also

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provide, *inter alia*, protection to workers coupled with Chapter II of the Constitution, 1968 and other relevant legislations on Labour and Industrial Relations Law (*End of Year Gratuity Act* or the *HIV/AIDS Act*).

Conclusion. Therefore, an employer shall not terminate a worker who has participated in a lawful strike but he may deduct a certain amount of money corresponding to the amount of days he was on strike. In addition, the composition of the EReT has been amended and the *Employment Relations (Amendment) Act 2019* enacts sufficient provisions on the powers of the President CCM (s.69), the establishment of the National Tripartite Council (s.98A et seq.) or protection of the worker on the workplace against discrimination, a worker's temporary absence or worker becoming or being a member of a trade union in addition to existing rights (access to workplace, right to information, prohibition of closed shop agreement, right to join or not to join a trade union, the right to collective bargaining and negotiating panels to arrive to a conciliation prior to a strike or freedom of association and assemble coupled with freedom of expression, protection against discrimination and slavery).

Keywords: Labour law, historical development, dismissal, Workers' Rights Act 2019

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Impact of Exchange Rate and Exchange Rate Volatility on Tourism Demand to Mauritius

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Abstract:

The tourism sector is the fastest growing industry in the world and its total contribution to global GDP was approximately10.3% (USD 8.9 trillion) in the year 2019, employing around 330 million people (10% of total employment). This sector has emerged as an engine of growth around the world and has the potentials to contribute directly or indirectly to all the Sustainable Development Goals. It has also been included in SDGs 8, 12 and 14.

Tourism is a key economic pillar and creates job opportunities in Mauritius, which is very much dependent on tourist arrivals. However despite the diversity of resources on the Island, tourist arrivals depend also on the competitive advantages of the destination country. Hence the main aim of this study is to investigate the impact of exchange rate and exchange rate volatility on international tourist arrivals to Mauritius. As per previous literature, a depreciation at destination induces inflows while a depreciation at the origin country meters international tourist outflows. Moreover, exchange rate volatility creates an environment of uncertainty and thus a country facing a volatile exchange rate will have a reduced number of inbound tourists. There have been a large number of studies that included either exchange rate or exchange rate volatility to one of the determinants of tourism demand and mixed results have been empirically obtained be it on a country specific basis or a panel of countries or a regional bloc. However this study has largely been ignored for destination countries such as Mauritius.

Annual data for the period 1983 to 2019 has been used to estimate an Autoregressive Distributed Lag (ARDL). The explanatory variables used were the real effective exchange rate, exchange rate volatility, the number of hotel rooms available in Mauritius (proxy for development in the destination country), income of the tourist, price level and a dummy variable for economic crisis. The ARDL Bounds test concluded that the variables are bound together in the long run and hence an Error Correction Model was estimated. The empirical results concluded that in both the short and long runs, exchange rate and its fluctuation have a negative but insignificant impact on tourist arrivals to Mauritius. Only the number of hotel rooms available in Mauritius has a positive and significant impact on the dependent variable in the short run. In the long run, the income of tourists and number of hotel rooms have a significant and positive impact on international inbound tourist to Mauritius.

The diagnostic test concluded that there is no evidence of serial correlation and the residuals are homoscedastic. However the Jarque-Bera value indicates the non-normality of the residuals. The cumulative sum of recursive residuals (CUSUM) test shows that the coefficients in the ARDL equation are stable within the 5% critical lines.

Keywords: Tourism, Exchange Rate, Exchange Rate Volatility, ARDL

Core Skills for the Future of ICT

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Introduction

The general, external environment consisting PEST-NG[iii] factors are critical to organisations' performance, success and outcome. These drivers are transforming the world of work and the future is increasingly unpredictable. Developing and maintaining the employability and adaptability of people in labour markets that change continuously under the influence of globalisation, technological change and new ways of organising work is challenging for education and training (E&T) systems. Many countries have been attempting to reform their E&T systems to meet the current and future demands for skills and competencies. This is because the skills that employers require are in constant mutation as well as the shelf-life of employees' skill sets is shortening (WEF, 2016). These mega trends underpinned by automation of repetitive and predictive tasks signal an increase in demand in the share of high-skilled workers while the number of semi-skilled workers is declining (ILO, 2017). Human capital has therefore become the decisive factor of value creation across industries.

Background

Technological change is affecting both the composition of tasks and the demand for skills. Automation from the convergence of artificial intelligence and big data are having a significant impact on jobs, disrupting the traditional work pattern ranging from significant job creation to job displacement and from heightened labour productivity to widening skills gaps (WEF, 2016). As the workplace continues to undergo substantial restructuring in response to new technologies, basic physical and cognitive skills will no longer suffice. The adoption of digital technologies across sectors to boost productivity has led to blurring lines between sectors and stakeholder groups and creating a range of possible economic, social and environmental unintended consequences. There is heavy impact on business models like Fintech, blockchain-enabled models and sustainable digital technologies. This in turn is shifting the composition of skills set of the labour force to cultivate a combination of multidisciplinary and transdisciplinary skillsets. Both developed and developing countries are grappling with these challenges. In the case of a developing country like Mauritius, despite improved educational attainment and labour policies, a persistent skills gap has installed (HRDC, 2018; World Bank, 2018(b)). The Mauritian labour market appears to be characterised by an education mismatch, especially among youth (World Bank, 2018). The Human Capital Index ranking of Mauritius has moved from 74th position out of 130 countries in 2017 to 52th out of 157 countries in 2018. In the long run, it would be difficult for countries like Mauritius from realising full potential of its labour force and ultimately constrain productivity and economic growth (World Bank, 2018). Albeit, the ICT/BPO sector remains buoyant. It registered a labour force of 25,000 and contributed to 5.3% of GDP in 2018. To maximise on the opportunities the ICT sector has to offer, it is critical that the talent pipeline is equipped with a set of skills that will allow the workforce to adapt to the changing workplace landscape and be resilient to the global forces.

[iii] Political and Legal, Economic and labour, Socio-cultural, Technological, Natural and Global forces

Objectives of the study

The main objective of the paper is to understand from a demand perspective, the skills of the future in light of the accelerating pace of technological innovation.

Approach and methodology

With a view to gauge the skills requirements in the ICT sector, data were generated from three different sources (i) survey of 131 enterprises conducted in 2018 by HRDC; (ii) compendium of 70 job profiles[iv] developed by the industry; and (iii) job advertisements in the ICT sector collected in January 2020.[v]

Major findings

Countries worldwide are on the verge of a technological paradigm shift which are impacting on business models. This in turn has contributed to labour market polarisation with an increase in the shares of low-skilled and particularly high-skilled jobs while there has been a hollowing out of middle skilled jobs. New jobs such as Cloud platform developers and architect, IoT specialist, Blockchain Engineer are emerging to suit the new business models. However, it is envisioned that many traditional jobs such as Engineers and IT Technicians will still remain important to sustain the perpetually changing infrastructure. At the core, navigating the contours of a changing economy warrants a multidisciplinary and transdisciplinary skillset ranging from complex problem solving skills to higher order thinking skills, analytical skills to logical reasoning. Moreover, as Gen Z are set to enter the future workforce, they will have to be resilient and prepared to constantly stay ahead of these developments and transformations with a creative mind. Education systems could therefore focus on imparting fusion skills that will help the workforce to make the leap from mere consumers to value creators.

Conclusion and significance

This study provides only a partial picture of skills requirements for the future. Further research could be conducted to understand how far the curriculum make provision for the development of such skills as from pre-primary level up to higher education and onwards.

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Keywords: Skills, human capital, technologies, workforce, ICT

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Trade: Boon or Bane? Evidence from Developing Countries

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Abstract:

Scholars like Zamit (2003) have argued that the pursuit of high and rising consumption in the North and of development in the South have together led to the increasing exploitation of natural resources in unsustainable ways, often by TNC investment in resource-extractive industries in developing countries. Policies promoting, liberalization, deregulation and export orientation respond to the logic of short-term profit maximization and international competition intensify the need for cost-cutting, resulting in the over- exploitation and wasteful use of natural resources Greater integration into the global economy especially for developing countries highly dependent on international trade may make it harder for these countries to achieve a sustainable development path.

In particular, countries that are endowed with natural resources or those highly dependent on the trade of primary goods may find themselves in a "specialisation trap" catering for a world market avid for more and more resources (Røpke, 1994). Others such as Lopez (2003) also argue that governments in developing countries may try to attract foreign investments even at the expense of sustainability through a 'race to the bottom'.

The objectives of this study is therefore to shed light on the impact of trade on the sustainable development in the context of developing countries which are characterised by a high dependence on natural resources. A panel data set of Sub-Saharan African (SSA) countries over a period of 35 years has been considered. Potential endogeneity and reverse causality have been addressed and tests of robustness by means of different estimation techniques namely FE, RE and SYS GMM carried out.

The results show that trade openness has a significant negative impact on a country's level of sustainability which is robust to the methodology employed. The trade patterns may be setting the economies in the sample on an unsustainable path of resource depletion. Besides the academic significance of these results, they also have some important policy implications. With globalisation facilitating capital flows on international markets (Stiglitz, 2000), this could lead to the exit of the revenues from the exploitation of natural resources from the host economy to be invested abroad instead of being invested locally in infrastructure and human capital development thus becoming an obstacle to sustainable economic growth and development. It is therefore crucial for these economies to diversify their economies and avoid over-reliance on the exports of primary goods which also tend to be particularly vulnerable to external shocks and volatilities. The re-investment of the resource revenues in other forms of capital for instance more investment in education is required as well as resource policies conducive to efficient extraction rates. The failure to implement sound policies would cause the so-called 'resource curse' to arise. Atkinson and Hamilton (2003) find that countries that escaped the resource curse utilised resource rents for investments rather than for current public expenditure.

Keywords: Trade, Developing Countries, Sub-Saharan Africa, Sustainable Development, Panel Data Analysis.

Virtual Poster Session

The Impact of Work-Life Balance on Job Performance among Working Mothers in Mauritius

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Abstract:

According to society, a good mother should be child-centred, full-time, stay-home mother. But this has changed in the modern era. In the early centuries, the man had control of the household and was the breadwinner for the family, while the woman's only role was to take care of the children. In this era, working mothers carry out family responsibilities while remaining engaged in their careers dealing with the challenging demands of their various roles.

A clear change also occurred in the general approach towards women in Mauritius. They were no longer restricted to household chores. Today, they can be seen to be working alongside men in every sphere of life. This clearly shows the empowerment of women. Women contributed a lot in the economic development of Mauritius since being independent in 1968. Today, traditional family has been switched to both husbands and wives to earning income. Working single mothers have also increased. Managing the two domains have become a part of their everyday life. In patriarchal societies, such as Mauritius, balancing between their professional and personal life is very difficult for working mothers.

Thus, the idea of work-life balance (WLB), together with its implications, is a fundamental issue that need to be studied as the number of working women is increasing and the difficulties, they face because of it is, without question, quite serious. The main purpose of this study is to investigate the relationship between WLB and working mothers' job performance.

This study explores the work-life balance theories and its different facets and explores several theoretical frameworks on which the understanding of the topic work-family relies upon. These include spill-over, compensation, segmentation and social-exchange theories; the impact of working mothers on work-life balance. It also discuss on work-family conflict (WFC), as almost all adults are engaged in several roles that require time, energy, and commitment. Many adults find that work and family are important in their lives. Work life challenges of working mothers, where there is an impact of factors such as pre-existing health status, parity, breastfeeding, the accessibility of social help from family and companions and work-related variables, e.g., timing of return to work, work pressure, and working environment on recovering of women after childbirth stress and their continuation of work and family responsibilities.
The consequences of work-life imbalance, where burnout is one of the factors that has been associated with work-life imbalance is discussed. Work-life balance and job performance, whereby organizations that ignore matters concerning employee WLB and this result in decreased worker productivity and consequently it will be more challenging to enhance worker job performance is addressed in this study.

The research approach that is selected for collecting data is quantitative and a survey will be conducted in Mauritius among professional women. The respondents will be chosen from a random sample of mothers who are engaged in paid employment or who are self-employed.

Keywords: Work-life balance, work performance, professional women

Industry, Innovation and Infrastructure

Virtual Oral Presentations

S_N2@P Reactions: Inversion *versus* Retention Pathways

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Abstract:

The bimolecular nucleophilic substitution (S_N2) reaction refers to the attack of an electron-rich species (nucleophile) at a reactive centre on a molecule and the simultaneous departure of a part of the molecule (leaving group). S_N2 reactions may occur through the inversion or retention pathways. In the inversion pathway, the nucleophile attacks the reactive centre from the side opposite to the leaving group and the stereochemistry is inversed from the reactant to the product. In the retention pathway, the nucleophilic attack occurs on the same side as the leaving group, maintaining the stereochemistry from the reactant to the product.

S_N2 reactions at the carbon centre (S_N2@C) are well-established both experimentally and computationally. However, S_N2 reactions at the phosphorus centre (S_N2@P) are less studied than S_N2@C reactions. The S_N2@P reactions of reactants containing a trivalent tricoordinate phosphorus [P(III)] centre were reported to generate a pentacoordinate [P(V)] intermediate which may undergo a Berry pseudorotation to determine the stereochemistry of the products. In an experimental study, Ye *et al.* (Organic Letters, 2017, 19, 5384.) proposed mechanisms for the attack of aliphatic and aromatic nucleophiles which dictate the stereochemistry of the products. They proposed that aliphatic nucleophiles attack *via* the inversion pathway while aromatic nucleophiles prefer the retention pathway.

The aim of this project was to study ion-pair S_N2@P reactions theoretically in the gas phase and in solvent. The inversion and retention pathways of the S_N2 reactions of PMe_3Cl, PMePhCl, PPH_2Cl, $P(CMe_3)_3Cl$ and P[(−)-Men]PhCl with EtMgBr and with MeOPhMgBr ion-pair nucleophiles were studied. The P[(−)-Men]PhCl, EtMgBr and MeOPhMgBr reactants were employed to compare the computational data obtained with the experimental observations. Ye *et al*. carried out the S_N2 reactions in tetrahydrofuran (THF) solvent in the presence of boron trihydride (BH_3). In order to mimic the solvent reaction conditions and investigate the mechanism proposed by Ye *et al.*, a model of the reactants containing a dative bond between the phosphorus and boron atoms was considered. All optimisation and frequency computations were performed with the B3LYP functional and the 6-31++G(d,p) basis set. The effect of bulk solvation was studied using the polarisable continuum model with THF as solvent. The activation strain model was employed to relate mechanistic observations to the strain and interaction between deforming reactants.

The gas-phase reactions investigated occur through typical S_N2 pathways without the presence of a P(V) intermediate, contrary to previous reports and contrary to the mechanism proposed by Ye *et al*. Conformational searches show that different inversion and retention pathways are possible for one particular reaction. As the bulkiness of the phosphorus-containing reactants



increases, the reactants show a preference for the retention pathway. Similar observations were made for the THF-solvated reactions. It is found that the preference for inversion or retention pathways cannot be explained only through the electronic or Gibbs free activation energies but also through the changes in entropy. This study demonstrates pathways towards phosphorus-containing molecules with bulky substituents which are challenging to synthesise. Our results also add to the existing literature on the mechanism of S_N2 reaction of P(III) reactants with ion-pair nucleophiles to form phosphorus-containing products which may be used as ligands.

Keywords: Bimolecular nucleophilic substitution; ion-pair; phosphorus

Innovative Tools to facilitate the Processing of Files and Organisation of Events

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Abstract:

Tools and equipment, such as washing machines, food mixers and elevators, reduce the need for user interventions and increase the speed, effectiveness and efficiency of completing tasks. Advances in computer hardware and software provide the means to develop tools to automate tasks, such as the processing of files, in various fields and in the organisation of events.

In the field of computational chemistry, for example, quantum chemical calculations gather data in text-based input and output files. Relevant information from these files is retrieved and compiled in spreadsheets and text documents. Certain tools facilitate the preparation of the input files and retrieval of information from the output files. However, time-consuming interventions from the user are still necessary for some calculations. For example, the processing of files, involving the activation strain model of chemical reactivity, can take several hours. The ExcelAutomat tool [1-3] was developed which completes the operations within five minutes. Preparing supporting information (SI) document is another area which can be time-consuming, especially, when hundreds of files are involved. The SI document accompanies research articles and includes various structure-related parameters obtained following quantum theoretical investigations. Tools exist which can extract and compile parameters for the SI. However, the extracted information has to be transferred to the SI document and custom formatting requires a knowledge of coding. Along the same line, in the organisation of events and conferences, several tasks require user involvement such as the recording of attendance, the issuing of badges and certificates of attendance, as well as the compilation of a book of abstract.

The main objectives of this research were to (i) design an interface to facilitate the tabulation of results and generate SI, (ii) provide options to generate infrared (IR) and Raman Spectra, (iii) generate letters of acceptance, badges and certificates for event purposes, (iv) register, record and monitor attendance of participants through a mobile application, and (v) design a mobile application to show the event details.

For the generation of SI and spectra, the ExcelAutomat tool was extended to include new worksheets, namely “genSI”, “genSIList”, “genSIBondLength”, “genSITemplates” and “RamanIRGraph”. Routines were written in the Visual Basic for Applications (VBA) programming language and build upon the existing library of the ExcelAutomat tool.

The graphical user interface for the generation of SI involves user forms and was designed using the toolkit "UserForm" in the VBA editor of Microsoft Excel. The forms update the list of templates, list of files and description of the parameters in the related worksheets. The tool was adapted to the open-source LibreOffice through the option "VBASupport" for cross-platform compatibility. The user launches the form from within ExcelAutomat to prepare a customised template. After the user specifies the output files, the routines extract the relevant parameters from the files directly to the SI document. Buttons are available in the sheet "RamanIRGraph" for the generation of IR and Raman spectra.

The CCUoM and QR applications were developed using MIT App Inventor to facilitate the organisation of events. The organisation of the CCUoM dissemination seminar was considered as a case study. A participant registered for the programme by filling an online form. Google Apps Scripts emailed the registration information, a unique QR code and a link to download the CCUoM application to the participant. The CCUoM application displays the programme details for the event. A participant can also filter the programme as per the author, time or title. At the event, the QR application scanned the code and sent the check-in time to a Google sheet. After the event, the QR application scanned the QR code again to register the check-out time and emailed the certificate of attendance. The certificates of attendance were generated using the Mail Merge feature of Microsoft Publisher and scripts written in VBA and Google Apps Script. In the VCCS-2019 conference, the book of abstract was successfully generated using VBA.

The developed innovative tools highlight how the processing of files and organisation of events can be facilitated. The extended ExcelAutomat tool parses files from several computational software packages and has a website (https://sites.google.com/view/excelautomat/home). The principles in designing and developing the tools can be applied to other fields and in the organisation of future events.

Keywords: Supporting information, Event Automation, Computational Chemistry, VBA, Google Apps Script

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Exploring the Prospects of Mobile Marketing in a Small Island Developing State (SIDS)

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Abstract:

Context and objective - Mobile marketing has recently experienced a considerable development due to the evolution of technology in mobile phones. According Bolat, Kooli and Wright (2016); Middleton and Cukier (2016) and Varnali and Toker (2010), mobile marketing has emerged as one of the most important marketing forms that allows companies to establish a perpetual presence (anytime, anywhere) in the customers' life. The increasing use and popularity of mobile marketing as a marketing strategy has prompted the attention of many researchers, academics and digital marketing professionals. A review of the existing literature revealed that most of the studies focusing on mobile marketing have been conducted in developed countries (Elliot, Ngugi & Malgwi, 2018), while limited research has been undertaken to explore the use and adoption of mobile marketing in a Small Island Developing State (SIDS) like Mauritius which faces unique and special developmental challenges such as remoteness, isolation, poverty, as well as limited diversification. To address this apparent gap in literature, this study[vi] aimed at exploring the prospects of mobile marketing in Mauritius, by analysing stakeholders' views on the current status of mobile marketing in Mauritius, the barriers limiting the adoption of mobile marketing by local firms and the criteria to measure the effectiveness of mobile marketing strategies. New insights obtained from the study will help in setting up effective mobile marketing strategies.

Methodology – To achieve the aim of the study, we used a qualitative research approach. Primary data were collected through a focus group meeting with different relevant stakeholders including decisions makers of different business enterprises, banks, telecommunication service providers and the government amongst others. Using a non-probability sampling method, the participants were recruited based on their involvement and experience in mobile marketing. During the discussions, a professional tape recorder was used to record the discussion. The audio recorded interactions with focus group participants were subsequently transcribed and analysed using thematic analysis.

Findings - Qualitative insights revealed that leading sectors in Mauritius including the telecommunication, airlines, banking sector amongst others are increasingly capitalising the potential of mobile marketing. According to the participants, several factors are driving the adoption of mobile marketing including the increasing number of smart phone users and the growth in connectivity and seamless payment solutions offered to smart mobile phone users.

[vi] Funded by the Higher Education Commission (TEC)

However, the participants considered that internal factors such as a lack of top management commitment, skilled marketing personnel and resources may affect the adoption of mobile marketing by Mauritian companies. Participants' response further revealed that different social media tools such as LinkedIn, Instagram, Facebook and Twitter are among the most widely used digital marketing tools by Mauritian based companies. Most of the participants consider that the local businesses are applying different parameters to assess the effectiveness of mobile marketing strategies such as the number of completed online transactions, online customers' experience reviews and the number of installed and uninstalled mobile apps. Based on the participants' responses, it can be deduced that (i) in general mobile marketing has a bright future in Mauritius and (ii) stakeholders should work closely and collaboratively to shape the future of mobile marketing trends for our small island developing state. The participants also made a series of recommendations to increase the effectiveness of mobile marketing strategies such as formulating the right content marketing strategy, designing the right approach in converting "likes" and "followers" into customers, integrating voice search technology in search engines/digital marketing strategy, encouraging merchants around the country to adopt mobile marketing and using powerful and versatile medium such as WhatsApp to promote brands.

Keywords: Mobile marketing, Mobile technology and applications, Digital marketing, SIDS

Virtual Poster Session

MobiLog, a Novel Mobile Phone-Based Data Logger, in Melting of Ice Experiment

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Abstract:

Data collection plays an important role in the conduction of experiments. In a classroom, for example, the traditional process of recording data over regular intervals of time involves a student standing in front of an instrument and writing the values as the experiment proceeds. This is time-consuming as the experimenter needs to be present throughout the experiment. The readings obtained may also be subject to human-related errors. Data loggers can automate these processes to a certain extent. However, they may not be readily available to individual students. In comparison, mobile phones and tablets are becoming more prevalent, with advance functions and can be used as substitutes for data loggers. Several applications, however, may be needed to record the readings and display the results in the form of a graph as in the case of a melting experiment.

Melting involves a change of state from solid to liquid and is a subject matter taught in secondary schools. During melting, the temperature stays constant as the energy supplied is used to overcome the forces of attraction between the particles. The temperature rises after the melting point as the kinetic energy of the particles increases. A graph of temperature against time illustrates the change in temperature from which the melting point can be determined.

The aim of the research was to develop a mobile application for data logging. The objectives of the research were to (i) design an interface to capture pictures from an instrument over regular intervals of time, (ii) write codes to take pictures over regular intervals of time and (iii) test the mobile application through a case study involving the melting of ice.

Both the front-end and back-end of the MobiLog application were designed using the Flutter framework (Dart Language) for the Android and iOS platforms. MobiLog also uses some open-source flutter packages. The application allows a user to input the total number of pictures and the time interval (in second, minute or hour) between each picture. After the user positions the mobile device over the instrument and clicks on the camera icons, MobiLog takes pictures at regular intervals of time, and constantly indicates to the user how many pictures have already been captured. Each picture is displayed after the experiment along with the time and an empty text box. The user can infer the reading of the instrument from the picture and record the value in the text box. After saving the readings, the application permanently deletes the pictures taken from the user's mobile phone. MobiLog also allows the user to visualise the data stored in the form of a line graph.

The melting of ice was investigated as a case study. Ice cubes were placed in a glass vessel and allowed to melt. A thermocouple was placed in contact with the ice cubes. The timer in the

MobiLog application in a mobile phone was set to 30 s and the total number of pictures was set to 60. The MobiLog application was positioned in front of the equipment's digital display and MobiLog captured a picture of the reading every half minute over 30 minutes. The reading was initially at 0 °C. After the ice melted, the temperature rose gradually reaching 11 °C. All the temperature readings were successfully captured by MobiLog.

MobiLog is a mobile application for Android and iOS platforms and enables data to be automatically recorded from instruments over regular time periods. Human intervention is limited to positioning the camera of the mobile device in front of the measuring instrument before the experiment and inserting the readings from each picture after the experiment. In the case study considered, the readings were successfully captured over 30 minutes. MobiLog allows the experimenter to focus on the analysis of the results and can be a valuable tool both for students and professional researchers.

