

Bishop Mackenzie International School
Diploma Programme Extended Essays



2019

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2019

Amy Almeida



Theatre

How does Max Jones use scenography in the 2014 Tricycle Theatre production of True West in order to create an environment of tension and opposition?

Introduction

True West, directed by Phillip Breen, is a play based around the relationship of two opposing brothers; contradicting each other both visibly and characteristically. The designer, Max Jones, played a crucial part in creating the environment so that the right tension and opposition between the characters could commence. How scenography was used in the 2014 Tricycle Theatre production of *True West* was a key contributor when creating an environment of tension and opposition. Since these themes were so central to the effectiveness of the play, a narrow focus on the visual representation of the emotions portrayed could further communicate how the characters react within their environment. This production was set in contemporary rural America with a set representing that time.

This research question is worthy of investigation because it explores the importance of having a working set created by an experienced scenographer in order to perform a successful production. The set is central to a production's success and the scenographer's personal designs and decisions could contribute to the character of the play. Gaining a deeper understanding of how this specific designer created the environment for *True West* requires investigating further into the effects his designs created.

The majority of the supporting research has involved either books or videos with minimal reliance on websites. However the most valuable resource was the opportunity to interview Max Jones, by email, and thus gain primary quotes and source materials, such as images, from him, specifically about the play and this investigation. The research conducted was to ensure the ability to rationally critique the set and analyse the aspects of it that played a part in its effectiveness.

In order to analyse Jones' work one has to comprehend the concepts of scenography; the specific aspects and decisions that Jones made in order to create the effects that he did. To answer this research question one would have to consider the role of the scenographer in the context of *True West* and the specific artistic effects Jones used to create the stated atmosphere.

Introduction to scenography

According to Brewster and Shafer, "theatre artisans create 'the world of the play' based on the playwrights words" (p17). The set and lighting designer are tasked with creating an environment ideal for the manifestation of the pieces' plot, structure, mood, and overall theme, needing to be especially arduous since they are creating the visual representation of the play completely derived from its literary script. According to Adolph Appia "the art of stage production is the art of projecting into space what the original author was only able to project into time" (Leach, p16). This encompasses elements of visual art as well as principles of design, incorporating structural and architectural skills. These design elements fall under six headings: "point, line, shape, mass, colour, and texture "(p 17). With multiple genres of theatre as well as different styles of set and design, the scenographer would have to consider every aspect that would build up the piece into the 'vision' of the final performance. This is achieved through using the elements of design as tools to achieve a greater effect.

When a production is either low on staff or is small enough, the magnitude of these jobs falls on an individual, the scenographer. Their role can encompass reading and analysing whilst also researching the script, developing and communicating design ideas, and implementing said design ideas in order to effectively tell a story. After they have given the script multiple readings as well as determining any overarching themes, genre, dramatic twists, subtext, and dialogue that is needed in aspects of the play, the scenographer converses with the director to finalise the style of scenography that they intended to use for this specific play (A Phaldon Theatre Manual, p 8). Once a design has been decided they now need to incorporate "the design elements ... [in order to] communicate essential information to the observer" (Brewster and Shafer, p 18).

The 2016 production of '*True West*' directed by Philip Breen, originally written by Sam Shepard (1980), follows two brothers; clean-cut Austin, an educated playwright, and poorly groomed Lee, who recklessly left civilisation for adventure and whose profession is questionable (play guide, p 3). The play is set in the brother's mother's house in southern California whilst she is away on vacation. Austin waits to meet a notorious Hollywood producer, Saul Kimmer, when he encounters his brother Lee and tension sparks with the impact. Addressing a multitude of personal topics, such as their father, opposing opinions, and their respective social standings, the tension between them

reaches critical levels as both brothers flare into unpredictable chaos and violence as anger and jealousy take hold of them and they try to reverse their roles; Lee attempts writing whilst Austin indulges in absurd petty theft. Catalysed by alcohol, the contrasting personalities of the two brothers provide a constant theme of opposition throughout the play which ends in carnage of both set and character as the brothers are rendered at their darkest. In the last interaction, Austin uses a phone cable to suffocate Lee to the fringe of death, but as the lights dim we watch Lee resurrected, the lasting image left with the audience is of barbarous glare between brothers (Digital Theatre+ SG)

Max Jones is a dedicated and successful designer working out of London. His involvement in this play was specifically directed towards the prop and scenic design as seen in image 1, with make up and lighting left to other individuals. Having read the script, Jones created a 'table chart' in which he breaks down each scene; he includes the characters involved, character location, time of day, as well as the psychological impacts of what the scene is meant to convey (Jones interview, Digital Theatre). All of this allows him to gain a deeper understanding of the play and sets his mind to creating an environment that aids in depicting said understanding. Moreover, once he had a substantial view of the play and how he wanted to portray it, he drew inspiration from other works to aid him in creating an overall stylised production (interview Digital Theatre). With *'True West'* he aimed at creating a domestic drama from a cinematic point of view; he "wanted to show the film version of [the play] on stage" (Jones, personal email interview.). He also drew inspiration from other works, such as the workings of "Lonely the Brave" (an English alternative rock band from Cambridge) which aided him in encompassing the still intense moments between the brothers and "Paris Texas" (a 1984 movie directed by Wim Wenders) which helped him solidify a colour scheme (interview Digital Theatre). Once an intelligible design was confirmed, he moved on to addressing the space provided for him and how he could adapt the environment to serve the play.



Image 1: Provided by Digital Theatre

The symbolism of the two brothers

The cold harshness of the concrete and darkness combined with the mundane kitchen and typical household structure mirrors Lee's quaintness and inability to break out of the cycle of petty theft and conning that he has fallen into, as seen in image 2. Jones's intention for Lee's half of the stage was to provide a space for him to "prowl the stage left area in the shadows closest to the fridge..., where the beer lives, and to the only exit.... since Lee is not a man to get trapped anywhere" (personal email interview). It is evident that this side of the room is geared towards Lee's personality, shallow (closer to the audience and the first part of the room one would walk into), dark, and typically mundane with the only exit. Moreover, stage left lacks any window or view of the outside, mirroring Lee's inability to break out of the life that he is currently living in and his blindness to the rest of the world and its possibilities. Jones managed to effectively portray this character through the set on his side of the room, making the character the personification of his environment.



Image 2, Maquette model of the set, Jones

Residing in the other side of the room, as seen in image 3, Austin is lavished with a grass carpet, stone wall, plant decor, and an excess of light, visualising his creativity and freedom to explore the world outside his house achieved by education. Jones incorporated "the green carpet to help define a slightly 'softer' space for Austin to exist within whilst he writes" (personal email interview). He is surrounded by nature and plants as well as the window towards the garden mirroring his opportunities to look out to the rest of the world, unlike Lee who is restricted to views of the house. Moreover his side is a lot deeper, mimicking Austins more advanced education and character where as Lee's is more shallow. Similarly one would have to walk further into the room in order to get to Austin's side. Supporting this is the contrast between light as well; Austin has a redundancy of light depicting



Image 3, Maquette model of the set, Jones

his half of the set as clear and bright, much like his future. Lastly, the downside to stage right is the lack of exit, Austin has cornered himself in his education and status and realises “at the end there is no escape... he is pinned stage right” (personal email interview). Lastly, because stage right is a lot deeper, once the destruction of the set started, there was more on Austin’s side to be destroyed, thus, Austin stood to lose more than Lee.

The structure and architecture of the set

As the play opens, we see Austin and Lee in their respective halves of the room. With Austin sitting firmly in his half and Lee standing hidden in his, the play starts off with the two completely separate and functioning as individuals. Jones created this aura in order to start the play by visually stating the differences between the two; by “highlighting both extreme differences in personality and also cultural class in the two brother’s” (personal email interview). Both sides of the room contradict each other as opposites, strongly defined with the line created by the carpet; Jones “was working towards this effect of heightened ‘opposites’”(personal email interview) through the obvious opposition. As the play progresses, we see both the characters venture into the other’s space, with Austin delving into Lee’s half with the introduction of the toasters and Lee’s attempt to use Austins typewriter. As the play draws to a close, the characters manage to destroy the typewriter and create carnage throughout the whole room, blurring the line between the two halves as well as the distinction between the two brothers. The set visually mirrors how both brothers defend into chaos and their truer more animalistic selves, as seen in image 4. Having this visual representation helps the audience understand this character development as well as communicates the extent of the devastation.