Keywords: Automation, data logging, mobile application, melting experiment, change of state

Quality Education and Lifelong Learning

Virtual Oral Presentations

Blended e-Learning as a Perspective of Imparting Education in a University

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Abstract:

Online or e-learning is highly valued today and emphasised in this unprecedented context of the pandemic COVID-19 compared with the past as a result of developments and technological advancements made through information and communication technologies, the Internet, social networks, etc. This has become a possibility for various learners to gain access to e-learning that was long time ago limited to a selected number of learners. The Université des Mascareignes (UdM) is actually training a selective number of its academic staff with Université de Caen* to develop hybrid training that combines synchronous and asynchronous learning. Through this learning platform, it will be seen that teaching with be concurrently carried out in class and online. By emphasising this learning approach, the UdM also expects the extension of such mode of learning within lifelong learning. Through the development of well-structured and tailor-made programmes, it is expected that there will be the possibility of offering courses both to existing university students and any individual seeking to learn a specific topic or course that matches his requirements. This perspective aligns with the concept of promoting quality online education to any prospective target audience of the university.

The present situation in Mauritius calls for higher consideration for e-learning in that high time to recognise e-learning and the distance learning mode as a complementary tool for education at various levels without undermining the greatness of working in a classroom with classmates and an educator providing the teaching guidelines and discussion for effective learning.

A questionnaire survey done in the form of fieldwork was used to find out the importance of developing lifelong education based on the e-learning platform. Questionnaires were sent to academic staff participating in the training including existing students at the UdM who are actually studying full and part-time courses and who are also using basic facilities of online education. Simple random sampling was done as all academic staff of the UdM are presently engaged in e-learning due to the national confinement of the COVID-19 pandemic.

The research findings related to the four key questions are discussed in this section. The findings stated that there was a genuine demand for e-learning at the UdM, students and academics purported the advantages of promoting e-learning. Additionally, the findings supported the sustainability of e-learning at the university including the constraints of such a pedagogical approach.

Keywords: e-learning, staff training, lifelong learning, students, learners

An Analysis of the Perception of Educators on the Learning Outcomes and Motivation/ Engagement of Students using Tablets under the Early Digital Learning Programme (EDLP)

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Abstract:

The EDLP (Early Digital Learning Programme) has been implemented since year 2018 in Grade one and in Grade two. In year 2019, it has been implemented in Grade three as well. This year that is in 2020 it is being implemented in Grade four. The focus of this research is to analyse the perception of primary educators on the learning outcomes and motivation/ engagement of students who use tablets. The Ministry of Education is putting emphasis on innovative education. These new technologies can be used as pedagogical tools to promote ICT mediated pedagogy in line with the strategy "moving towards a fully-fledged digital society." Since the last decade the Ministry of Education has been investing heavily in Information and Communication Technologies (ICT). Consequently, significant student learning outcome is expected from this project. The use of innovative technologies in school has a great impact in teaching and learning methods. Tablet usage in the past has failed to achieve expected results. This study, therefore, sets out to assess the effectiveness of tablets on student achievement and the implications on the returns of education. Other objectives of this study is to analyse whether the EDLP tools provided by the Ministry acts as pedagogical enhancers. ICT tools arouse the interest of learners. Complicated lessons are made easier. These tools can be used to support existing pedagogical practices. This study also analyses whether the learning resources in the tablets are aligned with objectives of the curriculum of subjects taught. The research will explore whether use of tablets positively engage and motivate students. The research will identify whether the use of tablets distract pupils in their learning. The results of this study are based on both a quantitative and qualitative study and thus comprises of both primary and secondary data. 200 questionnaires were designed to gather relevant information from educators. The gathered data was analyzed using SPSS through pie charts, bar charts and descriptive statistics. End of year examination results of students were also analyzed. The data revealed that the tools such as tablets and projectors provided by the Ministry of education enhance learning. The skills and knowledge of young learners are strengthened. The results also showed that the learning resources which are designed for students in the tablets are aligned with objectives of the curriculum of subjects taught. The learning resources should consist of well-defined educational aims, specific objectives, a structure and learning strategy. The result demonstrated that the use of tablets stimulates students' interest and concentration levels in class and create an engaging learning environment. Concerning tablet use as distraction in class, 70.5% of educators disagrees that tablets distract students from paying full attention in the classroom while 29.5% of them agree that students are distracted by tablets and do not pay full attention in class. Technological distraction is a major global issue in schools. Students are given tablets so that they excel in their studies. They should utilise these tools to the way they are intended to be used. The end of year results of students also indicated improvement in

performance while using tablets. The Pearson's correlation analysis, between tablet usage and performance index is 0.67. It is therefore concluded that there is strong relationship between tablet usage and the learning outcome of students. We can conclude that the use of tablets positively influences the performance of students. All the assessment of data gathered show that the objectives of the study have been met. Nevertheless, there are some contradictions where some educators agree tablets are a distraction to students. So, some solutions need to seek concerning the distraction issue. The education system has never been static. The rapid development and changes through the use of these innovative tool have started to make their impact deeply in our school.

Keywords: tablets, student engagement, motivation, performance, distraction

Transdisciplinary Learning Designs for Fostering the Entrepreneurial University Graduate

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Abstract:

As the University of Mauritius aspires to transform into an entrepreneurial Higher education institution, this study aims at qualitatively investigating a pedagogical framework which would enable that our graduates to be imbibed with transdisciplinary knowledge rather than single (siloed) disciplines. Discussions on the World Economic Forum suggest that to become more entrepreneurial and partner effectively with industry, there needs to be "a structured collaborative framework on the part of the university, an eye to common values, flexibility and smart programmes for budding start-ups". This entails rethinking curricula and exploring transdisciplinary learning design models that synthesise complex, wicked problems with collaborative networked teaching contexts so as to positively stimulate the development of T-shaped graduates with the horizontal bar of the T representing "a breadth of knowledge, interpersonal skills and the ability to collaborate across different other disciplines and the vertical bar representing the traditional and a depth of understanding of the field she has studied".

This paper will address the objectives of investigating how we can design:

(1) learner-centred, transdisciplinary teaching and learning strategies for developing entrepreneurial competencies.

(2) viable transdisciplinary assessment methods for measuring entrepreneurial competencies

From current and influential literature around transdisciplinary graduate education, entrepreneurial competencies and horizontal collaborative networks, the main pedagogical and epistemological approaches are synthesised. As substantiated from Figure 1 below, our choice of learning outcomes, learning environments, and assessment framework depend on our ontological and epistemological assumptions as well as on our disciplinary habits.

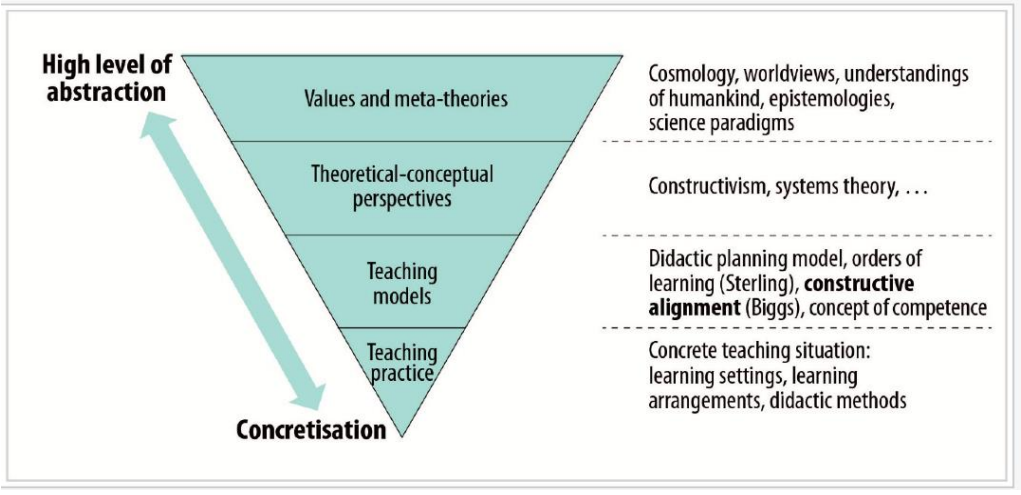

Figure 1: Heuristic model of a Tree of Science to show how our choice of learning outcomes, learning environments, and assessment framework depend on our ontological and epistemological assumptions as well as on our disciplinary habits. (Wilhelm et al, 2019)

Following the review, and within a socio-constructivist paradigm, Bird's model of entrepreneurial intentionality and the Dynamic Capabilities theory are synthesised and include the Self-efficacy theory as the theoretical framework for this study. This provided the basis for developing qualitative investigations around the concepts of Social competencies, Collaborative networking, Digital Literacies, Growth mindsets and Professional, Sustainable and Ethical practices. Twelve Final Year students and six academics from the six faculties/centres were invited for focus group discussions to discuss about concrete teaching and learning situations/practices which would then help to determine teaching models and validate the theoretical perspectives of this study. A thematic analysis of the discussions allowed for identifying patterns within the qualitative data sets (Terry et al, 2017).

Having a transdisciplinary approach to programme and curriculum development is essential for an entrepreneurial university. From the emerging themes, it was inferred that students preferred situational learning environments and case study approaches which could provide them with more holistic views of authentic problems that needed to be solved. They realised that teamwork and collaboration was not as easy as it seemed as communication of accurate and meaningful information was hampered by lack of familiarisation of discipline-specific terminologies. From the academic perspective, the current policies on university-industry engagement need to be reviewed. Also, the collaboration of educational researchers, administration and faculty is essential to determine a new university-wide pedagogical framework so that separate disciplines can be synergised and supported administratively and technologically to create a more transdisciplinary approach to teaching and learning.

The results emphasise the need for more empirical research into the readiness of the University of Mauritius to become an Entrepreneurial University from the administrative and technological perspectives. There needs to be more exposure to entrepreneurship cultures for idea generation, conscientious ethical and values-based professionalisation and investment into technology-enhanced learning and collaborative networks. The framework should also be tested at a university-wide level and in other higher education institutions for cross-case analyses of how students are involved into entrepreneurial projects and supported by technology, academics and administration. This study can have major significance for redefining our academic programme offerings and engagement with industry.

Keywords: Entrepreneurial Universities, Transdisciplinary competencies, Dynamic Capabilities Theory, Self-efficacy Theory.

Design and Development of an Assistive Technology for Visually Impaired Students

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Abstract:

Developed in 1824, the braille system enables visually impaired students to write and read. This system consists of a series of rectangular blocks called cells which have raised dots (wikipedia, 2020). The number and arrangement of these dots distinguish one character from another (Unicode, 2020). To understand the braille system, one needs a certain level of expertise. Hence specialized teachers and specialized braille books are needed for blind students. Most of the time, the braille system is not adapted to the ever-changing syllabus and on the other hand the teachers are not available 24/7 to attend to questions and answers.

In the context of my MSc Educational Technology project, I have decided to investigate how visually impaired students respond to the use of a learning resource in the form of a Google Assistant which I developed using the conversational learning method coupled with Artificial Intelligence (AI). This learning resource allows students to learn pronunciation while conversing with the system. It works through conversational speech, whereby students would interact by talking to the system, which in turn will answer back through the speakers to the users. Questions that are not available will be saved, analyzed and an appropriate answer, based on their syllabus will be formulated by an educator and inserted in the database. The system involves a user interface which will use text to speech and speech to text capabilities to synthesize the voice of the user into text and the text reply from the AI to sound/voice. The voice input from the user, being converted to text will be sent to the AI system whereby due to the deep learning capabilities, it can look for the answers if available.

AI can be broken down into two parts, mainly the Machine Learning and Deep Learning. Machine Learning involves designing algorithms that can learn from data to become more accurate and effective over time while deep learning involves using layers of artificial neural networks that create a human-like logic structure (Canonical Limited , 2019). The AI system will use a Probabilistic Relation Model (PRM), which together with a particular database of objects and relations, defines a probability distribution over the attributes of the objects (Getoor, et al., n.d.). The answer will depend on the highest probability based on the PRM. In case the answer is incorrect, the teacher can still check all the queries and correct it for the next input, hence improving the Machine Learning and Deep learning for future references. Whenever there is no answer, the system will give a pre-defined answer and will store the question in the unanswered queries for the teacher to write the correct answer accordingly. The user can re-ask the question later on to get the right answer.

A mixed research approach has been chosen to answer the main research questions of this study which are (i) How will the Google Assistant system affect the learning experience of the visually impaired student? (ii) Does this system help in improving the cognitive skills of visually impaired students?

The sample of participants identified for the study consists of students from a specialized school for the visually impaired as well as a few students from non-specialized secondary schools with similar disability. The participants will be observed during their usage of the google assistant system and they will also be interviewed to gather deeper insights into their learning experience.

Through the user-friendliness of the conversational learning system, it is expected that the visually impaired become more at ease at asking questions and would be able to find quick answers as compared to the braille system. It is hoped that with the GOOGLE ASSISTANT, the cognitive skills such as their ability to think, remember, learn and reason would be improved.

Keywords: Artificial Intelligence, Special Education Needs, Assistive technology

A Model of Transformative Quality for Graduates' Life Readiness

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Abstract:

This paper presents the development of a model for the assessment of transformative quality. While there are numerous studies focusing on the identification and assessment of graduate attributes, they contain some limitations in their approach. Most importantly, intelligence has often been assumed to be a fixed asset and rarely considered in the evaluation of higher education or graduates' attributes. Adapting the model of multiple intelligences in a holistic model of transformative quality for graduates' life readiness, this study propose a comprehensive model which can be used by universities to better think about the "quality of graduates" they "produce". The study consists of qualitative techniques such as focus group discussions and interviews, whereby the aim is to identify attributes of transformative service quality. This approach of ascertaining the quality attributes through qualitative methods such as interviews and focus group discussions, has been used by a number of researchers in the field. The model comprises of seven primary dimensions: intelligences, core technical skills, generic skills, grit, self-efficacy, civic engagement and moral integrity.

The multi-dimensional model proposed for assessing the development of graduate attributes provide an original and innovative way of thinking about the higher education outcomes by integrating the theory of multiple-intelligences as advocated by Professor Howard Gardner. Such an approach propose an alternative way of thinking about graduate attributes and addresses some of the major concerns with past models. It is recommended that future models of graduate attributes take into account the theory of multiple intelligence and also includes other cross-cutting outcomes such as grit, moral integrity and self-efficacy which have often been neglected in past studies. While the model proposed is not without limitations, it does provide a useful tool for the evaluation of higher education outcomes. Future studies, might look the objective measurement of the intelligences and other outcomes instead of relying on the self-assessment tools. The study also makes use of the quality function deployment technique which is applied to a specific programme as a case study. Two main dimensions of technical specifications were considered, namely, curriculum and pedagogy. From the case study, it was found that the graduate attributes requiring the most attention were moral integrity, emotional intelligence and cultural intelligence. As for the curriculum, the dissertation and practical training was identified as being the most important components. Finally, regarding the assessment methods, written assignments and reflective journals were seen as being of prime relevance. While this case study provides a useful methodological contribution with regards to the use of the QFD technique for mapping graduate attributes to technical specifications, it is limited to one particular case study. It is recommended that future research considers the application of QFD to other programmes in various fields. Finally, it is recommended that programme structures take into account the development of multiple intelligences by making them explicit therein.

Keywords: Graduate Attributes; Higher Education; Multiple Intelligences; Transformative Quality; Learning Outcomes.

From MDGs to SDGs: Tracking the Evolution of Sustainable Development Indicators over the Last Two Decades

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Abstract:

To be able to support a sustainable way of living on our planet, a clear definition of sustainability is required (Geurt and Arthur, 2008). Moreover, one has to be able to measure the present level of sustainability and indicate how far remote we are from complete sustainability (Lawn, 2004 cited by Geurt and Arthur, 2008). It is now widely accepted that in a world in which poverty and inequity are widespread, ecological and other crises will reign. Sustainable development thus requires meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life [World Commission for Environment and Development (WCED), 1987]. Since the adoption of the UN Millenium Declaration in 2000, much attention had been given to development and use of indicators to measure progress on achieving the Millennium Development Goals (MDGs). Policy makers, environmental community and the public at large are often confronted with common terms like ecological indicators, environmental indicators, environmental performance indicators and are unable to make clear distinctions between them.

It is very important for environmental managers to understand the different environmental indicators that are developed, so that proper interpretations are made and the right decision taken at policy level. Sustainable Development indicators, thus, are used to measure and calibrate progress towards SD goals. They are intended to provide an early warning to prevent economic, social and environmental damage. They are also important tools to communicate ideas, thoughts and values. The main goal of this study was to examine and assess the consistency, clarity and ambiguity level of Sustainable Development indicators developed by the United Nations and to analyse the evolution of sustainability goals over the last two decades. An in-depth literature search was conducted on the sustainability indicators which revealed that there were initially a set of 134 indicators and these were revised down to 58 indicators and later into a fewer number. The revised set of Commission of Sustainable Development (CSD) indicators published in 2006 by the UN comprised of a core set of 50 indicators that formed part of a broader set of 96 indicators of the SD. The idea for having a core set was to make the indicators more manageable by the users and to optimize resources available for government to develop the indicators. It was observed that most countries had developed their own set of Sustainability Indicators based on the CSD guidelines in the first decade (2000-2010). By critically reviewing works from prominent researchers in this field as well as through an assessment of country reports, a list of recommendations for improvement of the indicators provided by environmental researchers was compiled and presented in this paper. Through a desk review, the main limitations of sustainability indicators were identified. It was noted that most CSD indicators were dependent on intensive data availability. They required an effective breakdown of environmental indicators according to the main economic sectors of their respective countries and this sorting had to be performed by highly skilled statisticians and environmental experts. Many small countries were not assisted to perform such tasks and lack skilled personnel to manage the indicators. During future revisions of indicators in the second

decade, the thematic linkages that exist between the themes had been revisited by experts in order to reduce the ambiguities that could arise. A survey on local practices revealed that policy makers had to be properly trained and provided with adequate guidelines for the interpretation of new indicators introduced. It was imperative to reduce the number of SD indicators and lump them in main themes related to priority environmental concerns for them to be more manageable and effective. This would also help to optimize financial and other resources being allocated by the government at national level to monitor progress towards such indicators. Hence the emergence of the 17 SDGs (further condensed to the SIX SDG transformations) which are currently being considered to be the blueprint to achieve a better and more sustainable future for all. Understanding the evolution of the SDGs help policy makers to better grasp the concept of environmental performance monitoring.

Keywords: Sustainability indicators, Sustainable development goals (SDGs, environmental performance, standardization.

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Virtual Poster Sessions

An Augmented Reality Mobile Application adapted for Autistic Children

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Abstract

Autism Spectrum Disorder (ASD), a disorder which encompasses social, communication challenges and repetitive behaviours, is becoming more prevalent in Mauritius. As reported by the Ministry of Social Security, 1 in 1000 children is born with autism in Mauritius. Autistic children need to be handled appropriately as from an early age so that their conditions do not worsen. In Mauritius, there are several Special Educational Needs (SEN) schools, which offer educational services adapted to different types of children with disabilities including autism. Autistic children need different teaching methods in order to account for their behavioural, academic and social needs. According to research, the use technology has been very successful and has given promising results in the education of children with ASD in other countries. However, the use of technology is almost non-existent in most SEN schools in Mauritius. The aim of this project is to develop an interactive augmented reality (AR) mobile application for children having mild and moderate autism and who are between 3 and 7 years old. The AR mobile application will assist teachers in the classroom and allow autistic children to learn alphabets, words and colors. A survey has been first carried out in five SEN Schools to gather maximum information about the different techniques that are employed in the education of autistic children in Mauritius. Most of the teachers are in favour of using technology in class to assist them. The mobile application has then been developed based on pictures and audio cues to cater for the different learning styles of the autistic children. French language has been used for the audio cues in the application. The Audio cues allow the autistic children to hear words and hence they can repeat and learn the words. The AR mobile application has been tested several times by teachers and therapists and then has been refined accordingly to best suit the needs of the children having autism. The prototyping methodology has been used to refine the requirements. The AR mobile application has been designed using Blender, Vuforia SDK and Unity 3D. The AR mobile application has also been tested on different mobile phones in order to know the minimum requirements of device that can support the application. Any mobile device with at least a CPU of Octa-core 1.8 GHz, 4 GB of Memory, Battery 3400 mAh, OS Version 8.1, and Resolution 1080 x 2244 can run the AR mobile application. Furthermore, the acceptance testing has been carried in three SEN Schools. Five participants have been chosen for the acceptance testing namely two educators, one psychologist, one head of school and one nurse. A questionnaire consisting of several questions has been given to them to fill after using application. 35.7% of them are of opinion that the AR mobile application has educational value, 21.4 % of them think that the AR mobile application is user friendly, 28.6 % of them confirm that the mobile application is visually appealing and 14.3 % of them claim that it is a new and interesting conception. Also, all of them have recommended to use the AR mobile application. One SEN school has also decided to integrate the AR mobile application in their curriculum in order to assist the autistic children in the learning process. Most of the participants believe that if technology is used appropriately, this can assist autistic children in their learning process.

Keywords: Mobile, Augmented Reality, Autism, Application, Schools

Internationalisation of Higher Education in Mauritius

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Abstract:

The aim of this study is to conduct an exploratory study on the factors impacting cross border education in Mauritius mainly for UK based universities and to develop a framework and propose a set of recommendations for improvement. In recent years, cross border higher education (CBHE) has faced a prominent role in the higher education landscape as an increasing number of CBHE campuses are being set up throughout the world (e.g. International Branch Campuses (IBC)). CBHE has become the means to globalise higher education (Varghese, 2011). It is only very recently that transnational cross-border higher education in the form of the IBC has emerged as a disruptive education model, however the impact has been severely under researched, especially given recent political shifts such as Brexit and Pandemic crisis.

With rising prices in education, the costs of going abroad with complications in obtaining visas, degrees packaged in familiar settings looks increasingly attractive. In Mauritius, the Higher Education Commission demonstrated in a recent participation report (TEC, 2019) that fewer students are leaving to study, and more are enrolling into Private universities, evidencing that perhaps the international branch campus (IBC) model is gaining traction.

The study will use a critical realism approach as IBCs are operating in the context of hard objectives and external factors but there is still need for managers of IBC to develop their own understanding of their objectives within the context. Critical Realism can help to unfold unobservable structures and relationships as a methodological approach.

The main research question will be asking what are the causal factors affecting the IBC in terms of success factors and challenges for UK based universities. The research methodology will entail semi -structured interviews with the managers of the IBC. The sample frame will consist of three operational universities and two universities, which have currently been closed. For the operational universities, the researcher will interview two senior managers from each university and a former manager. For those that have been closed, the business partners and the campus directors will be interviewed.

Additionally, setting up a cross border education campus is a very complex venture as it involves replicating the services in the host country in terms of student and staff mobility, research policies and funding, quality assurance framework, regulatory bodies, international higher education strategy, national culture, strategic alignment, knowledge sharing networks, governance structures, curriculum, staffing issues and collaboration between the institutions. Thus, this can explain the need to explore the success and failure factors of IBCs.

This study therefore will seek to investigate these factors in the Mauritian context – there as yet has not been any in-depth look at how Mauritius has positioned itself, compared to other branch campus markets – in particular UAE and Malaysia, which have become highly competitive. This research can be useful for prospective universities and Government bodies to have a better

understanding of the factors affecting cross border education in Mauritius mainly when the Government of Mauritius is now welcoming 500 top Universities to set up in Mauritius with lucrative business packages which include tax exemptions, tax breaks for purchase of ICT hardware and software to promote online/blended delivery and visa facilities for non-citizens and their dependents.

Keywords: Research Week, University of Mauritius, international branch campus, transnational education, cross border higher education.

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Global Partnership and Sustainable Development Finance

Virtual Oral Presentations

Volatility and Market Interdependence in the US and the BRICS

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Abstract:

Stock markets exhibit a certain level of volatility. The triggers of volatility in stock markets tend to be different across economies. The concept of "contagion" links financial volatility from one market to more, especially during financial crises or economic downturns. The knowledge of volatility transmission alerts for possible losses. This is because the patterns of volatility during crises often display similar characteristics (Diebold & Yilmaz, 2012). It is argued that returns and volatilities should be studied together instead of separately, and there are implications in terms of portfolio diversification. The existence of significant co-movements of returns implies diminishing opportunities for investors to diversify their portfolios (Dedi & Yavas, 2016).

We aim to study stock market volatility in the emerging economies of Brazil, Russia, India, China and South Africa (BRICS) and one major market in the United States (US). Our interests on the BRICS follow the research undertaken by Ramlukun and Gonpot (2017) where volatility spillover effects within the BRICS group only were investigated. The group is again subject to more investigation with the impact of global markets, as is the case with the US market now in our study. The core objectives are to investigate specific models in their performance to track volatility in the stock markets and to analyze volatility transmission effects between the US and the BRICS.