Image 4, provided by Digital Theatre

Another structural uniqueness of the set are the modifications Jones made in order to create a feeling of discomfort; the extended full proscenium, as seen in image 5, with the visible roof and the depth of the room. The full proscenium was achieved through making the audience’s view longer in width and shorter in height.

Additionally, with the already restricted height, Jones designed a low ceiling with much of it visible to make the space feel even more closed off and restricted. He states that “the angle of the ceiling (specifically its beams) also visually helps ‘amplify’ the production as it visually thrusts the staging out of the Proscenium and into the auditorium. Adding a further dynamic to an obviously static environment” (personal email interview), again adding to the tension and the feeling of no escape. Jones deliberately had the “ceiling come in very low over their heads [in order to] compositionally emphasise the stage width” (personal email interview), and thus, adding to the proscenium effect. This unique stage image meant that the actors performing in the space looked confined and trapped in the set. The length of the roof extending away from the audience is also another technique Jones used to portray depth. Both these aspects provide the ideal environment for a toxic and explosive reaction between the two characters.



Image 5, Maquette model of the set, Jones

Jones also managed to create real depth in the set by having the audience face a corner of the room as opposed to a flat, head on wall; they are faced with the furthest point of the room downstage as the set gradually slope towards upstage, as seen in the blue print, image 6. This would help create depth differentiation between those downstage, who would look smaller and less significant than those upstage; moreover the depth mimics Austin’s depth of character and intellect where as Lee’s side is shallower. Jones stated that he deliberately used “complicated angles to create the set, ... [and commented on how] all of these physical distortions add to the unease felt throughout the play” (personal email interview). The set also has shallow staging; as on stage left we have the wall leading away form the kitchen towards the door which leaves very little space between it and the drop from the stage. This means anyone entering through the door immediately enters upstage and looks ‘down’ towards downstage, upon the room’s

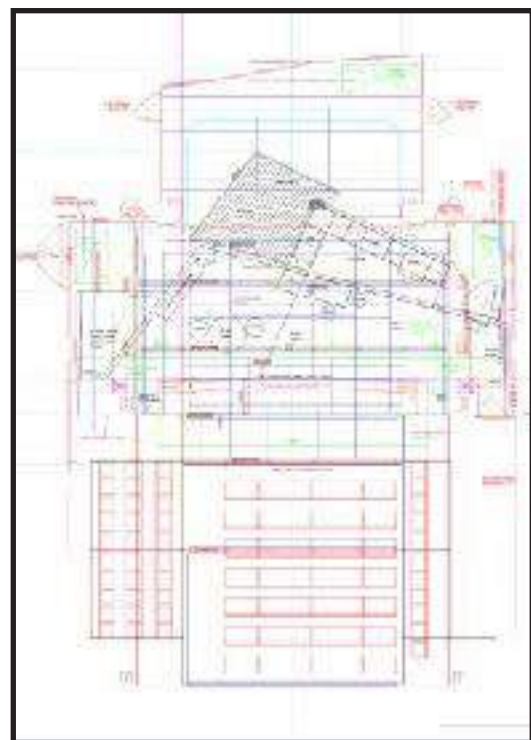


Image 6, Structural blueprint of the set, Jones

inhabitants. This could mirror the confrontational view those coming from outside the house would have when entering into the chaotic and maniacal interactions between the brothers.

The most protruding part of the set's structure is the kitchen instalment, as seen in image 7. As seen in the play, the architectural details brought in by the sharp angles and corners in the instalment provide the actors with a deeper space in which to perform.

The darker corners of the kitchen provide the perfect opportunity to distort or conceal a character and have them contrast with any highlighted character placed upstage. The area managed to feel wrong or different and created a sense of anxiety. Furthermore the kitchen counter provides the perfect surface that would later display the numerous toasters both highlighting them and keeping the rest of the stage



Image 7, Maquette model of the set, Jones

clear for use. It also resides in stage left, Lee's side, adding to the dark and dangerous feel of the character.