First, we look into the trends in market volatility from August 2007 to December 2018 with 2312 daily observations. We use and compare two volatility models, namely the Generalized Auto Regressive Conditional Heteroskedasticity (GARCH) and the exponential GARCH (EGARCH) models. In the GARCH model, we observe the rate at which the persistence in volatility dies in each market. The feature of volatility clustering is more apparent when the sum is closer to 1 and whereby the effects go away very slowly. In the EGARCH model, we observe the Leverage Effect. It shows that if there is a negative shock of a certain magnitude, then it engenders more volatility compared to a positive shock of the same magnitude (Raju et al., 2016). We then investigate the interdependence of the BRICS stock markets on the US market via shocks and volatility transmissions using the bivariate Baba, Engle, Kraft and Kroner GARCH (BEKK GARCH) framework. The parameters of the model are estimated using the full information maximum likelihood which is performed on the Matrix Laboratory (MATLAB) software.

Among the main findings, China is observed to be the only exception where the leverage parameter is not significant. The EGARCH model under the Student-t distribution proves the best fit model as compared to the GARCH model to capture volatility in the stock markets. We spot bidirectional shock transmissions of the US with Brazil and India. Moreover, there are

negative volatility spillover effects from the US to Brazil and Russia. China and South Africa show no shocks and volatility effects with the US market.

Our study provides important information about the Leverage Effect in stock markets. The negative sign of the leverage parameter indicates that the US and the BRICS stock markets are more sensitive to "bad" news than to "good" news, with the only exception being China. This translates as a good sign for international investors to use China for their investments and returns at times when the other markets are subject to external shocks and/or unprecedented events. For the second part, we studied the impact of the US market on the BRICS' stock markets. Within the BRICS, Brazil is the most influenced by the US while India and Russia follows in the rank. Finally, China and South Africa are de facto good platforms as per our findings to secure investments against external stock market risks arising from the US. This shows diversification benefits and portfolio strategies to international investors active in these markets.

Keywords: Volatility, Leverage Effect, Spillover, Investors

A High-Order RBF-FD Method for Pricing Zero-Coupon Bonds and Bond Options under the Regime-Switching Model

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Abstract:

A bond is a financial instrument that can be treated as the issuer borrowing money from holders for a pre-specified period of time and bonds that are not contracted to make periodic coupon payments are called zero-coupon bonds. These bonds are issued at a deep discount so that interest is then paid at the maturity date. Being among the most commonly traded financial instruments, more flexible and accurate numerical approaches with more realistic models are demanded for the pricing of zero-coupon bonds. As such, many financial models have been proposed and used by practitioners in today's financial markets. In fact, the models adopted in the industry are those which are as realistic and simple as possible. However, assumptions of constant volatility in interest rate models are not consistent with the behavior of interest rate levels observed in real financial markets.

The regime-switching model has then become an effective alternative to traditional approaches for they better reflect the random market environment. The adoption of the regime-switching model is motivated by its simple and representative way to describe the economic features observed in real financial markets. Following a continuous time Markov chain, the market parameters are allowed to switch randomly among a finite number of states in a parsimonious manner so as to capture varying states of economic cycles that exist.

The development of efficient and accurate numerical techniques to price zero-coupon bonds is still an active field of research. In this study, we therefore propose the extension of the localized radial basis function (RBF) method for pricing zero-coupon bonds and European bond option prices under the Cox-Ingersoll-Ross (CIR) regime-switching model. In this respect, a high-order radial basis function finite difference (RBF-FD) approximation is applied for the approximation of the regime-dependent partial differential equations (PDEs). Unlike the classical finite difference schemes, the RBF methods can operate arbitrarily on scattered nodes where both global and local approximations can be implemented. Employing global RBFs to approximate the spatial derivatives in the pricing PDE is usually based on all the nodes in the computational domain which results in the solution of dense linear system of equations.

The RBF-FD method is flexible with respect to the geometry of the computational domain, allows us to freely place additional nodes where required in order to improve the accuracy of the approximation and result in banded linear systems. We study high-order approximations using the RBF-FD scheme on a five-point stencil. Since the prevailing errors in option pricing occur around the points of singularity, high-order convergence can be restored using local node refinements near these singular points. Furthermore, for the temporal discretization, we consider the exponential time integration (ETI) scheme combined with best rational approximations based on Carathéodory-Fejér procedure for the resulting semi-discrete equations. Numerical results demonstrate that high-order convergent prices bond and bond option prices under the CIR regime-switching model are obtained using the localized RBF-FD scheme. We note that such high order of convergence for the bond and bond option prices under the Markovian framework has not yet been achieved.

Keywords: Radial Basis Functions; High-Order Finite Difference; Zero-Coupon Bonds; Bond Options; Regime-Switching

A Space-Time Repeated Extrapolation Approach for Option Pricing under the Finite Moment Log-Stable Model

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Abstract:

Lévy based processes have now gained much popularity since they can account for the fat tailed and leptokurtic distributions of asset prices. Particularly, the finite moment log-stable (FMLS) model, the modified Lévy-α-stable KoBol process and the CGMY process can capture the randomly changing volatility and the jumps exhibited in stock prices. The FMLS model is superior to several other widely used Lévy processes since it can capture the highly skewed feature of the implied density for log returns and simultaneously fit volatility smirks. The FMLS model has thus naturally received much attention among researchers and practitioners for the valuation of options. Under such model, the option price is governed by a fractional partial differential equation (FPDE) consisting of second-order derivatives replaced by an α-order spatial derivative. However due to the global feature of the fractional derivatives, solving FPDEs analytically reveals to be a challenging task of the so that we need to resort to numerical approximations.

The development of efficient and accurate numerical techniques to solve FPDEs is still an active field of research. In this study, we consider the FMLS model to price a European call option using a second-order convergent implicit difference scheme. We consider the Crank-Nicolson technique to approximate the time derivative, a central difference approximation for the first order spatial derivative, and a weighted shifted Grünwald Letnikov scheme to approximate the space fractional derivative. Furthermore, we show that the scheme is unconditionally stable and convergent through analysis. Due to the non-local structure of fractional derivatives, the numerical scheme involves solving at each time step dense and large linear systems, implying high computational cost and storage while implementing. Moreover, further refining the spatial and temporal grids to improve accuracy can be computationally very expensive. This is why it is important to develop and improve on existing techniques that allow for reduction of numerical errors, and also diminish the computational cost of the solving process.

A method which reveals to be very efficient to accelerate the convergence of any numerical scheme with known order of accuracy is the Richardson Extrapolation. Richardson extrapolation is a flexible and effective tool in reducing discretization errors and can be applied to various numerical methods with the effect of increasing the order of accuracy. We therefore propose to first use the Richardson extrapolation in time to improve the second-order approximation of the time derivative and thus minimise the temporal truncation error terms. We then apply a repeated spatial extrapolation procedure over the extrapolated solutions in time to obtain higher order of convergence.

It is shown from test cases implemented that the repeated extrapolation in time and space is very efficient in increasing accuracy. We also demonstrate by our numerical experiments that highly accurate option prices are obtained using the extrapolation approach in much less time



and space steps. In fact, the effective performance of the extrapolation method relies on the uniform convergence rate. Numerical results also show the advantage of the extrapolated solutions over the non-extrapolated ones using the classical finite difference schemes with only second-order convergence.

Keywords: Finite Difference; FMLS Model; Fractional Derivative; Repeated Extrapolation; High Order accuracy

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Climate Change

Virtual Oral Presentation

Spatiotemporal Distribution of Phytoplankton and its Correlation with Climate Variability in the South West Indian Ocean Region

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Abstract:

Phytoplankton are aquatic microscopic organisms that may live in both salty and fresh water bodies. These living organisms are single-celled plants but some species can be categorised as bacteria or protists. Marine phytoplankton are known to be the base of the aquatic food web. They provide food directly or indirectly to a plethora of marine lives ranging from animal-like zooplankton to gigantic whales. In addition, phytoplankton contribute enormously to the production of oxygen as well as the absorption of carbon dioxide in the atmosphere. The growth of phytoplankton depends on the level of carbon dioxide in the water, intensity of sunlight and nutrients such as nitrate, phosphate, silicate and calcium. They also require small amount of iron, hence limiting the areas of ocean favourable for their development. Other parameters that can influence their growth are water temperature and salinity, water depth, winds and type of predators that may feed on them. This paper aims to understand the effects of climatic variations on the spatiotemporal distribution of phytoplankton by mapping chlorophyll-a concentration and studying its correlation with climate variables such as sea surface temperature and ocean currents. It is to be noted that the surface chlorophyll-a concentration measured by satellites is commonly used as an indicator to quantify the phytoplankton present in the ocean. The region of study is the South West Indian Ocean (SWIO) which is defined between latitudes from -5 °S to -35 °S and longitudes from 35 °E to 70 °E. Satellite data for chlorophyll-a and sea surface temperature are obtained from the NASA Ocean Colour website. The dataset used is the MODIS-Aqua Level-3 Mapped Chlorophyll Data Version 2018 and the MODIS-Aqua Level-3 Mapped 11 μm Day/Night Sea Surface Temperature Data Version 2018. Daily data for surface velocity and ocean salinity are obtained from the Copernicus Marine Environment Monitoring Service website. These data are processed for rolling 32-day average for the period January 2018 to December 2019 and studied using the Pearson's correlation analysis. Results obtained revealed that the chlorophyll-a variability anti-correlates (r-value=-0.65) with the sea surface temperature and is mostly driven by seasonality with maximum (~0.45 mg/m^3) in winter and minimum (~0.05 mg/m^3) in summer. Moreover, there is a high concentration of chlorophyll-a throughout the year, around the west and south coasts of Madagascar as well as the eastern coast of the African continent, ranging between 0.3 to 0.45 mg/m^3 compared to other regions where the concentration does not exceed 0.15 mg/m^3. These high values can be attributed to the rapid mesoscale ocean surface current from the southern African continental shelf (Agulhas Bank) through the Mozambique channel (Mozambique current) which entrained the nutrients that are conductive to phytoplankton enhancement. This mesoscale ocean current also carries the phytoplankton towards the northern SWIO seas where the concentration of chlorophyll-a is relatively high (~0.3-0.4 mg/m^3).

Keywords: Phytoplankton distribution; Climate variables; South West Indian Ocean region

Virtual Poster Sessions

Promoting Sustainable Development through Taxation on Motor Vehicles in Mauritius

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Background and Purposes

The problems of poor air quality and traffic congestion are likely to constrain economic growth through adverse effects on human health, productivity and wasted time. Climate change is yet another problem that may hinder future development in vulnerable countries. In this respect, Mauritius is considered to be amongst the top 20 countries with the highest disaster risk for several years (**Disaster Risk Reduction Network, 2019**). All these issues are classic externalities requiring corrective action by the government. Given the seriousness of these problems, it is vital to address them with policy instruments that exploit in a cost-effective manner all the different behavioral responses throughout the economy that can help alleviate these issues. In this regard, fiscal instruments are often the most effective policy while at the same time mobilising valuable government funds (**Parry, 2018**).

Consequently, the aim of this research is to assess the efficiency of motor vehicle taxes in Mauritius with the view of promoting sustainable development in the country. In particular, the carbon taxation, motor fuel taxes and vehicle ownership taxes amongst others will be analysed and this research intends to come up with fruitful recommendations to alleviate pollution and traffic congestion in Mauritius through a reform of the taxation system.

Methodology

The methodologies for the research are in essence comprised of the black letter approach which will analyse the legal provisions relating to the taxation laws on Motor Vehicles in Mauritius. A comparative analysis will also be performed to find out the corresponding legal provisions relating to fiscal measures in the form of motor vehicle taxes in some European Union member countries. This comparative study will be carried out to suggest some more enhanced policies regarding motor vehicle taxation which may be inspired from the laws of the selected European Union member countries.

Findings:

This paper aims at responding to the research objectives set out above. In particular, it is found that the existing environmental tax framework has several loopholes. Hence, it is suggested that Mauritius government should consider the adoption of mileage tolls in order to tax miles driven by motorist. This would encourage people to drive less to reduce their tax bills. The study also calls for a reform of insurance taxes on motor vehicles through tax incentives. Currently, motor vehicle insurance takes the form of a fixed payment but by incorporating the Pay-As-You-Drive (PAYD) insurance scheme, motorists driving over the miles determined annually would end up paying more insurance than those who drive less.

Significance/Originality/Value:

At present, there are few literature on the researched topic and this study will be amongst the first academic writings on the effectiveness of the motor vehicle tax legislation in Mauritius. The study is carried out with the aim of combining a large amount of empirical, theoretical and factual information that can be of use to various stakeholders and not only to academics.

Key Words: Environmental taxes in Mauritius, tax on motor vehicles in Mauritius, the introduction of mileage tolls in Mauritius, the enactment of Pay-As-You-Drive insurance scheme in Mauritius.

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A Study on the Prevalence of Pre- and Post-Harvest Fungal Diseases affecting the Onion Crop in Mauritius

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Abstract:

Allium cepa L., commonly known as onion, is a vegetable crop cultivated and consumed worldwide. Mauritius features among the 170 countries cultivating onion for domestic use, with an average production of about 9000 t yearly. Onion is among one of the non-sugar food crops of high economic importance with an annual value of Rs 126 M and an annual per capita consumption estimated at 12-13 kg between 2012 and 2013. It is a seasonal crop grown in winter during the months of March to August and has a crop cycle of 3-5 months. In terms of diseases, onions are primarily affected by fungi both at the pre-harvest stage in fields and at post-harvest in storage areas. With climate change arising as a global issue of prime concern, it has been predicted that its adverse effects may impact food security directly by yield losses and indirectly by impairing the safety of the onion. Characterized by increased temperatures, changes in rainfall patterns and the increased frequency of extreme weather events, climate change is likely to increase the occurrence of fungal diseases in onions. Moreover, under favourable conditions, some mycotoxigenic fungi can produce mycotoxins at levels that impair food safety and threaten human health. So far in Mauritius, no studies have been done to assess the impact of climate change with regards to the cultivation of onion and the potential of contamination of the crop by mycotoxins. This study was aimed at undertaking a surveillance of fungal diseases affecting the onion crop and correlate it with climatic factors known to affect fungal growth, survival and dispersal. A disease survey was carried out in onion plantations from sub-humid, humid and super-humid agroclimatic zones of Mauritius during the onion season (June-October 2019) and disease incidence (DI) was determined. Agroclimatic data (temperature and relative humidity) were also recorded on-site. Diseased leaf and bulb samples of the Bellarose, Rosada, Chelsea, Noflaye, STAR 5516, Sunset and Sirius varieties were collected and brought to the laboratory for identification of the causal agent by microscopy, culturing and molecular methods. Post-harvest bulb samples from the red and yellow varieties were also collected from various storage areas during the months of February-April (Summer) and September (Winter) and inspected for diseases. Moreover, the Koch's postulates were applied in pathogenicity trials by spot-inoculating the isolates on healthy bulbs and observing for disease signs such as tissue discoloration, necrosis or mycelial growth. The main fungal diseases encountered on field in all climatic zones were suspected to be *Stemphylium* leaf blight and pink root with a mean incidence of 64.8% and 34.9% respectively. In sub-humid regions,

the suspected diseases observed were leaf blight caused by *Stemphylium* spp. (97.5%), pink root (68.8%) caused by *Phoma terrestris* and purple blotch or leaf blight caused by *Alternaria* spp. (41%). For humid regions, *Stemphylium* leaf blight (61.5%) and pink root (24.9%) have been identified presumptively. In super-humid regions, the prevailing diseases were presumed to be *Stemphylium* leaf blight (35.3%), pink root (11%), damping-off (8.3%) and umbel blight (0.7%), both caused by *Fusarium* spp. As for post-harvest diseases, brown stain typically caused by *Botrytis cinerea*, basal rot caused by *Fusarium* spp., pink root and neck rot were observed. Commensals such as *Aspergillus niger* and suspects of *Penicillium* were also noted. Pathogenicity tests with suspected isolates of *Stemphylium* spp., *Alternaria* spp., *Phoma terrestris* and *Fusarium* spp. resulted in disease outcomes in healthy hosts. Following statistical analysis using Pearson's correlation, DI for *Stemphylium* leaf blight strongly increases with increasing temperature (R = 0.8019) and DI for Pink root moderately increases with increasing temperature (R = 0.6299). In terms of humidity, DI for *Stemphylium* leaf blight strongly increases with decreasing relative humidity (R = -0.8686) and pink root moderately increases with decreasing relative humidity (R = -0.5333). So far, PCR and sequencing revealed *Fusarium oxysporum* as the etiological agent of basal rot and identified *Aspergillus fumigatus* as a post-harvest commensal. Future work will involve the definitive identification of the remaining isolates by molecular techniques and analysis of bulbs for mycotoxins such as aflatoxin, ochratoxin, citrinin, T-2/HT-2 toxin, zearalenone, deoxynivalenol and fumonisin, produced by *Aspergillus*, *Penicillium* and *Fusarium* spp. occasionally found on onion bulbs.

Keywords: Fungal diseases, onions, climate change, mycotoxigenic fungi, disease prevalence

Impact of Climatic Factors on Fungal and Bacterial Infections affecting Tomato Crops in Mauritius

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Abstract

Tomato is one of the most economically important food crops in Mauritius after potato and onion, with an average per capita consumption of ca. 12 kg/year. Indeed, the value of the tomato industry is estimated to be around Rs 300 M with an annual production of 14 700 t over an area of 935 ha and at a market price ranging from Rs 13.00 to 105.00/kg. Unfortunately, open-field and greenhouse-grown tomatoes are highly susceptible to various pathologies in Mauritius with an incidence rate ranging from 10-100%. Diseases affecting tomatoes are primarily caused by fungal pathogens, and many of these also have the ability to produce toxic secondary metabolites known as mycotoxins which pose a serious threat to human health. Moreover, tomato diseases of bacterial origin, once established in a field can also have severe consequences if the environmental conditions favour disease development. Changes in climatic factors such as shifts in the patterns of rainfall, increase in temperature and relative humidity, are likely to have a great influence on the incidence and severity of microbial diseases affecting tomatoes. The project was aimed at conducting a surveillance of diseases affecting tomato crops grown in different regions of Mauritius and aligning the known climatic variables with disease incidence. Tomato plantation in different agroclimatic zones (sub-humid, humid and super-humid) was surveyed for key diseases during the period March 2019- February 2020 and disease incidence was computed. Additionally, tomato samples (leaves, stems, fruits, roots) displaying specific signs such as spots, lesions and wilting were recorded and further examined for disease identification. Some of the collected diseased fruit samples were also used to perform mycotoxin analyses using ELISA kits. A digital hygrometer was used to measure the temperature and relative humidity of the visited areas *in situ*. Besides, climatological data for stations that were placed nearest to the visited field areas were collected from the Mauritius Meteorological Services. Isolation of the etiological agents was conducted followed by macroscopic and microscopic identification of the isolated microorganisms. Pathogenicity trials were subsequently done to confirm the ability of the isolated agents to cause diseases on healthy hosts. If similar pathology was reached, the identity of the presumptive pathogenic microorganisms was confirmed by PCR and sequencing. The most prevalent fungal diseases that were encountered in fields were Early blight (EB), *Fusarium* wilt, Grey leaf spot, *Alternaria* stem canker (ASC), Late blight and Anthracnose. Bacterial diseases observed were bacterial spot, bacterial speck and bacterial wilt. In greenhouses, the microbial diseases detected

included Grey leaf spot, Early blight, leaf mold, bacterial speck, pith necrosis and bacterial wilt. The disease incidence for each fungal and bacterial disease ranged from 1.4 to 100% and 3 to 58% respectively. The overall temperature varied between 23.5 and 30 °C. The minimum humidity recorded was 50% and the maximum was 80%. Infections mostly caused by fungal diseases were more prominent in areas that were super-humid such as Réduit and Camp Thorel. Early blight caused by fungi *Alternaria tomatophila* and *Alternaria solani* was the most frequent disease found infecting tomatoes both in fields and greenhouses. The climatic variables (temperature, relative humidity, rainfall) and disease incidence of EB were found to be weakly positively correlated (r= 0.1383 for temperature, r= 0.4101for relative humidity and r= 0.0424 for rainfall parameter). So far, fungus *Alternaria alternata*, responsible for ASC was molecularly confirmed. Trace amount of Alternariol mycotoxin produced by samples infected by *Alternaria* spp. was also detected on tomatoes after the mycotoxin test was carried out. Further work will involve the molecular identification of other isolates, and the detection of other mycotoxins such as altenuene, tenuazonic acid and fumonisin produced by *Alternaria* and *Fusarium* spp. on tomatoes. This research highlights the possible impacts of climatological factors on the susceptibility of tomato crops to microbial diseases which could adversely affect our food security and food safety.

Keywords: Climatic factors, Climate change, Tomato, Microbial diseases, Mycotoxin

A Surveillance of Pathogenic and Mycotoxin-Producing Fungi on Potatoes from Different Agroclimatic Zones of Mauritius

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Abstract:

Potatoes are considered as one of the most economically important non-sugar food crops in Mauritius. In 2017, the production and per capita consumption of potatoes was 14,124 tonnes and 16.41 kg/year respectively. However, with the global issue of climate change, potato production may be at risk in future years due to the prevalence of fungal diseases. Climate variability mainly temperature (T) and relative humidity (RH) have direct impacts on fungal infection, growth and spread. Since Mauritius has already reached a local production of 88 % of potatoes in 2014, it is even more crucial to assess the relationship between climate variability and fungal diseases in order to strive towards self-sufficiency. In addition, many fungal species can produce mycotoxins and the latter are chemically stable as well as heat-resistant. The adverse effects of mycotoxins following accidental consumption, can be acute with severe symptoms or can have long-term consequences on health which can include cancer and immune deficiency. Among the hundreds of mycotoxins identified worldwide, many of them gained most attention due to their adverse effects on human health and their occurrences in food. In this context, *Fusarium* spp. is one of the major fungi affecting potato tubers since it is common in the soil. In addition, *Fusarium* spp. can produce a range of different mycotoxins including deoxynivalenol (DON), zearalenone (ZEN), T-2/HT-2 toxin and Fumonisin. The objectives of this research were to investigate the prevalence of fungal diseases affecting potatoes grown in different agroclimatic zones and to assess the mycotoxin levels in diseased potato tubers collected from storage areas. Disease surveys were carried out in open fields in different regions of Mauritius such as Plaine Wilhems (super-humid), Moka (humid), Black River (sub-humid) and Rivière du Rempart (sub-humid) from November 2018 to October 2019. Disease incidence was calculated *in situ* and T and RH were recorded using a digital hygrometer. Monthly records of T and RH obtained from the Mauritius Meteorological Services (MMS) according to the different agroclimatic zones were computed simultaneously. Additionally, diseased potato samples (leaves and tubers) of varieties Spunta, Delaware and Vigora were collected from both open fields and storage areas and brought to the laboratory. Suspected fungal agents were

identified using microscopy, culturing and molecular methods and pathogenicity trials were also conducted to confirm the virulence of the fungi on healthy leaves and tubers. In addition, the mycotoxin-producing ability of *Fusarium* isolates was assessed from diseased potato tubers collected from different storage areas using mycotoxin ELISA testing kits. *Alternaria* Leaf Blight (ALB) and Late Blight (LB) caused by *Alternaria* spp. and *Phytophthora* spp. respectively were the mostly encountered fungal diseases on leaf samples collected from different agroclimatic zones. The DI of ALB varied from 0.5% to 33.3% during summer while that of LB ranged from 0.94% to 100% during winter with T and RH fluctuating from 21^{o}C to 28^{o}C and from 50% to 88% respectively. A positive correlation was also obtained between rainfall and the DI for AEL and LB. Major fungi identified on tuber samples collected from open fields and storage areas were presumed to be *Alternaria* spp. and *Fusarium* spp. causing symptoms of Early Blight and *Fusarium* Dry Rot respectively. *Fusarium* dry rot was the most prevalent one on diseased potato tubers in storage areas. So far, *Fusarium oxysporum* and *Alternaria alternata* on tubers from storage areas were confirmed using DNA sequence analysis. Interestingly, the pathogenicity tests done for *Fusarium* spp. (leaves and tubers) confirmed the identity of the etiological agent. The concentrations of ZEN (0.5-57.7µg), DON (1.5-3.5µg) and T-2/HT-2 toxin (5-11.5µg) were all of acceptable levels (50- 1000µg) in the affected potato tubers tested. However, the concentrations of Fumonisin (48-49870µg) were higher than the acceptable limit (1000-2000µg). Future work will involve the molecular characterisation of *Phytophthora* spp. on potato leaves from open fields. Equally, the mycotoxin, chaetoglobosin produced by *Chaetomium globosum* will be tested on infected potato tubers. From the results obtained, it can be inferred that the potato cultivation on our island is susceptible to climate-dependent fungal diseases that can compromise the yield and safety of this important commodity.

Keywords: Fungi, Potatoes, Climate change, Climate Variability, Mycotoxins

Environment Protection and Biodiversity Conservation

Virtual Oral Presentations

Investigating the Efficacy of Smell Repellents to mitigate Flying Fox Damage to Lychee Crops in an Oceanic Island

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Abstract:

The Mauritian flying-fox (*Pteropus niger*), is a Mascarene endemic whose original populations were driven extinct on Reunion and Rodrigues. It survives mainly on Mauritius, as a small population has recently recolonized Reunion Island from Mauritius. The species feeds mainly on various native and introduced fruits thereby disseminating seeds and thus play an important ecological role in the regeneration and long-term maintenance of native forests in Mauritius. *Pteropus niger* starts breeding in around May and give birth between August and December which coincides with the fruiting season of lychee (*Litchi chinensis* Sonn.), itself economically important to the local and export markets. Damages caused to cultivated fruits have generated a human-wildlife conflict which, exacerbated by exaggerations of population sizes and damage levels, led to mass-culling campaigns by the government. This triggered an uplisting of the species from Vulnerable to Endangered by the International Union for Conservation of Nature in 2018. With sugarcane field conversion to fruit crop cultivation, fruit grower-bat conflicts are likely to persist or intensify, unless appropriate measures are adopted. Our objectives were to evaluate lychee fruit losses and to assess the effectiveness of smell repellents as a non-lethal method to protect lychees. A field trial was carried out at Calebasses, Constance and Medine orchards between October and December 2018, to evaluate the efficacy of four commercial and one homemade smell repellents in reducing damages to lychee crops. A randomized block design with the three orchards as blocking variables was used. For each orchard, five randomly selected trees were used for each repellent (dispensed using repellent-soaked flags attached to tree canopies) with five trees serving as control with flags only (without repellent) and five trees without flags. The whole experiment consisted of 105 lychee trees. Fruit production per tree was estimated as the product of mean panicle number per tree and mean fruits per panicle and damage assessment was done, where fallen fruits under sampled trees were classified according to agents that caused their loss, namely bats, other animals (birds, parakeets, rats and monkeys), fungus and natural fruit fall. The data from control trees indicated that there was a significant difference between the causes of damage in lychee fruit ($F(3,6)=5.807$, $P=0.033$, two-way ANOVA). Damage by bats differed significantly between orchards ($F(2,12)=11.523$, $P=0.002$, two-way ANOVA), with highest damage recorded at Constance and lowest at Calebasses. However, there was no significant difference between bat damage on control trees, trees with flags only and trees treated with repellents. Bat damage on control trees varied from 3.4 % (at Calebasses for trees with flags only) to 71.0 % (at Constance). Assessed trees in Constance

were either found near the main road or were situated by a river, 1.14 km from the main road. Most of the trees found near the main road sustained less than 50 % losses, while all the trees by the river had over 50 % bat damage. The largest average percentage of fruit loss by other animals and natural fruit fall was 13.6 % and 21.4 % respectively, while the maximum fungal damage was 15.0 %. The high level of bat damage on lychee trees found by the river at Constance could be due to the presence of the water course along which bats tend to predominantly fly. The low bat damage recorded at Calebasses may be due to the availability of alternative food resources nearby. Apart from fruits damaged by bats, causes of damage by other animals, fungal damage and fruit loss through natural fruit fall was relatively low to negligible. Moreover, the number of tonnes of fruits harvested was high as compared to overall fruit loss and hence, despite undergoing fruit losses, farmers were able to recover from the marketable yield. The degree of bat damage recorded in the results compared to pre-culling figures indicated that mass culling did not reduce fruit damage to lychees. It is important to continue to research non-lethal methods to replace culling not only because the latter management does not lead to increased lychee production, but because culling elevates endangerment of threatened biodiversity and does so at a cost. There is much scope to rigorously test efficacy of several already implemented as well as novel approaches seeking to reduce lychee crop damage.

Keywords: crop protection, fruit production, lychee, Mauritius, *Pteropus niger*

Short-Term *in-situ* Experiment shows Substantial Negative Impacts of Invasive Alien Plants on a Declining Endangered Island Plant

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Abstract:

Up to 6,800 plants species endemic to oceanic islands are highly threatened with extinction. Although threats like habitat destruction and fragmentation play a role, it is generally recognised that invasive alien species nowadays pose the single most important threat to island plants. Many studies explored the role of novel interspecific interactions in driving declines of island plants, but these have mostly focussed on threats mediated by animals directly (e.g. seed predators, mutualism disruptors) or indirectly (through extinction of seed dispersal or pollination mutualists). Few studies have investigated the much more common and direct plant-plant interactions between native and alien plants, especially *in-situ*. Mauritius' remnant native forests are invaded by alien plants which halved the density of native woody plants over about 68 years. Control of alien plants is however documented to improve the quality of native forests through increased native woody plant flower and fruit production. The island's heavily invaded forests thus provide a good insular model to understand how control of alien plants can influence controphic interactions. We used an island endemic, endangered plant, *Roussea simplex* Sm. (Rousseaceae), currently in rapid decline to evaluate the influence of invasive alien plants (IAP) on the survival, growth and turnover of its vegetative modules and reproductive structures. We quantified these parameters using 14 random plants around which IAP were manually weeded paired with controls, at two sites namely Le Pouce Mt and Piton Savanne. Canopy cover before and after the weeding was quantified for vegetation cover using photographic images taken at each cardinal point to estimate the percentage of leaf cover versus sky or soil using the CAN-EYE v6.1 software which calculates the pixels of the image, and the weight of IAP removed was measured using a calibrated pesola. From each plant, ten random branches were monitored trimonthly for two consecutive years, where their elongation, branch survival, mortality, number of leaves, leaves' size and leaf turnover were quantified. IAP removal increased leaf size, turnover, accumulation, longevity and estimated leaf surface area. Leaf emergence varied significantly between treatments. Branch elongation and branching rate were higher for both sites where the aliens were removed. However, mean proportion of dead branches in Le Pouce Mt did not differ significantly between treatments, in contrast with Piton Savanne, where higher proportion of branches died in the control experiment. Plants with no weeds around produced more flower buds and had a higher survival rate compared to control plants. Degree of increase canopy opening post weeding and fresh mass of IAP removed correlated positively with total leaf area per branch. Alien plants reduce survival, growth and production of leaves and branches and lead to fewer flower buds being produced. Plant fitness improved most with greatest canopy cover reduction post weeding. Shading appears to accelerate the death of branches and subsequent death of whole plants compared to weeded

areas. The competition for light intensifies with extent of alien plant invasion, leading to higher branch and leaves' mortality. Presence of alien plants reduces flower buds' production apparently because *Roussea* must compete for resources resulting in less energy for reproduction. However, it was noted that in experimental plants, all flowers were predated by rats and did not reach fruit stage. IAP presence leads to higher mortality of *Roussea* plants. These would translate into progressively lower nectar and fruits for endemic flower visiting reptiles and birds, thereby weakening the mutualisms between *Roussea*'s pollinators and seed dispersers. Results highlight the vulnerability of endangered island plants to alien plant invasion, and the relative simplicity of corrective measures. Despite occurrence in protected areas spared from habitat destruction, threatened plants do decline due to IAP. Control of alien plants benefits the species' survival and growth; it also increases flower bud production which should strengthen *Roussea*-animal mutualisms triggering positive feedback loops benefiting other threatened species. However, higher production of flowers implies higher resource patch and increased attractiveness to florivores. Decline and extirpation of *Roussea* in invaded native habitats can be averted through timely weeding, but also concurrent rat control programmes. IAP weeding even on a micro-scale is a conservation strategy capable of improving prospects for specific endangered island plants and could be employed more often but should be coupled with control programmes of other alien species where necessary.

Keywords: alien plants; oceanic island; *Roussea simplex*; threatened species; weed control

Virtual Poster Session

A Study of the Diversity of opisthobranchs Sea Slugs (Mollusca, Gastropoda) in the South Western Region of Mauritius

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Abstract:

Detailed biodiversity data provide information about the relationship of species to their environment and on the state of the species itself. These are subsequently important for an effective management plan and conservation strategy. The opisthobranchs are a diverse group of sea slugs which are known for their pharmaceutical potential. It comprises of the nudibranchs, head-shield slugs, sea hares, side-gilled slugs and sap-sucking slugs. The aim of the present study is to investigate the diversity and abundance of opisthobranchs sea slugs at Le Morne for a one year period. The survey was conducted at low tide (less than 0.5m to 1.5m depth) with a sampling frequency of every two months starting from August 2019. Four belt transects of 50m×5m were used with each transect separated by two metre distance. The survey lasted a maximum of one hour. Sea slugs found within each belt transect were counted and photos taken *in situ*. Sediments were collected for nutrient analysis. This include nitrate, available phosphate and sulphate assessment. The abundance of opisthobranchs was calculated as the mean density along each transect with the diversity of species measured in term of species richness and evenness, using the Shannon-Wiener H' Diversity Index and Pielou's Evenness Index respectively. Among the four belt transects, transect 2 and 3 contained most opisthobranchs (0.828/m^2 and 0.832/m^2 respectively) with the most speciose genus being the *Bulla* (order Cephalaspidea) and *Oxynoe* (order Sacoglossa). Low Shannon-Wiener H' Diversity index values were obtained for all transects, with the lowest value reported in transect 4 (0.23). The Shannon Diversity Index ranges from 0 to 1, this implies that the species in transect 4 were not evenly distributed. The relative abundance of species is also known as its evenness whose values ranges from 0 to 1. Transect 3 reported an evenness value of 0.38, with a high proportion of *Oxynoe* (order Sacoglossa) (0.31). In transect 2, the proportion of the *Bulla* (order Cephalaspidea) was high (0.29). Transect 2 consisted of 100% sand, which is known to be the habitat of the *Bulla* while *Oxynoe* was restricted to the invasive seaweed *Caulerpa* sp, found in transect 3. Interestingly, in transect 3, different species assemblages were found on *Caulerpa* sp., namely: *Oxynoe* sp., *Bulla* sp., *Volvatella* sp., *Polybranchia* sp., *Elysia* sp., and *Phanerophthalmus* sp. The species recorded, belonged to the superorder Sacoglossa which feed mostly on algal host, seaweed and seagrass, explaining their low numbers (0.10/ m^2) in transect 4 (dominated by numerous patches of brown sponge). During the month of August, the sacoglossan (order Sacoglossa) were highly abundant (1.116 m^2). In October, no other seaslugs except the *Aplysia* (order Aplysiida) were found in high numbers (0.2 m^2). In January, only species of the genus *Phanerophthalmus* (order Cephalaspidea) were spotted. This is still an on-going research, and the current findings represent a stocktaking of the species present, their densities and distribution. The present results show that the species varies within each transect. The *Oxynoe* seaslugs are present abundantly in area only where their food resource (*Caulerpa* sp.) is abundant. The high number of seaslug from the order Aplysiida can be an indication of mating period.

Keywords: Opisthobranchs, abundance, Mauritius, distribution, belt transect

Sustainable Energy

Virtual Oral Presentation

Visualisation of Pareto Front Approximations in the Multi-Objective Optimisation of Distributed Generation Units

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Abstract:

Nowadays, global warming and energy crisis have urged the use of other clean and renewable energy sources to satisfy the environmental restrictions related to the Kyoto Protocol and other government actions. Distributed generation (DG) units such as photovoltaic (PV) and wind turbine systems are promising technologies for power generation. To benefit from most of the positive impacts of DG units, multi-optimisation is needed. Although several research works have been done on the optimisation of DG units considering different objective functions and constraints, the optimal solutions were presented mainly using the Pareto front. However, Pareto fronts are not appropriate for large number of objective functions. Therefore, other visualising tools must be used. Due to their stochastic nature, evolutionary algorithms are usually performed over several runs. Nonetheless, most papers show the convergence plots of the algorithms over a single run. In some cases, the non-dominated solutions from all the runs were superimposed to show the quality of each solution. This led to the loss of information on their distribution along the trade-off surface. Thus, the attainment surface plots are preferred to show the performance achieved in a certain fraction of the total number of runs.

This research focused on the use of three evolutionary algorithms namely Non-dominated Sorting Genetic Algorithm (NSGA-II), Strength Pareto Evolutionary Algorithm (SPEA2) and Multi-objective Evolutionary Algorithm based in Decomposition (MOEA/D) to identify the optimum size and location of PV systems in the IEEE-123 Node Test Feeder System. Optimisation was performed so that the active power loss, voltage deviation and total cost were reduced subject to constraints such as the size and number of DG units. The simulation was performed using MATLAB and OpenDSS. The optimisation algorithms were performed for 100 iterations over 50 runs. The optimal solutions were represented using visualising tools such as scatter plots, heatmaps, self organising maps and parallel coordinate plots (as shown in Fig. 1 to Fig. 4). Aiming to reduce the dimension of the approximation set, a new visualising method based on prosection (projection of a section and rotation) was also adopted. The projection plane, angle and section width were varied and their impacts on the proposed method was analysed. It was observed that prosections may be empty when small section widths or extreme angles (0° or 90°) are used. The results also highlighted the need for viewing different section planes to deduce the correlation among the objective functions. Furthermore, the median attainment surface plot was used to show the quality of the performance attained in 50 % of the runs. It proved to preserve the information regarding both the quality and the distribution of the solutions. As the results produced by the different visualising tools were almost similar for the three algorithms, it can be deduced that the solutions produced by NSGA-II, SPEA2 and

MOEA/D were nearly Pareto-optimal solutions. Hence, multi-objective optimisation helps the distribution system operators (DSO) to choose the most appropriate parameters for the DG according to the economical and technical needs of the consumers and the utilities. This research produces useful findings so that DSO and policy makers can propose new incentives and regulatory measures.

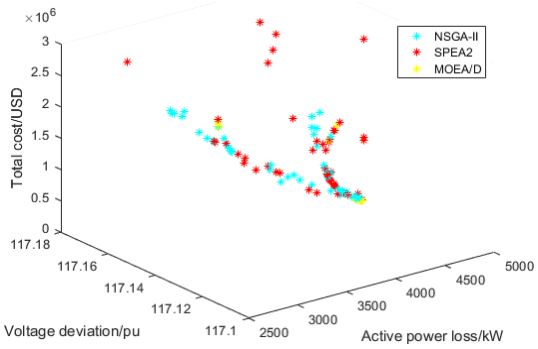
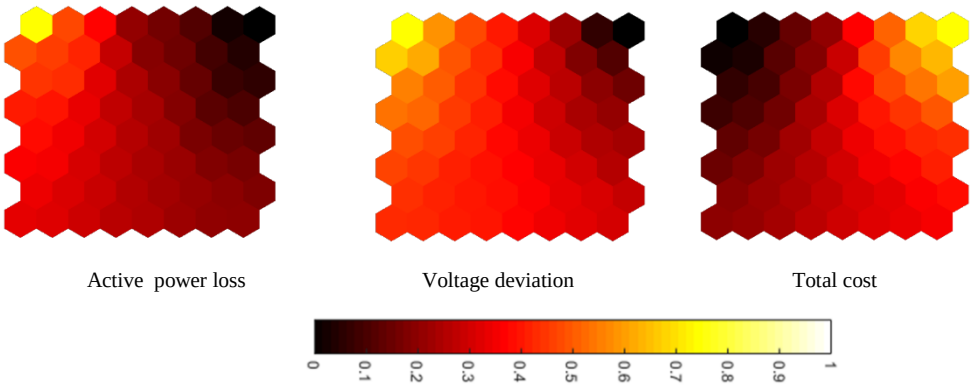


Fig. 1. Scatter plot

Fig. 2. Heatmap



Active power loss Voltage deviation Total cost

Fig. 3. Self organising maps

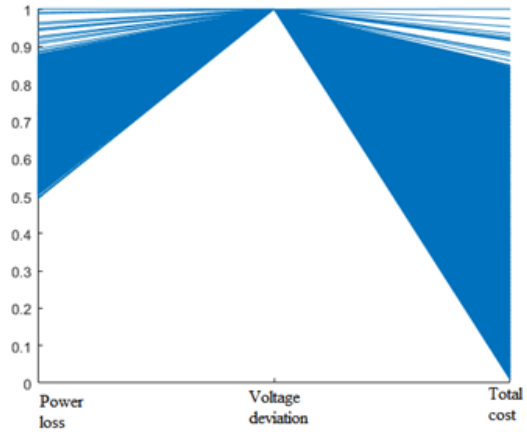


Fig. 4. Parallel coordinate plot

Keywords: multiobjective optimisation, DG units, visualisation of pareto front

Virtual Poster Session

Numerical Modelling of Turbulent Condensating Flows in a Smooth Horizontal Tube

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Abstract:

Experimental work on two-phase flow phenomena, including on boiling and condensation, has been conducted by many researchers and a variety of correlations for heat transfer and pressure drop exist in the literature. Similarly, the use of numerical techniques in simulations of equivalent flows is now becoming increasingly common. A number of steady-state simulations of condensation have been performed. Da Riva and Del Col [1] simulated the three-dimensional steady-state condensation of R134a in a 1-mm diameter minichannel using a Volume of Fluid (VOF) approach, while Liu et al. [2] used VOF to simulate condensation of water vapour in a vertical square minichannel of inner diameter 1 mm, at a saturation temperature of 100 ˚C. Da Riva et al. [3] considered the influence of turbulence on condensing R134a flows, also in microchannels. It was shown that including turbulence effects was necessary to capture the influence of mass flux on the heat transfer coefficient. The aforementioned efforts focused on steady-state problems, with far fewer studies have been undertaken in flows with time-dependent conditions. Of interest in this context is the work of Dahikar et al. [4], who performed unsteady two-dimensional co-current downward steam condensation flow simulations in a vertical pipe and the transient two-dimensional simulations of condensing FC-72 performed by Lee et al. [5] using Fluent.

The aim of this work is to conduct three-dimensional unsteady numerical simulations of turbulent condensing flows of R134a. The simulations, which are validated against experimental results, are performed in a horizontal tube with inner diameter 8.4 mm and length 1.5 m using Ansys Fluent. A mass flux of 100 kg m^{-2} s^{-1} and a saturation temperature of 40 ˚C are considered. The mean vapour quality is varied from 0.25 to 0.75. Of particular interest is the effect of varying quality on the heat transfer coefficient for unsteady conditions, and the wall temperature is also investigated. The influence of gravity and surface tension are included in the simulations.

The VOF approach is used to model the liquid-vapour R134a flows by solving a single set of momentum equations for the two phases. To capture the effects of turbulence, the SST k-ω model is employed. The continuum surface force model of Brackbill et al. [6] is applied to compute the surface tension along the interface while a PISO pressure-velocity coupling scheme is used to ensure that pressure and velocity are conserved. The geo-reconstruct method, based on the principle of Youngs' VOF approach [7], is chosen to reconstruct the liquid-vapour interface. At the inlet of the tube, mass flow rates of both liquid and vapour R134a are imposed at a saturation temperature of 40 ˚C. A pressure condition is applied at the outlet. A no-slip boundary condition is considered at the wall and a contact angle is considered. Simulations are conducted at a heat flux of approximately 5 kW m^{-2}, applied to the wall.

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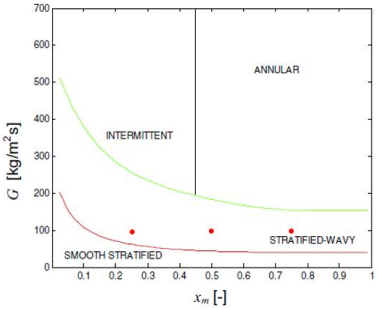

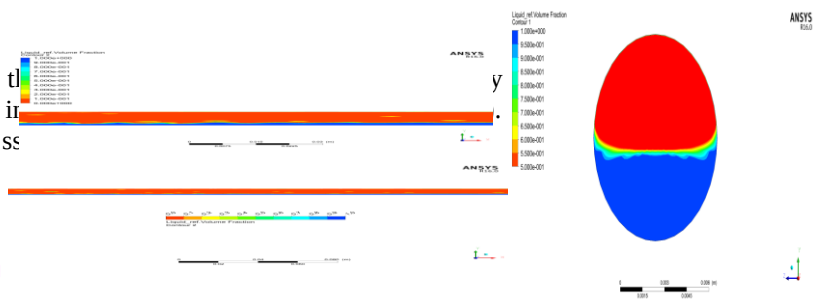

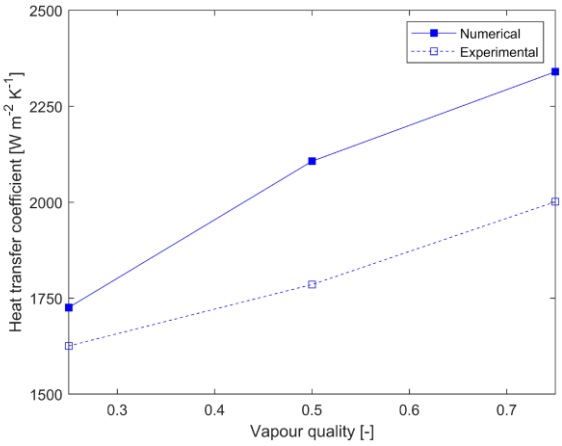

Fig. 2 Right: Comparison of experimental [9] and numerical heat transfer coefficients as a function of vapour quality.

The results suggest that, firstly, the resulting flow regimes in the pipes are correctly captured. In Fig. 1, we can see that the expected flow pattern based on the flow regime map of El Hajal et al. [8] is expected to be that of stratified-wavy flow, which is indeed the observed flow regime (see Fig. 1). Secondly, the predicted heat transfer coefficients can be compared with measured data obtained from experiments of condensing R134a flows conducted in smooth inclined tubes by Meyer et al. [9]. Fig. 2 shows such a comparison between the experimental heat transfer coefficient data in Ref. [9] and the numerical predictions from the present work, and indicates that the trend of increased heat transfer coefficient at higher vapour qualities is correctly captured by the numerical simulations. A good agreement (within 18 %) is observed between the numerically obtained heat transfer coefficient and the corresponding measured data. Of interest (although not shown here), is the finding that the bottom wall temperature is lower than that of the upper wall due to the condensed layer of R134a on the bottom wall under the effect of gravity (see Fig. 1), leading to a temperature difference between the top and bottom walls that would be of interest in certain practical applications of these flows.

Keywords: Condensation, Simulation, Volume of fluid, Heat transfer coefficient, Flow regime

Acknowledgements
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Grouped Theme
‘Water Resources Management and Health Hazards’

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Health and Well-Being

Virtual Oral Presentations

Evaluating Awareness, Perception and Knowledge of Clinical Trials among Mauritians - A Mixed Methods Study

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Abstract:

Background and objectives of the study

Although an integral component of evidence based medicine and health care system, the number of CT undertaken in Low and Middle Income Countries (LMIC) is significantly lower. The WHO further reckons that more than 80% of the major health problems are prevalent in LMIC, while most of the trials involving drugs are done in developed countries. The factors for this discrepancy include lack of resources, framework, expertise as well as participants. Mauritius has an existing legal framework to undertake clinical trials, but we have no data on how the Mauritians perceive CT and how keen they are to participate in trials. Hence, this study was conducted with the objective to explore the attitude of general Mauritian population towards CT and highlight areas of opportunities to address gaps in public awareness, perception and knowledge.

Approach and methodology

A mixed study was carried out which consisted of 2 phases: a qualitative, with thematic approach followed by a quantitative study with cross-sectional design. For the qualitative study, computer literate individuals were invited to fill an unstructured, online open-ended questionnaire. Data was collected till saturation was reached. All information was transcribed and coded, and thematically analyzed. Conclusions derived from the qualitative study were used to adapt a validated questionnaire used in Korea/India. The questionnaires were then distributed to more than 500 participants, who were randomly selected from common market place in different areas of the country. All participants were consented based on the Helsinki Declaration. Data was analysed using Microsoft Excel and Statistical Package for the Social Sciences (SPSSv23.0).

Major findings of research work

There were 23 participants who responded to the online qualitative survey, which showed poor knowledge and diverse views on CT. Various potential deterring factors to participation such as side effects of potential drugs and death were brought up by some participants. Among the favorable factors to participation, altruism, finding new cure and benefit to the society were mentioned.

364 people filled the quantitative questionnaire out of which 350 were correctly completed. There were 48% males and 52% females' participants and the average age was 40 ± 15. 78% participants had secondary schooling and above. Up to 48% of the participants were not aware of CT which included people of older age group, those from low socioeconomic status and those with low literacy level ($p<0.05$). However, majority of them were willing to participate in one (60%) if they had all the required information. Among those who previously heard about CT, only 43% of them had good knowledge of CT. Regarding perception of CT, majority of respondents ratified the value of research while a minority had poor perception related to trust

in research companies and conduct of CT. Respondents who had previously engaged in CT had better knowledge and perception of CT compared to those who did not participate in one (Odds Ratio=1.7).