The last structural decision made was to place the only stage entrance offstage; this being the door to the house. Since Jones deliberately structured the set so that there was "no front door to the outside world visible (off stage left), the whole family [were rendered] prisoners in some way [as well as creating the illusion that] anyone entering the room looked as though they has just appeared out of thin air" (personal email interview). The absence of a visual door makes the characters and the audience feel like there is no means of escape and thus helps push the conflict between the brothers to its climax. Since all this was happening in such a close and confined space the brothers had no choice but to address each other and had no way to avoid it. Jones manages to match the environment perfectly to the subtext and theme of 'the haunting past' (M. Wycoff, p 12) that run's throughout the play by creating what he described as "a claustrophobic, stifling domestic space from which there was no escape... for either brother" (personal email interview).

Props and placement

The placement of the typewriter meant that the person sitting at it was at odds with whomever was at the other end of the room, as seen in image 8, this being Austin's side it gave him a means by which he could sit and be further at odds with Lee, who is standing. Having the typewriter stage right, meant that they are facing and opposing anyone who would come into the room through the door, in this case Austin would be facing Lee for the vast majority of the play. This also meant that there was a lot of room for the actors to circulate around the typewriter and for the eventual carnage that was to ensue in that space. There was also symbolism connected to the typewriter as it represents the significance of Austin's education and the reason he is as successful in his profession as he is. It is the very object in the room that distinguishes Austin's character from Lee's. Its connotations warrants its placement in the centre of Austin's side of the room, which drew the attention of the audience towards it communicating its importance. With both the depth and the lighting differing in this side of the room, it furthers the representation of Austin and greater extent to which Austin is destroyed. Since Austin has more to lose, represented by the greater space, he has further to fall. So when he's brought down to Lee's level, he has undergone more character development.

Image 8, Screenshots from the play, Digital Theatre)

The glass door placed furthest away from the audience is the perfect way of introducing light and sound. Being backlit, the door was able to portray the passage of time as well as the time of day, allowing there to be both the light from outside and the light from within. The backlighting also takes away from the definition of the character's expressions and morphs them into more menacing silhouette's as seen in images 9 and 10. When trying to create the opposing views, opposing lighting intensity helped separate one side of the room from the other. Jones states that he will "often be thinking about lighting dynamics when [he] compositionally carves up a space. So the double door, stage right, facing into the garden was also used to great effect in order to also cast stage left into shadow" (personal email interview). Through watching the play one can see how having the deeper,

(Images 9 and 10, Screenshots from the play, Digital Theatre).

more articulate side of the room filled with the light coming through the glass door meant that they could have the other, messier side of the set engulfed in darkness. This further represents both the characters opposing demeanour, education status, and professional status whilst adding to and highlighting the opposition between the two. This accompanied with the sounds referred to though the glass creates a real sense of a garden. This manages to provide a sense of 'outside' for the set, an outside that the brothers can't get to. By interacting with things through the door the audience imagines what lies beyond their view as well as makes the set more believable and realistic as a suburban household.

The toasters, introduced as props at the beginning of the plot's climax, were placed fittingly in the kitchen as seen in image 11. Once stolen, the mass of toasters lay scattered around the instalment making it cluttered and chaotic. This chaotic and mad accumulation represents Austins indulgence into Lee's lifestyle; the absurd choice of kitchen equipment mirrored the insanity Austin falls to as he demonstrates the absurdity of Lees conduct. It also depicted Austin as having abundant capability as he



Image 11, Screenshot from the play, Digital Theatre

as having abundant capability as he extravagantly overachieve's and steals significantly more toasters than necessary, once again performing better than Lee but this time at Lee's own game.

The colours used in the set were very mundane and usual for interior design of the 1960's. This was done in order for the set to not be too striking but still have an impact on the audience, Jones used dark colours with low saturation and a mostly generic colour pallet. Deliberately using mostly brown tinted colours for stage left and lighter, more natural colours for stage right in order to enhance the representation of both characters. The set make it evident that there is a distinction between the colours and textures on stage right, that mimic those found in one's garden and help provide a lighter more appealing environment, and those on stage left, which are cold shades of brown and white, those typical in houses and associated with what was modern household interior design. Jones wanted to use strong colours in his work in order to "compliment and help emphasise aspects of the architectural compositions, whilst also taking a lead from domestic reference images of the period" (personal email interview). However, Jones also wanted the colours to support the feeling of discomfort and unease and thus tried to "steer towards colour combinations that might also make [the

audience] feel a bit queasy or unsettled”(personal email interview). Moreover the pink backdrop used in stage left was used in order to “contradict the masculinity of the grown men wrestling by putting them against a stereotypically feminine colour”(personal email interview). However, since its in stage left, the colour contrasts greatly with the masculinity displayed in Lee’s character and makes the half feel more uncomfortable and unfitting. And closer to the end of the play, both characters and the distortion of the props contrast with the colour. Lastly the pink is further justified because the play is set in the brother’s mothers home, so Jones had to design the space as if “all the interior decor choices would have of course been hers”(personal email interview), supporting Jones’ reasoning behind all the feminine colours in the set as well as the aspects such as the flower. Furthermore, Jones has said to have taken inspiration for this colour scheme from movies such as ‘Paris, Texas’ which also operates with a darkened yet saturated scheme.

Colours taken from screen shots of the play (authors own):

Natural colours in stage right		Hard colours in stage left	
 Plant rack	 Grass carpet	 Floor	 Front wall
 Roof	 Cushion	 Curtains	 Kitchen wall
 Stone wall			

The most unique decision made by Jones was to try and present the production as if it were a movie. When approaching the given space to work in he considered the “Proscenium Arch theatre [to be] much higher than required to stage domestic interiors, and thus the excess space above the audience’s view can feel far too vacuous and doesn’t reflect the natural proportions of a domestic interior” (personal email interview). This problem lead to Jones presenting the set in a filmic wide shot, as seen in image 12; a very cinematic stylised shot, meant that the stage was much more

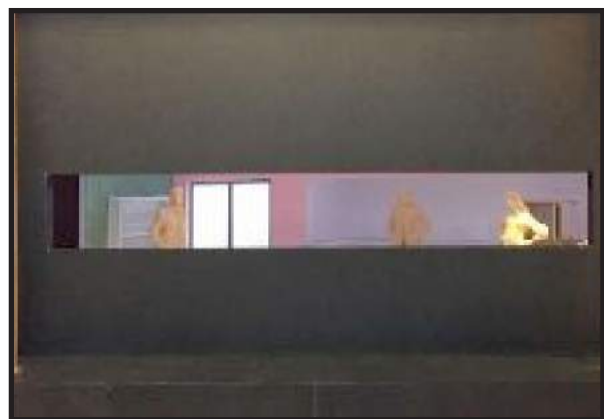


Image 12, Maquette model of the set, Jones

adapt to resembling a domestic house (Jones interview, Digital Theatre). He achieved the stretch wide shot through the two black sheets of fabric rising from the ground and lowered from the ceiling that resembled a sliding 'camera shutter' (Jones interview, Digital Theatre).

Although this didn't add to the tension exhibited in the production, it regardless imposed a movie like impression on the audience, meaning they would feel less involved with the intensity on stage and more like they are experiencing it through a screen. This detachment from the production also adds to the same effect as the enclosed set; since the play features the view of those outside the house, having the audience feel removed from the play puts them in the shoes of the outsider looking in onto the mayhem unfolding. The extent to which this was effective is evident through one's ability to notice it even when literally watching the production through a screen. Jones understood that the "wide shot or panorama naturally lends itself to a filmic landscape quality which I think really supports the 'opposites' play" for both brothers and thus he used this technique to full effect; using "the sliding 'aperture' designed to open and close each scene, much like an old cinema screen, to emphasised further the audience's panoramic view", this helps maintain the long but short view whilst opening and closing scenes and to prevent the audience from waiting for curtains to draw closed across the longer of the two distances.

Conclusion

Through this investigation one has gained a deeper understanding of what aspects went into creating this specific set and the effects these aspects had within the overall production. However, looking at scenography in general, this investigation provided insight into the workings of a professional scenographer and the skills and techniques they use in order to construct the ideal set. When watching the play, deducing the important aspects of was straight forward since the most relevant were the most effective. However trying to find the intent behind Jones' decisions was a harder task that was greatly aided by the conducted email interview. The interview also aided in legitimising and supporting claims made in the investigation. However, a completely accurate understanding of the play and how the visual aspects played a role in the production. This would include knowledge on the costume, lighting, and acting and how all mentioned aspects interact with each other and the audience. Regardless this investigation was focused on the scenography workings within the play.