Conclusion and significance

This study explored the awareness, perception, knowledge of CT among Mauritian adults. It showed that the population has poor knowledge, perception and awareness about CT. This can present a major hurdle when recruiting participants for CT. The findings of the study reflect the results from international studies. It is widely established that poor perception will lead to poor participation rate in CT. Hence, a lack of information and awareness observed in this study makes it imperative to have awareness campaigns and educational programs to enhance public engagement in CT and to make them aware of their rights as potential participants. Collaborative efforts of various stakeholders in CT should ensure that effective means to disseminate accurate and comprehensive information are being deployed in a population centered manner targeting those with low literacy level. Poor perception regarding trust and conduct in CT can be tackled by engaging the population in a two-way communication where the general population become active partners in the research process. This study also provided a foundation to guide future works. Further more in-depth and larger cross sectional surveys need to be carried out to assess the predictors that influence perception of CT among Mauritians.

Keywords: Awareness; general population; perceptions; knowledge; clinical trials

The Lived Experience of Teenage Mothers: A Phenomenological Study in Mauritius

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Abstract:

Adolescence is a defining moment in a person's life. It is the time where an individual acquires knowledge and skills, learns about relationships and gains enough maturity to assume adult roles. Nonetheless, at this age children are vulnerable to different risks and threats and some end up being victim of teenage pregnancy. According to the recent estimates from the World Health Organisation, around 21 million girls within the age of 15 – 19 years and 2 million girls below 15 years become pregnant in developing countries every year. Teenage pregnancy and associated motherhood remain a public health issue. Pregnancy brings a drastic change in the present and future of an adolescent's life. This study aims at understanding teenage mothers' perceptions of early pregnancy and motherhood.

Keywords: phenomenological, teenage mothers, pregnancy, motherhood

Objectives of the study

The objectives are to explore the lived experience of prim gravida mothers in adolescence and to establish the essence of being a teenage mother.

Methods

A phenomenological study which describes the essence of the lived experience of individuals has been used in this study. The psychological phenomenological approach illustrated by Moustakas which consist of identifying a phenomenon to study, bracketing out one's experiences, and collecting data from several persons who have experienced the phenomenon has been considered. Fifteen prim gravida teenage mothers were identified in the study with their babies aged between one to six months. The potential candidates were those who have experienced a common phenomenon. After being selected, they were provided with an information sheet stating details of the study and the signatures from their responsible parties or guardian were taken on the informed consent form. Throughout this study the anonymity of participants, privacy and confidentiality were maintained. In depth face to face interviews which consisted of open-ended questions were carried out. The interviews were all audiotaped and lasted on an average of 30 minutes. The last three interviews did not bring any new information in the study, which ensured that saturation was reached.

Findings and Discussion

Seven main themes and eighteen subthemes emerged in the study. The main themes are: i) Psychological milestones; ii) Motherhood related Anxiety; iii) Stigmatisation; iv) Drawbacks of being a teenage mother; v) Outcomes of being a teenage mother; vi) Role of partner as a parent; and vii) The need for support. The major challenges that the teenage mothers had to overcome were financial problems, fear and social isolation, fear of family members' reactions, fear of the law, school dropouts and infant health related problems. Out of the 15 participants,

only three of them were abandoned by their partners. They assumed the roles of a parent alone, they had financial constraints, they mentioned it as hard but they are coping with it.

Conclusion

This research provides an understanding of the essence of being a teenage mother in Mauritius. Despite their never-ending struggles, the teenage mothers remained brave and courageous. They have developed a stronger identity, became mature and responsible and better individuals. They have developed a special bonding with their children. The birth of their babies brought a new meaning and purpose to their lives. So far, with the help of their families, they are being able to satisfy the needs of their babies.

We have acknowledged the optimism of the young mothers, however, being from a low socio-economic background, they will require further assistance in life. A better guidance will enable the young mothers to combat their challenges better. Simultaneously, it will empower them to continue with their education and therefore, enabling them and their children to have a dignified life.

When less is more: Social Identity and Wellbeing

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Abstract:

With obesity rates increasing constantly and instances of diabetes and cardiovascular diseases reaching epidemic proportion in Mauritius, there is a need for effective policies to promote healthy lifestyles. One such valuable strategy is to increase physical activity. Indeed, an enormous amount of research demonstrates that physical activity is linked to the prevention of cardio-vascular disease, type II diabetes, cancer, hypertension, obesity, and depression, yet a majority of Mauritians are not sufficiently active to obtain these health benefits. Therefore, interventions that promote exercise are needed. Because many people engage in physical activity in groups (e.g., sport teams, fitness classes), and each group promotes different identities and exercise behaviors, it is crucial to understand how and why group memberships impact physical activity. The current study (N = 89) examines how number of social identities (one's self-definition in terms of social groups) and identity conflict (the degree to which social identities clashed with one another) impact physical activity. This study was conducted online, using Facebook and email invitations. We utilized a third-person perspective, where participants read a short interview and based on the information provided, they estimated the physical activity and group identification of a third-party (the interviewee whose number of identity and identity conflict were manipulated). Using this paradigm enabled the manipulation of number identities and identity conflict as well as to keep the exercise group standard for all participants. The experimental design consisted of a 2 (number of identities: few versus many) ×2 (identity conflict: low versus high) between-subject design, with physical activity duration and physical activity intensity as dependent variables. Participants reported the amount of minutes of exercise per week, the intensity of each work-out, levels of identification (centrality, importance and belongingness) with the exercise group, attitudes, thoughts, and feelings towards health promoting behaviors. A total of 89 (56 female, 33 male) participants were recruited by email and by Facebook posts (health related private groups) to take part in a study of life choices and health-decision making. Forty eight percent of participants were aged between 21 and 30 years, 23% aged between 31 and 40 years, 12% between 18 and 21, and 16% above 41 years. Analysis of Variance (ANOVA) revealed that physical activity duration and physical activity intensity are increased when one's "exercise" identity is prominent relative to other identities. The relationship between identity prominence and physical activity was mediated by identification with the exercise referent group for physical activity duration but not physical activity intensity. This indicates that the social groups we belong to play an important role in our health and suggests that an effective strategy for physical activity promotion is to increase the prominence of the exercise identity, by priming few social identities that conflict with one another. A prominent exercise identity will be more influential in behavior change. These findings will be discussed in the context of multiculturalism in Mauritius and the implications of implementing the Sustainable Development Goal 3 "Health and Well-being" adopted by the United Nations. The underlying logic of a social identity approach to health promotion, its strengths and limitations, will be discussed. Finally, directions for future research will be proposed.

Keywords: health promotion, social identity, number of identities, identity conflict

β-Thalassaemia Major and Psychosocial Functioning: A Case-Control Study on the Mauritian Paediatric Population

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Abstract:

Background and objectives of study

Thalassaemia is a rare inherited disorder, affecting the haemoglobin found in red blood cells. Haemoglobin is an essential component of the oxygen-carrying capabilities of red blood cells and in thalassaemia major, haemoglobin is affected to such an extent that there is a regular need for blood transfusion. Whilst the somatic complications of thalassaemia have been extensively studied, its psychosocial effects are still being researched upon.

Aims of the study were to assess the prevalence of beta-thalassaemia major (BTM) among Mauritian children and teenagers, to investigate the socio-economic factors that might lead to poor health in the population, and to compare the psychosocial and overall health coefficient of this population with that of their healthy peers.

Methodology

This is a case-control study with the study population defined as Mauritians aged between 6 and 18 with a confirmed diagnosis of BTM following treatment in a public hospital. The control group consisted of an equal number of individuals, matched for age, gender and household income. Consenting patients and their carers were made to fill the PedsQL™ questionnaire which provides a standardised approach towards measuring health-related quality of life (HRQoL). The study was carried out in hospitals during blood transfusions and in schools for the control population. Data was analysed using SPSS v21.

Major findings of the study

23 participants were recorded (a figure that represented all the BTM patients in the concerned age range attending the public health services), with a mean age of 11.8±3.5. This included 12 males and 11 females. All of the patients were still in school at an appropriate level for their corresponding age; 12 in primary and 11 in secondary schools. 7 were of low household income, 12 of medium income and 3 of high income. The percentile of BMI for age was at a mean of 38.2±23.8. Growth disorders (5) were the most common complications, followed by splenectomy (3), changes in facial appearances (2) and skin discolouration (1). Half of the

population presented no significant co-morbidities. The mean age of start of chelation agents was 6.1±1.2 years.

Mean physical (47.3±9.7), emotional (51.1±18.0), social (54.6±18.0), school performance (50.6±15.1), psychological (52.5±13.4) and total scores (50.6±10.2) were significantly decreased compared with the control group (p=0.001 for all). The younger age group (between ages 6 and 11) had better scores regarding social, emotional, psychological and total scores compared to older ones (aged between 12 and 18). Number of transfusions per year was found to negatively affect psychosocial quality of life (r=-0.655; p=0.001). Carers of BTM patients were found to systematically rate their health components worse than the patients themselves. No such difference was seen in the control group.

Conclusions and significance

BTM adversely affects all dimensions of HRQoL, the measure of which should be integrated as an important factor to assess overall health status of BTM patients. So as to optimise the smooth transition of these patients into adulthood, the biopsychosocial model should be adopted in the management of these patients. This will involve the patient, family members, school representatives and physicians all actively participating in decision making regarding the patient's health.

Keywords: Thalassaemia major; Quality of Life; PedsQL score

Antimicrobial Properties of Marine Fungi from *Haliclona* sp (sponge) and *Turbinaria conoides* and *Sargassum portieranum* (Brown Algae)

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Abstract:

Fungi are ubiquitous eukaryotes that can be unicellular or multicellular (Dörter & Momany, 2016). They carry out different roles in their environments and can be endophytes, parasites or saprophytes. Endophytic fungi spend the major part of their lives inside their host without the appearance of any symptom. They are thought to enhance the host defense system and promote growth (Ripa *et al*., 2019). A particular interest is given to marine endophytes as the chemical composition of their secondary metabolites have bioactive properties like anticancer, antioxidant, antimicrobial, anti-inflammatory. Moreover, their metabolites are different from their terrestrial counterparts as they are able to thrive in the adverse conditions of the ocean (Overy *et al*. , 2014). Sponges and algae support the highest diversity of endophytes and the latter inherit the capacity to produce unique structural and biological compounds with immense pharmaceutical potential (Menezes *et al*., 2010). The Mauritian waters harbor their own micro-organisms that have successfully adapted to their environment. The endophytes that are colonizing the surrounding oceans have been poorly studied and are awaiting to be identified. The secondary metabolites that these endophytic fungi produce also have to be discovered. The objective of this study was to isolate marine fungi from sponges and algae and use molecular tools to identify them up to the genus level. Selected endophytes will be grown in laboratory conditions and their secondary metabolites extracted and tested for antimicrobial properties. The sponge *Haliclona* sp. and the brown algae *Turbinaria conoides* and *Sargassum portieranum* were collected in the North and West of Mauritius during August 2018 at a depth of 1-2m. Marine fungi were isolated after surface sterilization of the samples and plating on nutritious agars prepared with seawater. Hyphal tips growing from the samples were observed during 1-4 weeks and sub-cultured repeatedly. With the morphological characteristics of the colony not being reliable, molecular characterization using the ITS region was necessary to assign putative identity (Jeewon *et al*., 2013). DNA extraction was therefore carried out using the CTAB method followed by amplification of the ITS1-5.8S-ITS2 region by PCR. 28 selected fungi were grown in liquid cultures and their intracellular and extracellular metabolites were extracted using ethyl acetate. These crude extracts were then tested against Gram positive and Gram positive bacteria using the disc diffusion and MIC tests. Fungi belonging to the Hypocreales order and genus Aspergillus and Pestalotiopsis were isolated from the sponge *Haliclona* sp. *Aspergillus penicilloides* and *Cordyceps memorabilis* were recovered from the brown algae *Turbinaria conoides*. Regarding *Sargassum potieranum*, *Pseudopithomyces maydicus*, *Acremonium sclerotigenum* and *Curvularia lunata* were identified. The ITS region was found to be a suitable region for amplification in order to identify fungi up to the ordinal

level. BLAST searches resulted in percentage identity ranging from 97.5%-100%. The selected isolates showed potential antimicrobial properties. 75% of the broth ethyl acetate extracts were able to inhibit the all the three bacteria while 78.57% of the mycelium extracts were able to inhibit the three bacteria. The mycelium extract of the *Acremonium* sp. from *Turbinaria conoides* showed highest zone of inhibition (21.50±0.071mm) against the Gram- positive *Bacillus cereus*. Therefore, some of the fungi isolated in this study are producers of bioactive secondary metabolites which will be characterized in future work. These promising discoveries encourage further search for bioactive metabolites from this group of micro-organisms and can help to fight antibiotic-resistant microbial infections.

Keywords: Fungi, Endophytes, marine, antimicrobial, molecular

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A Study on the Development of HLA Antibodies in Multiply Transfused Male Patients in Mauritius

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Extended Abstract:

Background: Understanding the development of HLA antibodies (Abs) would help in improving the transfusion management of MTMPs and facilitating the possibility of finding a compatible donor for future transplantation.

Objectives of this research: 1) to elucidate when HLA Abs are formed in the MTMPs in relation to the time period (TP), the transfusion episodes (TEs), the number of pints of blood transfused (NPBT) and the type of blood transfused (TBT); 2) to study any associated conditions, if any, with the development of HLA Abs; 3) to elucidate whether ethnicity has a bearing on the development of HLA Abs in the MTMPs or not; 4) to compare the unique patterns of HLA allele and haplotype frequencies across the DEGs in the MTMPs with the donor population; and 5) to identify specificities of HLA Abs across the DEGs in the MTMPs.

Methodology: HLA Abs seroconversion was studied on 50 sera from 22 naïve male patients (LAT-M®, One Lambda) for a period of 225 days. Further HLA Abs screening was done in 63 MTMPs across the DEGs (LABScreen™, One Lambda). The diversity of the HLA alleles was, then, established in 172 donors and 103 patients across the DEGs (LABType® SSO, One Lambda). HLA antibodies and typing profiles have, also, been matched in 24 MTMPs awaiting renal transplantation across the DEGs. Data acquisition was done using LABScan™ 100 and LABScan3D™ flow analysers (Luminex Corp., Austin, TX) and results were analysed by the HLA Fusion software ver. 2.0, 3.2, 4.1 & 4.3 (One Lambda); Arlequin software version 3.5.2.2; SPSS 16.0 for Windows® and a p value of < 0.05 was considered statistically significant (2-tailed).

Main findings: There had been a significant increase in the development of both HLA Class I & II Abs in relation to the TP ($t = 6.283$, $n = 49$, $p = 0.000 < 1\%$); TEs ($t = 5.466$, $n = 49$, $p = 0.000 < 1\%$); NPBT ($t = 7.668$, $n = 49$, $p = 0.000 < 1\%$) and TBT ($Z = -5.657$, $p = 0.000 < 1\%$). The weighted scores of the development of HLA Abs (both HLA Class I & Class II; HLA Class I and HLA Class II) were, significantly, increased across the DEGs, with more antibodies prevalent in the Afro-Mauritians ($Z = -6.902$, $p = 0.000 < 1\%$; $Z = -6.520$, $p = 0.000 < 1\%$; $Z = -4.213$, $p = 0.000 < 1\%$). The initiation of allo-immunisation occurred through the building-up of the mild reactive (MiR) (NBG ratio of 1.5-4.9) HLA Class I antibodies ($Z = -4.642$, $p = 0.000 < 1\%$) that, subsequently, flared up into the very severe reactive (VSR) (NBG ratio of > 100.0) HLA antibodies ($Z = -2.867$, $p = 0.000 < 1\%$). Whilst, the initial phase of HLA Class II Abs seroconversion occurred incrementally from the moderate reactive (NBG ratio of 5.0-9.9) to severe reactive (NBG ratio of 10.0-99.9) and then to the VSR (NBG ratio of > 100.0) DSA in the MTMPs ($p < 0.001$). The diversity of the donor load was due to a significant unrelatedness

between the Indo-Mauritians/Afro-Mauritians and the Mauritian Muslims/Afro-Mauritians (F_{ST} = 0.01157, n = 2, p = 0.00901; F_{ST} = 0.01297, n = 2, p = 0.03604), with *A*24 B*15 C*08 DRB1*12 DQA1*06 DQB1*03/ A*68 B*58 C*06 DRB1*12 DQA1*01 DQB1*05* occurring within 5.77% of the Afro-Mauritians; *A*01 B*40 C*06 DRB1*11 DQA1*05 DQB1*03/A*11 B*44 C*07 DRB1*07 DQA1*02 DQB1*02* appearing within 6.41% of the Mauritian Muslims; *A*02 B*40 C*15 DRB1*15 DQA1*01 DQB1*06* detected within 5.68% of the Indo-Mauritians. Unique cross-reactive HLA Abs against *HLA-DRB1*01/-DRB1*16/-DPB1*19* were observed in the Afro-Mauritian MTMPs. Inter-locus specific Abs against *HLA-DRB1*10/-DQB1*06/-DPB1*06/-DPB1*20* were, also, detected in the Indo-Mauritian MTMPs and cross reactivity pattern in the DR/DQ loci was identified in the Mauritian Muslims MTMPs (Abs against *HLA-DRB1*10/-DQB1*06*).

Results achieved: MTMPs would have poorer outcome in finding a suitable donor for transplantation as early as 184 days ($\chi 2$ = 12.889, p = 0.000 < 1%), being the 5th TEs whereby 42.9 % of HLA antibodies have been formed ($\chi 2$ = 43.223, n = 18, p < 0.001). Our Risk Prediction Model 1 [Platelets count, WCC & NHTR (non-severe)] could, significantly, predict the development of HLA Class II antibodies in MTMPs, tested on 32 sera [$F(3, 32)$ = 11.741, p = 0.000, R^2 = 0.524 (β = 0.700; t_{32} = 5.220; p = 0.000 < 1%)].

Conclusion: MTMPs developed a plethora of common and rare specificities of HLA antibodies reactive to the donors' antigenic determinants.

Clinical Significance: There is a clinical need for the setting up of the Mauritius Blood and Transplant Reference Laboratory redefining the policy actions and protocols in the segmenting of unrelated donors in terms of ethnicities, algorithmic eplet matching and DSA monitoring in the sensitised patients awaiting transplantation.

Keywords: Multiply transfused male patients (MTMPs); different ethnic groups (DEGs); donor-specific antibodies (DSA); non-haemolytic transfusion reaction (NHTR); WCC (White cell count); NBG (Normalised Background)

Behaviour Coach: A Generic Framework for the Development of Mobile-based Applications aimed at promoting Healthy Behaviour Changes through Gamification

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Abstract:

Physical inactivity and unhealthy diet are major contributing factors for type 2 diabetes and could also lead to the development of other associated health conditions such as cardiovascular diseases, hypertension and kidney diseases. The case for Mauritius requires particular attention since the percentage of citizens suffering from diabetes is alarming.

Since physical exercise and food consumption are considered as modifiable risk factors, behavioural interventions can serve to bring about positive change. Researchers have successfully ported behaviour change interventions to smart devices and are often referred to as Digital Behaviour Change Interventions
The current research addresses the lack of physical activity and unhealthy dieting through the use of wearable technologies and a mobile application with gamification elements which will motivate individuals to adopt healthier lifestyles and move away from sedentary behaviours. While digital games have gained in popularity, non-digital formats such as physical board games preserve a reputation for their therapeutic attributes. The proposed project's main aim is to merge the characteristics of 'offline' games with the data tracking capabilities of wearables and smartphone-based sensors, to promote sustainable and healthy behaviours including physical activities and proper dieting.
The two main expected outcomes of the research work are firstly, a flexible framework for researchers to easily develop similar mobile applications and thus, provide this as a tool for future research in terms of an extendable framework to cater for different health problems and to target different population groups. Secondly, a mobile application developed using the generic framework that will enable users to engage in exergames to perform physical activities and adopt proper dieting behaviours.

An extensive literature review of existing research related to the promotion of physical activity and diet which use wearable technologies and gamification has been undertaken. Alongside, an evaluation of existing technologies, including the latest advances in sensors usually employed for activity tracking has been conducted to identify their different capabilities, limitations and under-utilised potential in the area of behaviour change interventions. An online pilot survey has been conducted, enabling refinements to the questionnaire and the final version is currently being disseminated. Upon preliminary analysis of the survey results, a focus group study is intended to further explore and clarify any aspects deemed necessary. The analysis of the survey and focus group study will help towards the formulation of a set of requirements in order to maximize the impact of the intended mobile-based exergames applications on Mauritian citizens.
A tentative architecture of the proposed generic framework has been designed from which prototype mobile applications demonstrating the use of sensors and other methods to monitor physical activities have been developed. A user-friendly authoring tool has also been developed

to enable scientists/therapists to develop mobile applications through a Graphical User Interface for behaviour interventions.
The next phase of the project will be to conduct an in-depth evaluation the prototypes to refine the architecture and design of the mobile application and authoring tool. A three-months Randomised Controlled Trial will be conducted for a full-fledged evaluation of the application and assess its impact on individuals.

Keywords: Digital Behaviour Change Interventions, exergame, generic framework

Validation of the Design of a Wearable Device to arrest Bleeding from Cannula Dislodgement during Nocturnal Sessions of Home Hemodialysis

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Abstract

Nocturnal Home hemodialysis is an extension of the conventional in-centre hemodialysis with the purification process being more physiological: a slower rate and a longer duration. In the preferred setting, blood is recirculated from the arteriovenous fistula to the hemodialysis machine and back for an average period of 6 to 8 hours for 3 or more times per week. Currently, the dialysis nurse monitors the patient throughout while the patient often sleeps. There is more risk of bleeding due to cannula dislodgement in this isolated setting. The consequences of such a bleeding are more serious owing to the time interval from onset of bleeding till primary remedial measures are taken.

This review aims at validating the design of a non-invasive, safety wearable device to detect blood loss due to dislodgment of the arteriovenous cannula and to stop this bleeding through the use of an inflatable pneumatic cuff placed over the site of puncture.

A conductivity sensor (blood component detector) can be used, which could detect any blood leak within 100ms and required only 2ml of blood to be activated. The refresh rate of this sensor is 3-4 seconds. Two such sensors are used; one placed at each of the two needle puncture sites. This battery operated sensor uses 2 electrodes to detect any voltage changes due to blood leak or overt bleeding. The signal is amplified and fed to a microcontroller. The Atmel ATtiny Microcontroller 2313 is readily available and cost-effective, and can be connected to the sensors using a RS-232 cable. The microcontroller is in turn linked to an inflatable silicon cuff, wrapped around the arm of the patient over the sites of needle puncture. Upon detection of any blood leakage, the microcontroller activates the pneumatic device and the cuff is inflated around the arteriovenous fistula. This generated pressure around the arm will stop further bleeding. A silicon cuff of bladder size 16x30 cm will be adequate.

The calculated time taken for cuff pressure to reach 120 mm Hg is 10 seconds with an expected blood loss of about 50 ml, from the time of detection till the arrest of bleeding.

In this setup, bleeding due to cannula dislodgement could be effectively arrested by using a pneumatic cuff to increase pressure. The amount of blood loss would be permissible and the response time adequate for use during nocturnal home hemodialysis.

Venous needle dislodgement represents a significant number of deaths in hemodialysis centres, especially where the nurse to patient ratio is low. The less serious cases require blood transfusions and intensive care hospitalisation for fluid resuscitation, increasing the economic burden. Recurrent episodes of dislodgement create apprehension among the patients and reduce their quality of life. The above device might help in these two aspects.

The setting described could be the basis of a novel, wearable safety device to prevent the serious complications of acute blood loss during nocturnal home hemodialysis. It is battery operated and requires no external supply. Rechargeable battery or even thermal energy operated designs could be implemented. Notifications could be in the form of a LED light, a buzzer alarm or a smart message could be sent by the device if a network module is connected to the microcontroller. To increase spatial detection, multiple point detection in the form of array sensing patches could be used. The cuff could be adapted to better accommodate the needles and lines used in hemodialysis.

Keywords: home hemodialysis, nocturnal hemodialysis, arteriovenous fistula, acute bleeding, haemorrhage

Virtual Poster Sessions

An Investigation on the Relationship between Body Image and Eating Attitudes in Mauritius

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Abstract:

The notion "what-is-beautiful-is-good" has led to excessive concerning about body image (Dion, Beirscheid & Walster, 1972; Solomon, Zaichkowsky & Polegato, 2005). Appearance ideals for both men and women are clearly established in society. To maintain a body image that appears attractive to themselves and others, adult men and women get involved in a number of unhealthy behaviours, including disordered eating attitudes. Research showed that choices about what, how and when to eat becomes more difficult as a person's concern for body image increases eventually leading to particular attitudes towards eating that turn into a lifestyle. Alvarenga, Scagliusi & Philippi (2012) describe eating attitudes as the thoughts, beliefs, affect, behaviour and relationship towards food that can determine people's choices of food and health status. These attitudes become disordered when adults adopt unhealthy methods to lose or control their weight, are obsessively preoccupied about food and calories, feel angry when hungry, use food as an escape to psychological problems and eat until they feel sick. When these patterns of thoughts, beliefs, feelings and behaviours become extreme, eating disorders may arise.

The objective of the present study was to investigate the relationship between body image and eating attitudes among the adult population of Mauritius, with respect to their gender, age and relationship status. 99 adults, comprising of 37 males and 62 females took part in the study. The age range was 18 to 65 years comprising of 69.7% were young adults (18 - 39 years old), 20.2% middle adults (40- 55 years old) and 10.1% older adults (56 - 65 years old). Participants were recruited from different workplaces through the snowball and convenience sampling technique. A questionnaire containing demographic items, the Body Shape Questionnaire and the Eating Attitudes Test was administered to the respondents. Statistical results revealed a significant positive relationship between body image and eating attitudes ($r_s(97) = .42$, $p<.001$). Females were significantly more likely than males to demonstrate body image disturbances, ($t(97) = -2.74$, $p = .007$). Females and males did not differ significantly on their negative eating attitudes ($t(97) = 0.09$, $p = .926$). No significant difference was found among the three age groups under study for body dissatisfaction and eating attitudes $F(2, 96) = 1.88$, $p = .159$. Additionally, there was no significant difference among single participants, those being in a relationship and married with regard to body image dissatisfaction and disordered eating attitudes ($F(2, 94) = 0.39$, $p = .676$).

On a concluding note, the results indicated that adults associate their body image to their eating attitudes. Gender differences in body image and eating attitudes were assessed and gender had a significant effect on body image but not on eating attitudes. This suggests that body image disturbances remain dominant in women, yet men and women do not treat their eating attitudes differently. Also, no variations were noted for body image dissatisfaction and eating attitudes

among participants belonging to different age groups. This implies that age is not an influential determinant of body dissatisfaction and eating attitudes, unlike what previous studies have found. It was found that relationship status was not a factor determining body image dissatisfaction and disordered eating attitudes.

Keywords: body image, eating attitudes, gender, age, relationship status

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Health Literacy and Compliance among Hypertensive Patients: Need to tailor Interventional Strategies to efficiently target Prevailing Risk Factors

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Abstract:

Hypertension accounts for around 30% of the diseases affecting the Mauritian population. Many interventional strategies have been implemented in the country, namely: advertisements against hypertension, tobacco use and healthy diet; physical activity; health talks; introduction of new areas to help in hypertension treatment including the stroke clinic; enforcement of more strict laws against alcohol; and increasing the financial support to elderly. Yet, it is seen that nearly 70% of the hypertensive patients still have an uncontrolled Blood Pressure despite being on regular follow-up.
Compliance is often correlated to health literacy and health literacy is an assessment of health education in a community. A compliant patient is careful to limit the risk for disease progression in daily life and follows the advice and drug regime of the treating doctor.
It is also known that risk factors for hypertension differ in different areas because of population composition, genetic factors as well as prevailing life styles and habits of the people.

The aim of this study is to assess whether compliance is related to health literacy among hypertensive patients in a rural area of Mauritius. A survey to identify other risk factors prevailing in this group is done to tailor future intervention strategies against hypertension in this area.

Hypertensive patients on regular follow-up in a rural area of Mauritius were recruited for this quantitative cross-sectional study. A questionnaire based survey was done on their diet, habits, lifestyle, physical activity, current hypertensive medications other drug history and their compliance to treatment. Individual observations were recorded including height, weight and blood pressure. Data obtained was analyzed using the SPSS statistical software. The Chi-square test was used in the assessing any relationship between two parameters.

312 hypertensive patients voluntarily participated in this study. The baseline characteristics were:
Mean age of the participants was 59.0; mean BMI was 27.4, 205 participants were overweight; and gender distribution was 41.7% male and 58.3% female.
50% of the participants were still having a salty diet and 56.4% had food rich in fats/cholesterol. Regular alcohol consumption was seen in 41.6% of participants and 17% were smokers. 51% of the participants have a sedentary lifestyle.
39 women in the reproductive age formed part of the study out of which 9 were still taking oral contraceptive pills.
26.0% of the participants had a systolic blood pressure of more than 140 mmHg, out of which half had been on follow-up for up to 5 years, a quarter for 5 to 10 years and the rest for more than 20 years.

The chi-square tests performed showed an association between BMI and systolic BP; number of drugs and systolic/diastolic BP; and a positive relationship between regularity of taking drugs and control of hypertension.

This study illustrated that compliance is correlated to health literacy. Both were consistently low in the studied population. Despite being known hypertensive patients, most of the participants had an unhealthy diet and lifestyle. Many modifiable risk factors have not been addressed in this population.

Interventional strategies against a disease must be adapted to the population in which these are implemented. However, these strategies are designed at a National level. Using feedback from hypertensive patients among a rural community in Mauritius, we have demonstrated that the implemented strategies have failed to sensitize the studied population.
Future targeted interventions in this population must aim at increasing the level of health education. This involves the help of all, especially teachers, media, doctors, social workers, volunteers, psychologist and nutritionist. There is need to accentuate tobacco cessation sessions in this population.
This study illustrates a situation whereby the introduction of the family doctor concept would help in addressing a prevailing non-communicable disease. The family doctor will be the facilitator for implementation of interventional health strategies as well as a health guardian.

Keywords: Hypertension, compliance, health literacy, health education, family medicine

SGLT2 Inhibitors and Genitourinary Infections in Diabetic CKD patients: The Need for Active Screening

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Abstract:

In 2018, the FDA approved the use of SGLT2 inhibitors for primary and secondary prevention of cardiovascular events in diabetic adults. These medications have also been validated for use in diabetic chronic kidney disease (CKD) patients. However, available studies have shown discrepant results on the risk of genitourinary infections in this population when using SGLT2 inhibitors. For instance, a major recent study investigating the adverse effects of this class of drugs among the diabetic CKD population was interrupted during its course for safety concerns.

In this review, we explored the incidence of genitourinary infections on diabetic CKD patients using SGLT2 inhibitors. The plausible causes for the above-mentioned discrepancies in the results are explained through established renal physiological processes and available pharmacological knowledge on these drugs.

The MEDLINE, Embase and Cochrane Central Register databases were searched since inception till February 2020 on trials involving the use of SLGT2 inhibitors in diabetic CKD patients and reporting a risk assessment on genitourinary infections. For Randomised Controlled Trials (RCTs), the study quality and risk of bias were assessed using the Cochrane Collaboration's Risk of Bias tool. In an attempt to quantify the risk of genitourinary infections, extracted data would be pooled under random-effects model with explanation on heterogeneity.

Only 6 studies were included in this review. 4 studies were RCTs and were performed for a duration of more than 1 year. Out of these RCTs, one included diabetic CKD patients in a study lasting 2.9 years. All the 4 studies reported genitourinary infections as secondary outcomes and only 2 quantified these adverse outcomes.
The remaining 2 studies were post-hoc analyses using multicentre databases and were retrospective in nature. A significant risk for genitourinary infections was seen in both.
There is an increased incidence of localised genital infections, more seen in women, in this population on SGLT2 inhibitors. Candidiasis was the commonest infection. Reports of isolated severe cases of urinary tract infections were seen in all the RCTs and these led to poor outcomes like urosepsis and diabetic ketoacidosis.
The baseline population demographics in most of the studies were: hypertensive patients, those at risk of cardiovascular events and those with diabetes for about 13 (95% CI 8.2- 15.8) years. Subjects in the CREDENCE trial, the one study involving only diabetic CKD patients, comprised 96% hypertensive patients with above 75% having early CKD and a non-nephrotic range of albuminuria. Increased risk of urinary tract infections was not observed but a higher incidence of genital infections in the form of vulvovaginitis and balanitis was reported.

The SGLT2 inhibitors increase the risk of genital infections and accentuate the severity of urinary tract infections in diabetic CKD patients.

SGLT2 inhibitors block the reabsorption of glucose from the proximal convoluted tubules. This induces renal glycosuria and osmotic diuresis. This urine enhances microbial growth.
In diabetes, there are increased episodes of glycosuria, immune dysfunction and increased bacterial adherence to the uroepithelium. Moreover, in longstanding disease, nephropathy and neuropathy can occur leading to anatomical bladder changes with microbial growth in the loci created by trabaculations. There is a significant risk of asymptomatic bacteriuria in diabetic CKD patients and a need for longer regimes of strong antimicrobials for urinary tract infections. Complications in the form of pyelonephritis, urosepsis and even death are higher among diabetic CKD patients than in non-CKD diabetics. The risk is independent of the glycaemic HbA1C control but increases with the blood glucose level.
Mycosis and genital infections increase in diabetes due to immune dysfunction and poorer vascular supply. Neuropathy delays the time of detection in the absence of active screening.
There is, hence, a need for active screening for such infections in diabetic CKD patients on SGLT2 inhibitors. An example of screening for urinary tract infections would be in the form of routine urine nitrite dipstick and urine culture for suspected cases. For genital infections, genital examinations should be performed on routine follow-up sessions, and more often in patients with previous genital infections, disability, voiding problems and peripheral vascular disease.

Keywords: SGLT2, diabetes, chronic kidney disease, genitourinary infection, urinary infections

Sustainable Water Management and Sanitation

Virtual Oral Presentations

Intensified Organic Matter and Phosphate Removal in a Novel Adsorption Integrated Horizontal Sub-Surface Flow Constructed Wetland Technology

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Abstract:

This study addresses the development of a novel adsorption - integrated horizontal sub surface flow constructed wetland (HSSFCW) to treat high strength industrial wastewater using coal ash and alum sludge as adsorbents. The objectives are to: (1) assess the intensification of chemical oxygen demand (COD) and phosphate (PO_4) removal; and, (2) generate a set of rate constants of removal of COD (k_{COD}) and phosphate (K_{PO4}) for design purposes. Batch and continuous column adsorption tests using coal ash and alum sludge were performed. The respective adsorption index (n) of coal ash and alum sludge was 2.82 and 2.26. Since n lies between 1 and 10, this study demonstrates that coal ash and alum sludge are good absorbents and could be utilized to intensify the performance of HSSFCW technology. The maximum adsorption capacity of coal ash was 63 mgCOD/g and that of alum sludge was 67 mgPO_4/g. The saturation times were 9 min/g for coal ash and 12 min/g for alum sludge. Two parallel treatment trains were set up where each train was coupled with two HSSFCWs in series, each having dimensions of 3.0 m × 0.5 m × 0.5 m. One train, denoted as "intensified beds", comprised of one HSSFCW in which activated coal ash was used as substrate, followed by the other one packed with alum sludge. The other train, acting as a control, was comprised of two conventional HSSFCWs in series which were packed with gravel. Cattails (*Typha Latifolia*) were planted in all the four beds at a planting density of 8plants/m^2. The system followed a start-up regime of a period of 10 weeks of continuous operation with synthetic wastewater of low COD loading (in the range of 107-130 mg/l) and phosphate loading of 23-71 mg/l at a hydraulic retention time (HRT) of 24 hrs and a water depth of 0.40 m. After successful start-up, the experimental beds were operated with much higher COD and phosphate loadings in the range of 912 - 1563 mg/l and 316- 380 mg/l, respectively. Samples were taken from the inlet, within the system and outlet of the systems. These samples were analyzed for COD and PO_4.Preliminary results found removal efficiencies for COD and PO_4 of 91% and 100% for coal ash and alum sludge. In addition, the kinetics of COD and PO_4 removal were determined by fitting the progression of removal of these pollutants along the bed into the K-C models. Preliminary investigations showed that the rate constant for COD (k_{COD}) for intensified coal ash HSSFCW was 0.45 m/d and for intensified alum sludge HSSFCW, the K_{PO4} obtained was 0.98 m/d. K_{COD} and K_{PO4} shall be further investigated under increasing COD and PO_4 loadings that simulate medium-strong industrial wastewater. Hence, an intensified HSSFCWs using coal ash and alum sludge to increase COD and PO_4-P removal has been successfully developed. The rate constants obtained can now be used for future projects of intensified HSSFCW in industries treating high strength WW. The

intensified beds will be as one of the most suitable sustainable and least-costly wastewater treatment. The Mauritian industrial sector will benefit from an emerging wastewater treatment technology to promote sustainable and green industrial production. The project will originally contribute in developing design criteria for this technology, which is currently unavailable.

Keywords: novel, rate, adsorption, intensified beds, industrial wastewater

Characterisation of Wastewater from a Paint Manufacturing Industry in Mauritius

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Abstract:

The increase in industrial wastewater generation is likely to give rise to potential health and environmental hazards. Faced with stringent environmental conventions and the growing depletion of water resources, the recycling of wastewater has become a major concern. Wastewater from paint manufacturing plants has stimulated significant apprehension in the scientific community since these industries are the major consumers of water and chemicals. These industries generate highly coloured wastewater of high turbidity with a strong odour and high loads of organic and toxic chemical substances such as surfactants, bactericides, oils, solvents, and preservative agents. The discharge of these wastewater into water bodies can result in environmental variability, as the presence of dyes prevents the passage of sunlight, thus inhibiting the photosynthesis of aquatic plants. Consequently, these lead to the exhaustion of dissolved oxygen for aquatic animals. In addition, the mere occurrence of toxic substances in water bodies can cause the death of several living beings. Likewise, the direct release of these wastewater into sewer systems generates instabilities in biological treatment processes. These wastewaters yield high concentrations of inorganic salts, acids and bases in biological reactors resulting into the rise of treatment costs. The present study aims at characterising wastewater generated by a paint manufacturing industry in Mauritius. The specific objectives of the study were to develop wastewater sampling strategy and to analyse the pollutant parameters as per the following Mauritian regulations –The Environment Protection Act (EPA) 2002 – Standards for Effluent Discharge Regulations and The Wastewater Management Authority (WMA) Act – (Standards for Discharge of Industrial Effluent into a wastewater system) Regulations 2004. For the purpose of this research, the characterisation study was conducted during the production season. The samples were collected from October to December 2019 during the second week of each month. 2L grab wastewater samples after each physicochemical treatment were collected and pooled together to produce one composite sample. The resulting wastewater was analysed for physicochemical properties and heavy metal contents. The physicochemical parameters analysed were pH, electrical conductivity (EC), total suspended solids (TSS), biological oxygen demand (BOD5), chemical oxygen demand (COD), nitrate, phosphate, sulfate, free chlorine and sodium. Heavy metals ions analysed were cobalt, iron and copper. pH was measured using a pH meter following *ASTM D1293 (2012).* Electrical conductivity was carried out with the aid of EC meter. Total suspended solids (TSS) were quantified by gravimetric method. Biological oxygen demand (BOD_5) and chemical oxygen demand (COD) using *Standard Methods for the examination of water and wastewater, 21st Edition, 2005*. BOD was determined by the difference in the dissolved oxygen levels of wastewater sample prior incubation and after 5 days of incubation at 20℃. COD of the wastewater sample was obtained through open reflux method. Colour was determined using *Cobalt Standard HACH Method 8025*; nitrate using *Cadmium Reduction HACH Method 8171*; phosphate using *USEPA PhosVer 3 Ascorbic Acid HACH Method 8048*; sulfate using *USEPA SulfaVer 4 HACH Method 8051*; free chlorine using *USEPA DPD HACH Method 8021;* by spectrophotometric method using

HACH DR 2500 spectrophotometer. Sodium was determined using *ISO 9964-3:1993* using a clinical flame photometer. Following *ISO 11885:2007*, wastewater sample was digested using nitric acid and the digest was analysed for heavy metals using ICP-OEX apparatus. Among the physicochemical parameters, the TSS, BOD_5, COD, nitrate, phosphate, sodium and cobalt were found to exceed the acceptable permissible limits for discharge in water bodies (EPA 2002) and the sewer systems (WMA 2004) in Mauritius; while pH, EC, colour, copper and iron were within the norms. The maximum TSS value was high, thus reflecting the amount of oxygen needed to synthesise both organic and inorganic solids present in the wastewater. The high range of the BOD_5 values suggested that the paint manufacturing industry generates high strength polluted wastewater. The COD level was found to be six times greater than the BOD_5 level which indicated significant presence of toxic contaminants such as the presence of heavy metals. The current characterisation study confirms the presence of heavy metal in the wastewater samples. One of the outcomes of this research will help towards the strategies to adopt for the treatment of wastewater from the paint manufacturing industry. The treatment of the wastewater will give the industry the possibility for recycling rather than disposing it.

Keywords: paint manufacturing industry; wastewater; characterisation study; heavy metals; treatment

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Grouped Theme
‘Food Insecurity and Livelihoods’

UoM Virtual Research Week 2020 Scientific Sub-Committee Grouped Theme 'Food Insecurity and Livelihoods'

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UoM Virtual Research Week 2020 Organising Sub-Committee Grouped Theme 'Food Insecurity and Livelihoods'

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Sustainable Agriculture and Food Security

Virtual Oral Presentations

Sustainable Approach for the Management of the Tomato Fruit Fly, *Neoceratitis cyanescens* Bezzi in Tomato Cultivation in Mauritius

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Abstract:

Tomato (*Lycopersicon esculentum* **L.**) is an important cash crop grown on about 700 hectares by farmers in Mauritius. Three species of fruit flies, namely *Ceratitis catoiri* **Bezzi**, *Dacus ciliatus* **Loew** and *Neoceratitis cyanescens* **Bezzi** (*Pardalaspis cyanescens*) have been listed by Mamet and Williams (1993) to infest tomato fruits in Mauritius. Yet, no research has been undertaken to investigate the economic importance of these fruit flies. The seasonal abundance of these pests still remains unknown.

Larvae of fruit flies are concealed inside fruits and their control poses special challenges. The control recommendation for the melon fly, *Zeugodacus cucurbitae* (e.g., use of protein and Success™ (Spinosad) baits) had been extended for the control of fruit flies in tomato without any in-depth study on the attractiveness of these baits to these fruit fly species. Planters, as such, are still relying on pesticides for control of fruit flies in tomato. The heavy reliance of farmers on synthetic insecticides tends to threaten safe tomato production, sustainability, human health and the environment. This project aimed at determining the economic importance of tomato fruit flies and developing a package for their management in tomato cultivation.

As a prerequisite for the development of such a strategy, the economic importance of the three fruit fly species was first determined during May 2014-May 2016 in untreated tomato plots on research stations (Réduit, Wooton and Richelieu) and in treated fields of growers (Notre Dame, L'Espérance Trébuchet, Plaisance and Plaine Magnien). *Neoceratitis cyanescens* was found to be the major species attacking tomato and constituted 99.9% of the species recovered from infested tomato fruits. *Ceratitis catoiri* and *Dacus ciliatus* were not recovered. Furthermore, another fruit fly species was recovered namely *Zeugodacus cucurbitae* but at a very low percentage (0.1%).

Fruit damage in untreated plots was significantly higher than those in treated fields of growers and it varied from 47% to 100% in untreated plots and from 0% to 26.7 % in insecticide treated fields.

A novel and cheap method was developed to rear *N. cyanesncens* in the laboratory. The suitability of tomato (*Lycopersicum esculentum*), potato (*Solanum tuberosum)* and bringelle anghive (*Solanum macrocarpum*) as oviposition substrate and larval diet for *N. cyanescens* was studied in the laboratory. *Neoceratitis cyanescens* females preferred potato tubers over tomato and bringelle anghive for egg laying and hatched larvae successfully developed in potato compared to the other substrates.

Fruits with signs of fruit fly damage were collected from tomato plots on Crop Research Stations and famers' fields and reared in laboratory. Recovered tomato fruit fly pupae were

placed in plastic containers for emergence of adult fruit fly or any parasitoids. Two parasitoid species namely *Tetrastichus* sp. and *Psytallia* sp. were recovered. *Tetrastichus* sp. was the predominant parasitoid.

The relative attractiveness of four baits (red wine (any brand) @ 300 mL/L, Success @ 10 mL/40 mL water, Protein hydrolysate @ 20 mL/L baited in bottle traps and the bait Ceratiprotect (diaminopentane, ammonium acetate and trimethylamine) baited in a Conical trap (Ceratipack) were evaluated in a tomato plot. Wine baited traps and Ceratipack were comparatively more effective in capturing tomato fruit flies.

Based on findings of the study, an IPM package for the management of fruit flies in tomato field, based on use of parasitoids (biological control) and mass trapping is proposed.

Keywords: Tomato, fruit flies, fruit damage, *N.cyanescens*

Potential Insecticidal Activity of *Senna siamea* and *Cassia fistula* against *Bactrocera dorsalis* (Hendel), a Polyphagous Insect Pest

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Abstract:

The oriental fruit fly, *Bactrocera dorsalis* Hendel (Diptera: Tephritidae), is a highly polyphagous pest and has been reported to cause severe damage in fruit production worldwide due to its broad host range, high reproductive capacity and wide climatic tolerance. The females of *Bactrocera dorsalis* lay batches of about 10 to 30 eggs under the skin of ripe vegetables and fruits. The average female fecundity varies from 1200 to 1500 eggs over its whole life cycle under field conditions. The larvae of *Bactrocera dorsalis* feed on the most nutritious part of the fruit pulp, while being shielded from parasites and predators. The oriental fruit fly can infect numerous fruit crops such as guava, mango, peach and citrus amongst others, causing tremendous economic losses through direct fruit damage, fruit drop and export limitations. Due to the highly frequent use of synthetic pesticides to control the fruit fly, the development novel ecofriendly biocontrol agents is the prospective challenge. The main objectives of the study are to screen the different vegetative parts (mature leaves, flowers, fruit pulp, seeds) of the crude extracts of *Senna siamea* Lam. and *Cassia fistula* Linn. for the presence of phytochemicals and to investigate their insecticidal activity against *Bactrocera dorsalis*. The plants extracts (leaves, fruit pulp, seeds, and flowers) of *Senna siamea* and *Cassia fistula* were prepared by successive solvent extraction with methanol, petroleum ether and dichloromethane. Both qualitative and quantitative screening of the plants extracts were carried by using standard protocols. Bioassays test were conducted on the first instar larvae of *Bactrocera dorsalis* with different plant extracts of *Senna siamea* and *Cassia fistula* to evaluate its insecticidal activity. Alkaloids, flavonoids, steroids, tannins, phenols, anthraquinones and coumarins were detected in the different extracts. The highest polyphenols and flavonoids content was observed in the mature leaves (101.26±6.13 mg GAE/g) and flowers (2.54±0.14 mg QE/g) of methanolic extracts of *Senna siamea*. The mature leaves of *Cassia fistula* exhibited the highest total polyphenols content (183.28±4.60 mg GAE/g) and the flowers of *Cassia fistula* yielded the highest flavonoids content (7.94±1.34 mg QE/g). Strong (100%) larvicidal activity was observed with the dichloromethane extracts of the mature leaves and petroleum ether leaves of *Senna siamea* and *Cassia fistula* plant respectively against the first instar of *Bactrocera dorsalis* larvae. The plant extracts of *Senna siamea* and *Cassia fistula* exerted a toxic effect on the pupae and adults after being treated in the larval stage. Morphogenic abnormalities were observed in the treated pupae and adult along with a significant decline in the resulting adult population. The presence of the phytochemicals in the plants' extracts may be associated with the observed effects. *Senna siamea* and *Cassia fistula* showed promising potential for the management of *Bactrocera dorsalis* by causing mortality, and disruption in growth and development, leading to increased vulnerability of the adults to other mortality factors. All of these will hinder them from causing damage to crops. Therefore, the extracts of the different vegetative parts of *Senna siamea* and *Cassia fistula* may serve as a potential, efficient and ecofriendly biopesticides against *Bactrocera dorsalis*.

Keywords: medicinal plants, *Senna siamea*, *Cassia fistula*, *Bactrocera dorsalis*, biopesticide

InnoVAL – Pole of Research for 'Innovative Agriculture Value-Chains for Food and Nutrition Security'

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Abstract:

The Faculty of Agriculture (FoA), University of Mauritius (UoM) hosts the Pole of Research (PR) in Food and Nutrition Security (InnoVAL). The PR was set-up in Year 2017 to respond to the global challenge of increasing Food and Nutrition Security, in line with the UN Sustainable Development Goals (SDGs). The PR aimed at bringing together researchers of the Faculty of Agriculture with complementary expertise, and collaborating researchers and institutions from Rodrigues, South Africa, India, UK and Australia, to enable collaborative research projects and training. The key words driving our agenda for the SDGs were 'Partnership' – 'Multi-disciplinary research' – 'Innovation' – 'Agribusiness', to increasing agricultural productivity, creating opportunities for innovation and value addition, and fostering public-private partnerships (PPP) for economic growth and wealth creation.

InnoVAL has evolved from a group of researchers working individually on research projects, to the emergence of a stronger network of researchers working collaboratively on specific projects facing Food and Nutrition Security, in an environment that is increasingly constrained by Climate Change. Gradually, InnoVAL has moved from a fragmented approach to multidisciplinary and transdisciplinary research, collaborating on concrete research projects. This approach has enabled InnoVAL to respond to calls for research proposal in the area of Food and Nutrition Security, namely:

(i) 'An assessment of food waste generated by the Food and Beverages sector of the Hotel Industry in Mauritius for Sustainable Food Waste Management' (funded by the UoM; RFS-A Scheme), and the

(ii) DeSIRA Project (EU-funded; 'Climate-relevant Innovation through Research in Agriculture' - Supporting Sustainable Agriculture for improved Food Security and Safety in the Republic of Mauritius'.

The aim of InnoVAL is to seek further collaborations with international research groups. There is an urgent need to foster stronger collaborations with relevant stakeholders locally, namely (i) the Food and Agricultural Research and Extension Institute (FAREI) and (ii) the Rodrigues Regional Assembly (RRA). Team members have also contributed to research projects with potential for commercialisation, e.g. Slowbite™ Health Products, EcoPEC Food Freshness Retainer™).

InnoVAL is contributing to the setting-up of the AgriTECH Park on the UoM Farm to support its vision for improved Food Nutrition and Security and environmental sustainability through a renewed agriculture sector, with greater opportunities for value-addition, commercialisation of agricultural products and the setting-up of agribusiness initiatives. An Agro-processing Unit has been set up on the AgriTECH Park (with expertise from New Maurifoods Ltd). InnoVAL and the AgriTECH Park will strengthen collaborations and partnership with Institutions (including regional and international linkages), stakeholders, NGOs, SMEs and MSMEs to leverage the facilities available on the AgriTECH Park and promote research commercialisation.

InnoVAL has contributed to the development of industry-led and industry-focused curriculum for trained human capital required for effective agricultural transformations and entrepreneurship, e.g. MSc Food Safety and Food Innovation, Certificate of Competency in Poultry Production in collaboration with the LFL Academy (to be offered in academic year 2020-2021), Top-Up BSc (Hons) in Agriculture for Rodrigues, BScAgribusiness Economics and Management (with the University of Arizona; USA). A bankable project has been submitted to the FAO for the setting-up of the Indian Ocean Commission Regional Training Centre in Poultry Production (IOC-RTCPP) at the FoA (UoM), to address the research and training needs of the poultry sector in the Indian Ocean region.

InnoVAL has been active in engaging the community and stakeholders to discuss Food and Nutrition Security challenges. It has been involved in the organisation of,

(i) Australia-Africa Universities Network (AAUN) workshop on: 'Food Security and Nutrition: Technological Innovation to promote entrepreneurship' (23 July 2019; in collaboration with the University of Pretoria).

(ii) Workshop on 'Achieving Food and Nutrition Security: Actions to meet the Global Challenges in a Changing Landscape' and 'Campus Numérique pour la Sécurité Alimentaire' (4 March 2020; in collaboration with the EU, AUF and Agreenium).

As we move forward on the 2030 Sustainable Development Goals, InnoVAL will gauge 'what the community gets back from InnoVAL' by measuring the 'impact' of its 'efforts' on 'Food and Nutrition Security.' An 'Impact Case Study' of InnoVAL (2017-2021) will be undertaken to measure the impact underpinned by research, training and community engagement.

Keywords: Pole of Research, Food and Nutrition Security, Partnership, SDGs

Climate Smart Feeding Strategies for preventing Heat Stress in Broilers

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Abstract:

Poultry can only regulate their body temperature within a narrow environmental temperature range (16-26°C) known as the 'comfort zone'. High ambient temperatures outside the 'comfort zone' coupled with high relative humidity (RH), will affect negatively the productive efficiency of broilers, as birds will have to divert part of the energy intake to cool down their body. This study was an industry-led research and was conducted in collaboration with the Livestock Feed Limited Ltd (LFL; Member of eclosia Group), as part of an MSc dissertation project. The research work was undertaken on the Poultry Unit of the University of Mauritius Farm (Réduit), during the peak summer period in Mauritius (January-February) to assess the impact of heat stress on the performance and welfare of the birds. The environmental temperature and RH were monitored in the open-sided poultry house, as well as the key performance indicators for broilers (live weight; live weight gain; Feed Conversion Ratio; water: feed ratio; body temperature the blood plasma corticosterone level of the birds. The potential of supplemental betaine (Betafin^{TM}) as water and feed additives in alleviating heat stress in broilers and improving performance was evaluated. Due to its zwitterionic structure, betaine has osmo-protective properties that protect intestinal cell proteins and enzymes from heat stress. Betaine also exerts an osmo-regulatory role in cells regulating water balance, and protecting cells and tissues from dehydration and osmotic inactivation.

Six-hundred (600) Hubbard Classic mixed sexes day-old chicks were randomly allocated to 12 pens in a Completely Randomised Design (CRD) and a 12.3 birds / m^2 density. The maximum and minimum environmental temperature of the poultry house were recorded using an electronic thermo hygrometer, as well as the RH. The four treatments were the control, continuous supplementations of 0.1% and 0.2% dietary Betafin^{TM} S6, and 0.1% w/w Betafin^{TM} BT in drinking water, each with 3 replicates. The feeding phases were: Starter 0-20 days, Grower 21-34 days, and Finisher 35-42 days.

The results indicate that the birds were subjected to conditions of heat stress throughout the 42-d production cycle (environmental temperature > 26°C). The diurnal pattern of temperature and RH were monitored on day-27, day-33, day-34, day-40 and day-41. Heat stress was severe at the end of the cycle, particularly after 35 days (31.6ºC, 32.6ºC with relative humidity >64% at peak exposure at 40, 41 days). The hottest period of the day (32-33°C) was at about 14:30 with a RH of 65%. Betaine tended to improve 42 days live weight (up to 5.8%), average daily body weight gain during the last week (up to 21.9%), mortality (up to 31.7%), % breast meat yield (up to 8.6%), cumulative FCR (up to 3.1%), and it reduced (P=0.19) blood plasma corticosterone level (from 2549 to 1083 pg /mL with 0.2% dietary level at 39 days). No effects (P>0.05) were found on cumulative feed and water intakes. Orthogonal contrasts analysis showed that birds supplemented with betaine suffered less (P<0.05) from hyperthermia at 40 d

(-1.2ºC). The patterns of feed and water consumption rates measured on specific days suggest that betaine tended to stimulate feed intake during hot hours while retarding its drop, improving the resilience of birds to heat stress conditions. The improvements in growth rate, feed conversion efficiency and livability of heat-stressed broilers confirmed that feeding betaine-supplemented diets could be considered as part of a strategy to alleviate heat stress.

Based on overall results, betaine was recommended to the local broiler industry prior to and during heat stress at a dietary level (Betafin^{TM} S6) as high as 0.2 %. The results obtained have informed the development by the Livestock Feed Ltd (LFL) of an innovative '*Summer Collection Feeding Programme'* for broilers. This is in line with the vision of the Feed Industry for a sustainable livestock sector through the efficient use of feed resources. Furthermore, the results show that the capture of ambient temperature and relative humidity data will assist in monitoring the level of heat stress in the birds and inform the development of climate smart feeding strategies for broilers.

Keywords: heat stress; broilers; betaine; improved productivity

Virtual Poster Sessions

An Assessment of the Use of a Combination of Sea Water and River Water for Irrigation Purposes on Chilli Production (*Capsicum annuum*)

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Abstract:

The global water use for agriculture represents about 70% of the total freshwater withdrawals. There is a crucial need to find efficient water use methods and techniques in agriculture. The utilisation of saline water for irrigation purposes in crop production can be promising in the near future. Chilli (*Capsicum annuum)* is one of the most broadly used spices worldwide and is incredibly appreciated for its pungency. A study was carried out to assess the effect of different combinations of sea water and river water on chilli (*Capsicum annuum*) as test crop. The experimental trial was conducted in an open field from September 2018 to January 2019 at the University of Mauritius Farm, Réduit. The study was performed by assessing water quality parameters of sea water, river water and a combination of both sea water and river water, soil parameters and NPK content in soil before plantation and after plantation, plant parameters at different growth stages and yield as well as fruit quality parameters of chilli. The experiment consisted of six treatments allocated as follows: T1-10% sea water: 90% river water, T2-15% sea water: 85% river water, T3-20% sea water: 80% river water, T4-25% sea water: 75% river water, T5-100% river water and T6-100% sea water laid in a Randomised Block Design (RBD) with four blocks. Sea water samples were collected from Flic en Flac while the river water samples were obtained in the vicinity of Bassin Canard in Réduit. The water samples were analysed to determine the pH, electrical conductivity (mS/cm), alkalinity and NPK content. Soil tests such as soil pH and electrical conductivity, total nitrogen, total phosphorus, available phosphorus, total potassium and available potassium were carried out prior to crop establishment and after the crop cycle. The plant parameters assessment was done at three growth stages namely vegetative, flowering and fruiting stage and chemical analysis of the fruits were also performed. Statistical analysis was performed using the Minitab® 18 Statistical Software. The General Linear Model ANOVA was used to determine p-value from comparisons between blocks and treatments. Tukey's tests with a confidence interval of 95% were also carried out to analyse the means of the various treatments. The results showed that the pH level and NPK of the water content were in range acceptable for irrigation purposes across the different treatments. An overall increase in all the soil parameters was observed except for the nitrogen content of the soil after the application of the different treatments. All the plant parameters measured such as plant height, canopy diameter, number of leaves, total leaf area, number of branches, shoot dry matter content, fruit size and NPK content in plant tissues and yield were statistically affected ($p<0.05$) by irrigation with the different treatments. T1 showed an astounding development in plant height, being 16.0 % taller than T2 at fruiting stage as it had the required amount of nutrients for better growth and development of the chilli plants. Shoot dry matter content increased throughout the whole growth period and T1 was observed to be the most significant treatment as T1 produced the tallest plants (114 cm) and the largest canopy diameter (80.0 cm). The longest fruit length (10.6 cm) and biggest fruit diameter (14.0 mm) was recorded with fruits harvested in T1. T1 produced the greatest marketable yield of 9.21 t/ha, being 8.6 % higher when compared to chilli plants irrigated with 100% river water

as there was satisfactory supply of elements as a supplement for better crop growth and development. The total soluble solids and titratable acidity of the chilli fruits were statistically affected ($p<0.05$) by the different treatments. Fruits harvested under T4 recorded the highest acid content (0.093 g/100g malic acid) as acid content increases with salinity. T1 recorded the lowest total soluble solids (3.23°Bx) due to a decrease in the water content of the fruits. The results of this study demonstrated that chilli can be grown successfully with improved fruit quality with a combination of 10% sea water: 90 % river water as T1 was successful in achieving the highest yield.

Keywords: *Capsicum annuum*, sea water, river water, water quality, fruit size, yield, total soluble solids, titratable acidity

An Evaluation of the Perception of Biofarming at both Producers and Consumers Level in Mauritius

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Abstract:

Increasing demand for food supply due to rapid growth in human population has triggered agricultural intensification during the last few decades. For addressing the growing food demands, agrochemicals (fertilizers and diverse pesticides) are rigorously used in agriculture, which accomplishes the gap between food production and consumption. However, concurrently unbalanced use of agrochemicals also causes environmental deterioration and pose severe challenges to aquatic and terrestrial ecosystems. Agricultural production in Mauritius has relied heavily on agrochemicals inputs such as fertilisers, pesticides, herbicides and fungicides to attain high crop yield. According to the Digest of Agricultural Statistics, the importation of agrochemicals was 49,926 tonnes amounting to Rs 971,270 million both for the sugar and non-sugar sector in the year 2016. During the last few decades, research has shown that the use of chemicals in the agricultural sector has been detrimental to our local ecosystem and human health. The incidence of human diseases related to the excessive use of agrochemicals has also raised concerns about food quality and safety among consumers. Due to the adverse effects of the agrochemicals on both human and the environment, new measures were adopted by the Government to promote biofarming as a sustainable agricultural production technique. Biofarming is the strategy to encourage producers to move towards safer food production systems taking into account the Mauritian context by reducing the use of chemical inputs. It is one of the Government priorities to produce at least 50 % of the food production in the next two coming years through biofarming. A survey was carried out to evaluate the perception of biofarming at both producers and consumers level. The survey consisted of face-to-face interviews through an administered questionnaire with a sample of 20 key producers who have adopted biofarming approaches and 120 consumers of bio products. The analysis of the survey data was carried out using IBM SPSS 19.0 statistical software. One of the main findings revealed in the study was that cultural practices involved in biofarming were labour intensive and time consuming. The study also depicted that the adoption of mixed cropping helped in reducing pest susceptibility and increased yield. This would only be possible when all the farmers in a specific region would adopt biofarming approaches as stated by the interviewees. The producers engaged in biofarming raised their concerns about the lack of market facilities to sell their produce. Most of the produce were sold at farm gate level and surprisingly fetched a higher price on the market. Moreover, it was found that the willingness of consumers to buy bio products was statistically dependent on the price of the produce ($p<0.05$). It was also depicted that 62.8% of the interviewed consumers stated the price of the produce was the main constraint and was considered as too high. The survey results revealed that 60% of the consumer respondents were found to opt for bio products since they were aware of the detrimental effect of different chemical residues on human health. Results obtained in the study have shown that much more consideration should be given concerning to the general framework of biofarming scheme before venturing in the production system. The challenges of the biofarming sector in

other countries can be taken into consideration by the local authorities to facilitate the transition of traditional farming to biofarming practice among Mauritian producers. This study has set a baseline for further investigation in the field of biofarming practices at national level.

Keywords: Biofarming, survey, perception, producers, consumers

An Enhanced Rapid DNA Extraction Protocol for the Characterisation of Isolated Microalgae

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Abstract:

Microalgae are photosynthetic microorganisms that lack specialized organs such as leaves, vascular tissue, as plants do. However, when it comes to cellular composition, microalgae can synthesize lipids, proteins and carbohydrates as well as numerous bioproducts such as vitamins, pigments and antioxidants. They have been receiving a lot of attention due to their characteristics and potential applications such as the production of phytochemicals, secondary metabolites, biofuels and food/feed additives. Locally, the use of microalgae is very limited to a few companies and our local pool of microalgae has not been properly screened for commercial applications. Prior to usage, the identification of microalgae up to species level is very important to validate further works and also because some species are known to produce toxins.

In this project, water samples were collected from 4 reservoirs and 1 river; Mare aux Vacoas, La Nicolière, Mare Longue and Midlands Dam; and from Rivière Tamarin respectively using a 5µm phytoplankton net. The samples were inoculated on Bold's basal agar (BBA) agar and incubated in controlled environment at 24°C and 14 hours of 50µmol $m^{-2}s^{-1}$ light intensity. After 14 days, isolates were selected, sub-cultured and identified through microscopy. Isolates such as *Pseudochlorella* sp, *Scenedesmus* sp, *Chlamydomonas* sp and *Lemmermannia* sp were identified, based on morphological characters such as cell shape, cell size, chloroplast shape and cell colour. Most of the isolates were postulated to belong to the Chlorophyta phylum. Due to a potential risk of inaccurate identification, molecular analysis was initiated and all experiments were performed in triplicate.

Prior to extraction, all isolates were cultured in liquid Bold's basal medium for 10 days. An initial protocol which was devised for microalgae using TE as lysis buffer, proved to be inefficient at extracting DNA. Since microalgae cells are closely related to plant cells, is was hypothesized that the protocol could be modified at the lysis step with the replacement of TE buffer with CTAB buffer. This buffer has been utilised for years for the extraction of DNA from plants. This modification yielded DNA for all isolates with minimal yields of 72.80ng/µl to maximum yields of 323.90ng/µl. The cationic strength of the CTAB proved to be more effective than TE buffer. In terms of quality, variations were observed with the extracted DNA. A minimum absorbance ratio for the A260/A280 of 0.56nm and a maximum of 1.80nm were observed. The low values could be related to the presence of contaminants such as phenol but did not impact further experiments.

The original protocol was devised to yield PCR amplifiable DNA. The use of CTAB did not affect this aspect of the protocol. DNA was amplified from all isolates with 2 pairs of primers; P45 – P47 and FW1 – REV1 for 18S and D1-D2 large ribosomal units, respectively. The successful amplification of the DNA with these primers proved that the isolates are eukaryotes. Therefore, this newly modified protocol could be employed for the extraction of microalgae DNA as it is cheap, rapid and efficient. For future works, the PCR amplicons will be outsourced

for sequencing and then analysed for identification purposes with phylogenetic studies. Further tests will be performed on the isolates such as rate of growth, biochemical characteristics (lipids, essential fatty acids, proteins and carbohydrates) and toxicity. These results will allow selection of the best candidates as source of feed for aquaculture practices and biofuels production.

Keywords: Microalgae, DNA extraction, PCR

A Study on the Effect of combining Granular and Foliar Fertilisers to achieve an Optimum Yield of Cayenne Pepper (*Capsicum annum L.*)

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Abstract:

The application of the right amount and type of fertilisers should be done according to the crop requirement in order to achieve optimum marketable yield. Studies have shown that the overuse of chemical fertilisers has a detrimental effect on the environment. In order to prevent the deterioration of the soil structure and fertility, alternative fertiliser application methods need to be further explored. An open field study took place from October 2018 to January 2019 at the University of Mauritius Farm, Réduit, to assess the efficiency of a combined application of granular and foliar fertilisers on cayenne pepper (*Capsicum annum*) as test crop. Granular fertilisers were comprised of Triple Super Phosphate, Muriate of Potash and Calcium Ammonium Nitrate while Facilgro® was used as the foliar fertiliser. Effectiveness of the fertilisers applied was studied by analysing the soil NPK content both before the transplanting stage and after the crop cycle. The NPK content of the crop was determined during the vegetative, flowering and fruiting stages. The experimental field trial was set up as a Randomised Block Design with four replications where each block was divided into 6 plots each of size 4.5 m by 2.4 m. Twenty cayenne pepper plants were grown in each plot. The experiment consisted of six treatments in total where three of them were composed of combinations between granular and foliar fertilisers (T2: 75% Granular + 25% Foliar, T3: 50% Granular + 50% Foliar and T4: 25% Granular + 75% Foliar) and two of them involved the sole application of only granular (T1: Recommended fertiliser application by Le Guide Agricole) and foliar (T5) fertilisers each at 100%. A control (T6) of the experiment was also set up where no fertiliser was used. It was observed, after the crop cycle that, soil treated with 100% granular fertilisers had the highest increase in the total Nitrogen content which might have been due to the twice application of Calcium Ammonium Nitrate in the cycle where most of the nitrogenous compounds might have not been able to get readily absorbed by the plant roots. Moreover, treatment combination 50% granular + 50% foliar (T3) produced the maximum number of marketable cayenne peppers (12.3 t/ha). One reason accounting for this result might be the presence of phosphorus in both the basal and foliage applied fertilisers which promoted root growth leading to a better absorption of nutrients and water from the soil triggering efficient translocation to the fruits. Therefore, this study has demonstrated that the combination of both granular and foliar fertilisers each at halved doses enhanced the growth together with the yield of the cayenne pepper plants. A statistically significant positive influence was found between the plants treated with the different fertiliser combinations on all the studied parameters as compared to plants without any fertiliser application (Control). Treatment 3 (50% Granular + 50% Foliar) proved to be the most effective fertiliser application technique since, it had highest values for shoot diameter, number of leaves and flowers, leaf area, shoot dry matter content and finally marketable produce. The application of only foliar fertiliser had the least effect in promoting the plant growth and yield of the chilli plants. This implies that foliar fertiliser can be used as a nutrient supplement rather than an elementary method of fertiliser application. Moreover, considering that halved doses of granular and foliar fertilisers enhanced the yield of

cayenne pepper, beside increased profits for farmers, sustainable agriculture can also be achieved by reducing the application of basal fertilisers thereby minimising leaching to the environment.

Keywords: Granular fertiliser, foliar fertiliser, marketable yield, nutrient supplement, *Capsicum annum*

Hunger and Poverty Eradication

Virtual Oral Presentation

Halophilic Microorganisms with Antimicrobial Activities Isolated from Mauritian Mangals

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Abstract:

Antimicrobial resistance in bacterial pathogens is a major worldwide problem associated with high morbidity and mortality in humans. Efforts to battle antimicrobial resistance are generally focused on developing novel antibiotics. However, studies show that resistance arises regardless of the nature or potency of new drugs. In the past few decades, repeated isolation of known compounds from heavily investigated terrestrial microorganisms has limited the development of new and effective drugs for treating human diseases. The mangrove ecosystem proves to have a unique environment for a rich microbial diversity which may possibly lead to the discovery of a panoply of novel bioactive compounds. The aim of this study is to isolate marine microbial natural products with antibacterial activities from mangrove forests of Mauritius. The specific objectives are to isolate and characterise the microorganisms, extract their secondary metabolites and test the antibacterial potential of those metabolites. To achieve these objectives, sediment was sampled from a north eastern mangrove forest, microorganisms were extracted and cultured on five different solid media, namely, Zobell Marine Agar, Modified Nutrient Agar, Modified Growth Media Agar, Seawater Agar and Modified Seawater Agar. Specific characteristics of the isolated strains were obtained using methods such as colony morphology analyses, Gram staining, microscopy and lactose fermentation tests. Selected isolates were grown in liquid culture and their specific growth curves were determined according to absorbance at 600 nm. Once the growth characteristics were obtained, crude extracts were filtered through 0.22 µm pore size sterile filter membranes and the crude filtrates were directly tested for antibacterial properties. Antimicrobial susceptibility testing was carried out against six test organisms: *Escherichia coli* (ATCC 25922), *Bacillus cereus* (ATCC 11778), *Staphylococcus aureus* (ATCC 29213), *Staphylococcus epidermidis* (ATCC 12228), *Klebsiella pneumonia* (ATCC 13883) and *Pseudomonas aeruginosa* (ATCC 27853) using disc diffusion, broth macro dilution and agar overlaying assays. Tetracycline and ampicillin were used as controls. Subsequently, potential secondary metabolites from the crude filtrates were extracted with 99.95% (v/v) ethyl acetate. The ethyl acetate extracts were then tested for antimicrobial activity against the same panel of test organisms using disc diffusion assays. Following sampling and isolation on diverse media, a total of eighty-eight microbial isolates were obtained in axenic culture and characterised. A diverse range of pigmentation and morphologies was exhibited by the isolates. Sixty-eight strains were Gram-positive and the remaining twenty were Gram-negative. Four Gram-negative strains were positive to the lactose fermentation test, therefore indicating that they belong to the *Enterobacteriaceae* family. The crude extract from the gram-positive isolate Z3RZ3 showed no activity against the six test organisms using the disc diffusion assay. However, the extract apparently affected the production of the metabolites pyocyanin and pyoverdine produced by *P. aeruginosa*, as the usual blue green colour of by *P. aeruginosa* did not appear on the culture agar. In the broth macrodilution assay, the crude

extract showed bactericidal activity against *E.coli*, *B.cereus* and *P.aeruginosa*. *Pseudomonas aeruginosa* is commonly recognised by the ability of its cells to adhere to each other to form biofilms. When observed under the microscope, the metabolite from Z3RZ3 disrupted the cell-to-cell adherence of *P.aeruginosa*, which is resistant to many commercially available antibiotics mainly because of its ability to form biofilms. The ethyl acetate extract (Z3RZ3e) also exhibited activity against the tested organisms with zones of growth inhibition ranging from 4 to 10mm. Overall data generated so far indicate that mangrove sediment microbiota could be a source of bioactives of potential pharmaceutical interest. This project also contributes to the United Nations SDG1 and SDG3, which are to "End poverty in all its forms everywhere" and to "Ensure healthy lives and promote wellbeing for all at all ages" respectively.

Keywords: Novel compounds, mangrove ecosystem, microorganisms, antimicrobial activity, SDGs

Sustainable Consumption and Production

Virtual Oral Presentation

Eco-Design Modular Flat Pack Shoes

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Abstract:

A prevalent problem in the fast-changing fashion industry is the recyclability of footwear and combatting with the huge amount of waste generated. When it comes to traveling, carrying shoes along can be cumbersome. They often get distorted, squashed or deformed during travel. The project aims to investigate and undertake researches that address these problems. To provide a solution, modular flat-pack shoes were designed to make available user-friendly, effortlessly portable and sustainable footwear. The strategic factors of sustainability considered were minimisation of material and energy use; implementation of processes and materials that are eco-friendly; designing long-lasting and durable products; design to ease separation of materials or parts; prolonging the life of materials and simplify their disposal. Analysing the difficulties people encounter while traveling, footwear that can be flat packed with easy for transportation was designed. The anatomy of shoes were scrutinised before sketching and designing model templates for assembly into final products. The design development integrated an innovative feature of 'Mix and Match' where by the shoe could be customised as per the consumer's preferred choice for any occasion to create a distinctive look. Women's footwear were designed for different models of shoe tops or uppers with one pair of sole which are detachable and interchangeable allowing the user to create various styles. The uppers can be easily assembled and disassembled by means of open end zippers and sliders. The assembly enables the users to get involved in a creative design application as well as be part of the shoe making process; a feature not customary in readymade shoes. In addition, having only one pair of sole and multiple tops or uppers would occupy less space, facilitating users to carry different shoe models. This will also allow the user to travel light compared to carrying multiple shoes to go with different outfits. To reduce environmental impact across the product lifecycle, shoes were designed with an objective to use minimal raw materials. Main resources essential for shoe making process such as leather, zipper, lining, glue, velcro and sponge were researched. The inner sole was made from pressure moulding and the outer sole was from hot compression moulding. Horsemen glue, a special adhesive for cold work, was used for making the upper parts of the shoes. Water resistant transparent Glue ref 9000 was used for bonding the outsole to provide strong adherence. Colours of the leather were selected based on the use for both casual and formal occasions. Nylon thread number 2 was used for stitching. Zippers and Velcro were used with precision. Sewing of leather was carefully done to avoid any faults. These shoes can be stored away without taking up much space. Obstacles encountered during the shoe making process lead to modifications in the process. The shoes were tested for their performance, ease of assembly, fitting, comfort, slip resistance, traction, water absorption and feedback was obtained in terms function and design. The eco-designed shoes pay attention to use of high quality leather. They have has an outstanding tear resistance and flexibility. A business model was proposed. A logo 'NIGEL' and was designed to project the product as a sustainable shoe brand. The shoe packaging was designed considering the transportation and effective use of

material for storage. Each part of the shoes can be obtained separately if ever a part is damaged or worn out. To encourage people to opt for these shoes, users can have an option to buy one pair of sole and assorted uppers separately. Thus the price can be budgeted by the customer during purchase. As the shoes pack flat and can store away without taking up much space it revolutionizes the logistics of footwear storage and transportation. Working on this sustainable concept, further innovative ideas can lead to more creative footwear models. They can be locally manufactured generating employment. Such Eco-friendly products contribute to add value to the sustainability of the environment. Development of like products will reduce waste production around the world. Using less material, the shoes are lighter, use smaller packages and conserve natural resources which in turn lowers the environmental impact. The project introduces promising initiatives for the modern shoe industry and draws attention to the importance of eco-consciousness through design.

Keywords: Eco-consciousness, Mix and Match, Modular Shoe Design

Virtual Poster Sessions

Visitor Management – A Sustainable Tourism Development Strategy

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Abstract:

Sustainable tourism development has gained impetus in both the research and practical fields in the recent years in Mauritius. There has been visible gradual acceptance of it being the apt tourism advancement solution. This concept accentuates that both the visitors (tourists) from the demand side and the hosts (destinations) from the supply side, hold crucial roles in its success. Given that the sustainable tourism development concept is grounded around environmental protection, many destinations including Mauritius, are using and trying several strategies to manage visitors as an ecological safeguard measure. The aim was to capture the various visitor management strategies currently adopted and / or envisaged for the future by tourism hosts in Mauritius. Using purposive sampling, 2 types of information were captured through semi-structured in-depth interviews with key tourism stakeholders (from the supply side) in Mauritius. Alongside, based on the author's personal observation as well as content analysis of existing literatures, additional visitor management strategies were discovered.

Out of 10 out of the 15 targeted participants responded positively to the interviews. With the NVIVO software, the recorded responses were analysed and given the qualitative nature of this study, codes also known as themes, could be generated. The identified visitor management strategies were reinforced with the researcher's own contributions and they were as follows: 1) adopting an established quota of visitors based on a pre-reservation system, 2) the application of a more strict entry criteria like obligatory presentation of relevant documents for entrance permit, 3) a review of the allowable number of visitors in case of group visit, 4) applying a grading system to organised visits such as silver, gold or platinum packages alongside leveraging the price paid per package, 5) a review of visit price during the year, at specific planned times so as to minimise mass visits, 6) strategic partnering with other hosts such that visitors can be directed to a variety of hosts for allowing regeneration of the natural flora and fauna, 6) a review of allowable number of visits per visitor during a specific period of time, 7) an introduction of a compulsory green visitor-contributorship measure such as obligatory participation to an ecological involvement like tree planting or providing financial support to environment-preservation activities, 8) keeping under-developed road infrastructures to reduce influx of vehicles and hence more control of number of visitors; the latter will have to use only host-allowed vehicles with low carbon emissions, 9) restraining lodging provision near the site, 10) sensitization campaigns about too frequent or heavy visit-related harms caused to the host/ destination, 11) crowd management strategy such as operational hours extension, 12) application of obligatory start of visit to dedicated educative lanes at the host such that visitors are aware about their behaviours and impacts and for allowing them to have a better acculturation about expected responsible behaviours from visitors; digitalised interactive lanes and other supported materials can be provided such as leaflets and maps or even compulsory downloads of educative mobile phone applications, 13) reinforcing guided and supervised visits and 14) application of both positive and negative reinforcement measures such as fee charged for unfriendly actions towards the environment and also discounts or points accumulation for best practices noted; all these supported with video cameras. It is to be noted that most of the respondents were from private tourism organisations.

This study supports the sparse research conducted about visitor management strategies as part of sustainable tourism development in Mauritius. The strategies generated from this study will allow existing and emerging tourism organisation to improve and plan ahead their visitor management strategies adapted to the local context while understanding the evolving global dynamism of the tourism industry. However, more research is needed to leverage the balance of actions towards environmental protection and economic return when the above visitor management tactics are applied by the host. Moreover, it is pivotal to understand the expectations and interests of all stakeholders of tourisms. So, additional research may be conducted to capture the strategies proposed by other categories of stakeholders for development of amore sound and plausible sustainable visitor management framework.

Keywords: Sustainable, Tourism, Development, Visitor, Management

Mitigating the Deterioration of Eggs in a Climate Constrained Environment- Strategies for Smallholder Egg Production

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Abstract:

The aim of the present study was to find an alternative storage method for eggs produced by the small scale egg producers and to examine the efficacy of spraying oil on the eggs in extending their shelf life and reducing rapid deterioration of the egg quality. The eggs were subjected to 2 treatments (oil treated and untreated) and stored at 4 ℃ and 35 ℃ for 2, 19 and 26 days. The egg quality was assessed by determining (Yolk index, Haugh Unit, pH of albumen and air cell size. The crude protein and crude fat of eggs at 4 ℃ and 35 ℃ of Day 26 were determined. In addition, a survey was conducted with 28 eggs producers in the Eastern region of Mauritius to assess their eggs storage facilities and to gauge their acceptance of using an oil spray as a method to preserve the quality of eggs.

A total of 270 eggs were used and the treatment combinations Randomized Block Design. As storage time increased, the egg weight decreased. Untreated eggs stored at 35 ℃ showed a drastic increase in weight loss 3.94 g at Day 8 while the oil treated eggs lost only 0.74 g. The decline in weight is attributed to the loss of carbon dioxide through the pores of the egg shell. An interaction ($p<0.005$) between Yolk Index, Haugh Unit and storage time was observed. The Yolk index and Haugh unit decreased significantly as storage length was prolonged. Eggs treated with oil stored at 34 °C and 4 °C did not show a significant decrease in yolk index until day 8 as the values of yolk index were 0.216 and 0.312 respectively. The air cell of the eggs was found to increase in size from 15 mm to 40 mm with storage time. On day 8, the air cell the size of the eggs stored at 35 °C was greatest 26 mm and even the eggs sprayed with oil and stored at the same temperature had the second largest air cell size 21 mm than the rest. An air cell is formed when the inner cell membrane starts to separate from the outer shell membrane of the shell. The crude protein was 44.8 % for fresh eggs but on day 26 it significantly ($P< 0.05$) decreased, almost twice 25.3 % because of the denaturation of the quaternary structure of protein. However, the crude fat of fresh eggs was 50.8 %, and did not decrease significantly as the lipid structure of fat found in the yolk was not affected by storage time. 89.2 % of the respondents preferred to store eggs at shelf after collection and were hesitant to invest in refrigeration because of high electricity cost and maintenance.

This research showed that eggs treated with oil along with refrigeration maintain their quality until Day 26. The oil spray method is a cheap and non-time-consuming method and can be easily used by small scale egg producers to reduce rapid deterioration of egg quality especially during summer when the temperature is ambient.

Keywords: Egg quality, Haugh unit, Yolk index, Oil spray

Grouped Theme
‘Social Justice’

UoM Virtual Research Week 2020 Scientific Sub-Committee Grouped Theme 'Social Justice'

Chairperson:	**Assoc Prof (Dr) R Nunkoo**
Members	Dr M Michel
	Dr R Ramtohul
Secretariat	Mrs V Bhurtun
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UoM Virtual Research Week 2020 Organising Sub-Committee Grouped Theme 'Social Justice'

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Secretariat	Mrs V Bhurtun
	Mrs D Seenarain

Gender Equality

Virtual Oral Presentations

Film Industry in Mauritius: The Representation of Gender Identities in Mauritian Cinematography

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Abstract:

Fiction films reflect and reinforce the representations of gender roles within a particular society (Geena Davis Institute, 2019). Although nascent and not well structured into a proper professional industry, the local film scene is very dynamic and produces a great number of short films and a few feature films as well. In our study, we propose to analyse a large sample of these films in order to determine whether representations of gender identities are fair and balanced or subject to stereotypical treatment.

Our study uses content analysis and focus group interviews to examine the representation of gender identities and roles across multiple genres of movies through three angles, namely: hegemonic masculinity portrayed in Mauritian movies, stereotypes associated with women in Mauritian movies and the portrayal of non-binary gender diversity in Mauritian movies. In this paper, we will focus on the comparative presence and treatment of men and women in local film-making.

Methodology

A content analysis based on around 180 films produced by both amateur and professional filmmakers was carried out. The short films were obtained from the Mauritius Film Development Corporation, and the short film collection DVDs from the *Association Porteurs d'Images*. The movies analysed were divided into two categories, namely short films which were produced by amateurs and those which were professionally directed. The criteria for differentiating between the two categories were based on film budget, quality of camera work and character depth.

A focus group was also carried out and the aim was to gather knowledge to gauge to what extent Mauritian movies portray reality as it is and more specifically, how young adults assess the portrayal of gender in local movies. For the group discussion, students aged 20 to 22 from the University of Mauritius were targeted.

Findings

A thorough analysis of the film corpus indicated an unequal distribution in the gender of filmmakers and film protagonists and in the allocation of screen time, across both amateur and professional categories of films. Not only were women under-represented, they were also depicted through stereotypical roles as victims rather than assailants, except for ghosts which tended to carry sexualised female attributes such as long hair and long painted nails.

Participants in the focus group discussion responded critically to a sample of short films which they deemed to portray predominantly patriarchy, female submissiveness and objectification of women, and thus more in line with the male gaze theory of cinema (Mulvey, 1989).

Keywords: film, media, gender, heteronormativity, stereotypes, content analysis, focus group

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The Representation of LGBTQ+ in Mauritian Media: The Case of Transgender Persons
La représentation des LGBTQ+ dans les médias mauriciens : le cas des personnes transgenre

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Abstract:

Quand nous parlons de genre, nous pensons immédiatement au genre masculin ou féminin aussi appelé le genre binaire qui est le plus commun de tous les genres; c'est-à-dire, toute personne qui s'identifie comme étant un homme ou une femme indépendamment de son sexe biologique (Butler, 1990). Or, les identités transgenres sont considérées comme étant le troisième genre et celui qui est le plus controversé. A Maurice, il reste du chemin à faire pour atteindre l'égalité homme-femme que ce soit au niveau professionnel, socio-économique ou familial. Mais, il existe aussi des discriminations envers des personnes qui ont eu une orientation sexuelle differente dont on parle moins. Ceci, même si la communauté LGBTQ+ (Lesbienne, Gay, Bisexuel et Transgenre, Queer et autres) qui a pendant longtemps vécu cachée, prend de l'ampleur et bouscule tous les codes d'une société encore assez conservatrice.

En tant que miroir de la société, voire agents de changement, les médias y jouent un rôle primordial et constituent donc un terrain d'analyse fertile pour comprendre les évolutions dans une société. On peut donc se poser la question de savoir s'il existe une reconnaissance de la communauté LGBTQ+ de la part des médias? Pour tenter d'y répondre, nous analysons les contenus parus dans la presse locale sur les cinq dernières années afin de quantifier la couverture médiatique qui est consacrée à la communauté et de décortiquer la qualité des contenus publiés à ce sujet. Pour ce faire, nous avons recours à l'analyse de contenu qui est une méthode mixte quantitative (comptabilisation d'articles) et qualitative (déconstruire des phrases, images, plans vidéographiques, et habillage de textes, entre autres).

Lors de notre analyse, nous nous attarderons en particulier sur les questions suivantes: Il y a-t-il une représentation biaisée des différentes sous-communautés des LGBTQ+ par les médias mauriciens? En particulier, il y a-t-il sous-représentation des transgenres en comparaison avec les autres identités non-heterosexuelles telles que les gays et les lesbiennes dans les médias de Maurice, ce qui équivaudrait à une annihiliation symbolique (Tuchman, 1978) ? A quelle fréquence les médias abordent-ils la question des transgenres ? Lorsqu'elle existe, quel est le traitement qui leur est accordé ? Cette représentation est-elle neutre ou stéréotypée?

L'étude a permis de conclure à une sous-représentation des personnes transgenre dans les médias mauriciens avec une tendance à mettre en avant les attributs sexuels de ces derniers et un non-respect de leurs choix de prénoms, malgré quelques très rares efforts pour mettre en avant une insertion socio-professionnelle positive.

Keywords: gender; transgender; LGBTQ+; media; content analysis; stereotypes

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Peace and Justice

Virtual Poster Session

L'obligation de faire dans la phase précontractuelle en droit civil mauricien

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Résumé

Le contrat est traditionnellement né de la rencontre d'une offre et d'une acceptation, et celles qui résultent parfois d'une négociation précontractuelle. Toutefois, la phase qui précède la conclusion du contrat ne repose pas toujours sur le modèle classique résumé par le binôme offre et acceptation. C'est notamment le cas en matière immobilière, où la conclusion du contrat projeté, de la vente, par exemple, est souvent précédée d'une négociation plus ou moins longue, au cours de laquelle les parties cherchent à échanger leurs points de vue et à rapprocher leurs positions. De plus, pendant la phase précontractuelle, les parties peuvent conclure des véritables contrats, appelés avant-contrats, censés les rapprocher de la conclusion du contrat définitif. Il en va notamment de la promesse unilatérale de contrat, de la promesse synallagmatique de contrat et du pacte de préférence.

Cette phase précontractuelle est, sans doute, source d'effets juridiques et nous pouvons notamment y observer la présence d'un type d'obligation, qui est l'obligation de faire, et qui est traditionnellement opposée à l'obligation de donner et celle de ne pas faire. Si dans certains cas (promesse unilatérale de contrat) l'obligation de faire peut sembler être présente dans la phase précontractuelle, sans véritablement l'être, dans d'autres cas (négociation précontractuelle, promesse synallagmatique de contrat, pacte de préférence et offre irrévocable) l'obligation de faire est réellement présente.

La sanction qui frappe l'inexécution de l'obligation de faire, analysée dans cette présentation, dépendra directement de l'existence/inexistence, pendant la phase précontractuelle, du consentement au contrat définitif projeté, à la vente, par exemple. D'une part, si les parties n'ont toujours pas données leur consentement au contrat définitif (négociation précontractuelle, promesse synallagmatique autonome) la seule sanction envisageable en cas d'inexécution de l'obligation de faire, consistera en l'allocation de dommages et intérêts à la victime de cette inexécution de l'obligation de faire, car personne ne peut être forcé à devenir partie à un nouveau contrat. D'autre part, si l'une des parties s'est déjà engagée, en donnant, dans la phase précontractuelle (pacte de préférence, promesse unilatérale de contrat, promesse de contrat valant contrat, offre), son consentement au contrat définitif, l'exécution de l'obligation de faire devient concevable, car aucune pression intolérable n'est exercée sur le consentement de la personne ayant déjà consenti au contrat définitif. Par conséquent, il devient possible d'opter pour une sanction plus vigoureuse que l'allocation de dommages et intérêts, telles que la substitution du bénéficiaire à une partie au contrat, la déclaration sans effets de la révocation de la promesse/de l'offre ou encore le remplacement de la forme authentique (notariale) par un jugement de la Cour suprême de Maurice, dans le but d'assurer le transfert de propriété de la chose à l'acquéreur.

Plan de la présentation

I. Présence de l'obligation de faire dans la phase précontractuelle
   A. Une fausse présence
   B. Une présence avérée

II. Lien indissoluble entre la sanction de l'obligation de faire et le consentement au contrat définitif
   A. Les dommages et intérêts dictés par l'absence du consentement au contrat définitif
   B. Les sanctions rendues possibles par l'existence du consentement au contrat définitif

Reduced Inequalities

Virtual Oral Presentations

A Hybrid Intercultural Literacy Pedagological Model for the University of Mauritius

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Abstract:

Background and objectives of the study

This paper introduces a conceptual framework to expand the Stanfield hybrid intercultural literacy pedagogical model and its use of digital technologies and traditional face to face teaching and learning strategies to Mauritius higher education with the University of Mauritius being the major institutional focal point. Pedagogically, many if not most universities around the world in emerging and mature Eastern and Western democracies, undergraduate and graduate courses focused on Cultural Otherness as dehumanized experiences (e.g. ageism, anti-religiosity, caste, disability , elitism, ethnocentrism, racism, and sexism) and their varied intersections and synchronisms, attempt to teach students not to offend or discriminate against those individuals and their representation groups they have been socialized to presume are superior or inferior human beings or not human at all. In such pedagogical goals, often the stress is on teaching students intercultural competence. Intercultural competence is, for the most part, politically correct interpersonal communications skill learning to minimize if not prevent offending or discriminating against Cultural Others and to learn basic principles of Cultural Others' historically embedded world views.

Approach and methodology

The major curricula spotlight will be constructing and testing and implementing effective hybrid intercultural literacy teaching and learning experiences in University of Mauritius with required first year and follow through last year major capstone experiences. The societal contents of this extension of the Stanfield model of hybrid intercultural literacy in Mauritius will be the Mauritian historically culturalized ancestral variations crossed over by skin color diversities with systemic political, economic, and social inequality formations.

We will use small group collaborative technologies to extend the classroom experiences of faculty and students to other countries in and outside Africa with matching faculty and student peers interested in exploring intercultural opening experiences in other nations useful for developing more effective intercultural opening skills in Mauritius as a multicultural emerging democracy.

Major findings of the research work

Our pedagogical model in encouraging students to transform positively in their thoughts, actions, life styles, and in embracing Cultural Others as fellow human beings is called intercultural literacy. Intercultural literacy teaching and learning includes and goes well beyond what conventionally has been considered as intercultural competence pedagogy. Intercultural literacy is a transformative pedagogy embedded in restorative justice process norms, values, and practices such as mutual historical memory sharing, mutual confessions, mutual apologies, mutual forgiveness, mutual reconciliation, and unified restored community life. The

participants in restorative justice based intercultural literacy teaching and learning processes are socially and culturally defined perpetrators and victims of routinized and more episodic dehumanizing Cultural Otherness involved in the just briefly defined transparency learning processes embedded in clarification "difficult conversations" and in collaborative task problem solving interspersed with times for critical self and collective reflection about what is being learned about self and others. Thus, through restorative justice embedded intercultural literacy pedagogies, students not only learn intercultural competency skills but also more deeply are provided the encouraging spaces to transform their value systems, life priorities, and personal identities much more than in courses which stress merely intercultural competence or more basically, intercultural appreciation.

Conclusion and significance

In the over 15 years Stanfield has been experimenting with intercultural literacy pedagogies in undergraduate and graduate classes on race and ending race in the United States and in other race-centered nations around the world, he has found students are particularly apt to be receptive to not only learning intercultural competency such as gaining an understanding of the histories and cultural traditions of RACIALIZED OTHERS of both dominant and subordinated statuses, when virtual and Internet technological experiences are integrated skillfully into more conventional face to face pedagogies such as class room lectures and discussions and small group assignments and presentations. This is because "race" like other forms of dehumanized Cultural Otherness is a hyper sensitive difficult conversation discourse topic which students tend to be ill-equipped verbally or non-verbally to articulate directly in transparent fashions - at least until comfort level is established. He has found in his hybrid (virtual/ face to face) race and ending race courses and those taught by others that technological venues such as on-line chat rooms, blogs, emailing, face book, forums, You Tubes, and cultural websites (such as museums) , and video-conferencing are invaluable in creating and sustaining quality cultural comfort levels. Indeed, he has found over the years that in his hybrid race and ending race courses, technological venues , especially those in real time, facilitate such deep sustaining comfort level development that students working together in multi racialized ethnic small groups on term long collaborative problem solving projects begin to hang out together outside of class as emerging friendship groups over the course of the term, a sure indicator that they may be on the lifelong path of becoming interculturally literate.

Keywords: Cultural Literacy, intercultural competencies, Pedagogical model, University of Mauritius

Analysing the Scope for a Full-Fledged Disability Act for the Republic of Mauritius: Opportunities and Challenges

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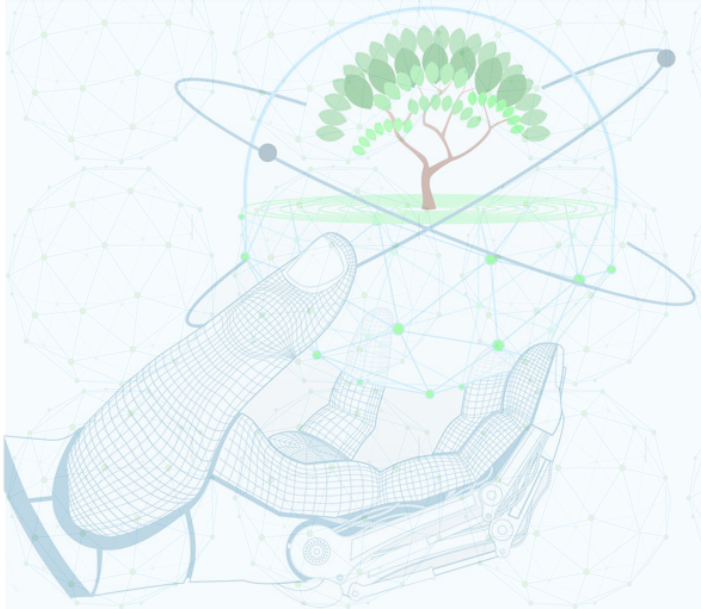
Abstract:

Legislation pertaining to disability in Mauritius is scattered and messy. The four main pieces of law that can be relied upon by people suffering from physical or mental disabilities in Mauritius include the Constitution of Mauritius, the Training and Employment of Disabled Persons Act 1996, the Equal Opportunities Act 2008 and the National Pensions Act 1976. However, Parliament has yet to enact a single, streamlined, comprehensive and effective Act that will respond to the growing need for a more human rights-based, equitable and just response to people dealing with stereotypes, discrimination, lack of access to opportunities, especially education, training and employment only because they happen to suffer from a physical or mental disability. Our country's obligations under international law, for example, as per the United Nations Convention on the Rights of Persons with Disabilities, has meant that successive governments have taken steps to put into place appropriate policies, structures, and mechanisms to create an enabling environment for persons with disabilities. In the recent government programme 2020-2024, where the very title includes the word "inclusive", it is surprising to note that there is scarce mention of how the government intends to make the lives of disabled persons in the Republic easier, especially in line with Sustainable Development Goal (SDG) 10 (reduced inequality) and all other related goals such as Goals 1 (no poverty), 3 (good health and well-being), 4 (quality Education), 5 (gender equality), 8 (decent work and economic growth), etc. The main objective of this piece of research is to study the current policies, structures, mechanisms and legislation in place in the Republic and assess their effectiveness in providing greater security and protection to persons with disabilities, with the overarching aim of proposing a robust, holistic and effective piece of legislation in this area. As this research assesses the current legal framework and then proposes a new way forward, the main research methodology used is descriptive and evaluative, coupled with a conceptual analysis section. It will be argued that the barriers faced by persons living with disabilities in Mauritius should be perceived from a multi-sectoral approach, such as gender, education, employment, access to leisure and sports, and infrastructure as well. It will also be suggested that the problem is not so much with the lack of policies, mechanisms and legislation in this field, but rather with their implementation at the level of Ministries, public bodies, and private entities, and also with the fact that their existence is not adequately communicated to the very people who are supposed to benefit from them. Therefore, the ultimate finding of this piece of research will be putting forward a legislation that empowers persons with disabilities and also providing a critique of existing outreach and communication strategies in terms of disability mainstreaming in the Republic.

Keywords: Disability Law, Sustainable Development Goals, Human Rights, Mainstreaming



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