Overall it is evident that Jones incorporated masses of thought and deliverance behind every aspect of the set and the depiction of the stage as a visual representation of the characters being performed on it. The use of the space provided was ideal for the play

and demonstrated a great understanding of how to construct a set. The set was idea for the play and conveyed everything that it was intended to, thus being massively successful in helping convey the subtext of tension and opposition running through the play. Having used the majority of the elements of design, the set was successful at determining the overall effect of the production and proved to be very detailed and effective.

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Muhammad Ali Bheda



Economics

What will be the effect on Pakistan's economy once Gwadar Port is functional?"

Introduction

Disclaimer: This essay was made before the Pakistan elections in 2018.

I decided to write my Extended Essay on Economics as I have a strong passion towards the subject in school and aspire to do further studies in University. Out of the 4 topics within the IB Economics course, I selected development by means of international trade. I believe development is the most interesting subtopic as an observer can evaluate the data and statistics of how a country is progressing economically and from there, draw conclusions on what actions could be taken to help the situation. My research question is "What will be the effect on Pakistan's economy once Gwadar Port is functional?" and this is relevant to development as I will be looking at the Literacy rates and GDP of Pakistan and Sri Lanka courtesy of the World Bank and will analyze the change after the port's functionality.

You can consider this essay to almost be a comparative report as I will be looking behind the success of the Colombo Port in Sri Lanka to see if Pakistan can replicate this. I believe that the essay itself will gather a lot of interest not only in my social groups but in general as well because the main functionality of the port is the throughput of goods from China. This project is known as the China Pakistan Economic Corridor (CPEC). China has a reputation of large scale trading being the world's number one exporter and so all the goods leaving China for Gwadar will see Pakistan's export rates increase majorly. It is the responsibility of a country's government to spend revenue appropriately to augment economic development and maintain a positive trade deficit amongst other things, but this highlights one of Pakistan's biggest issue; corruption within the government.

To successfully answer the research question I formulated I will be conducting both primary and secondary research and will be presenting it accordingly. My primary research includes an online interview with the CEO of the Intergovernmental Panel on Climate Change in Pakistan (ICPP), Mr. Pasand Khan. The secondary research includes data I will be getting online in order to make graphs of literacy rates and GDP primarily, pre and post port functionality for both Sri Lanka and Pakistan and from there a comparison and conclusion.

The CPEC

What is the CPEC?

The CPEC was initially established in May 2013 by former Pakistan Prime Minister Nawaz Sharif along with current and former China presidents Xi Jinping and Hu Jintao. The CPEC is number of different infrastructure projects on the border between Pakistan and China and was valued at \$46 billion in 2013. It is currently worth \$62 billion as major development has maximized the revenue that could be generated. Pakistan's intention to grow economically by means of infrastructure and transport were matched by China's ambitions to cut export costs as well as improve diplomatic ties with Western Asia. (Tribune, 2016)

Some of the infrastructure projects include the Karakoram Highway, Khunjerab Railway and Gwadar Port. All forms of transport were taken into account when the project was established meaning that there would be at least one project for every type of transport; highway, railway and port projects. The Karakoram Highway is located in Burhan, Pakistan which borders with China, the highway was officially open to the public in 1986. In 2010, a large landslide around Gilgit and Burhan severely damaged the highway and Pakistan had to reconstruct accordingly. China funded Pakistan with \$90 million in order to rebuild the damaged parts of the highway, as a token of appreciation and condolence for the many lives that were taken due to the natural disaster (over 1000 deaths were laborers of the highway). The Khunjerab Railway was completed more recently in 2008 and is a part of the long term CPEC projects. The railway begins in the city of Xinjiang Uyghur and extends to Havelin, Pakistan which is connected to the Khunjerab Pass, another border with China. The last project is the Gwadar Port which will be investigated in more detail during the comparison of the data. Located in Gwadar, construction began in 2002 and progress has continued indefinitely, by 2025 they expect to complete all extensions. (Dawn, 2017)

What motivates these countries to trade with each other?

Pakistan is a country that is developing economically, and to be trading with Asia's most powerful economy is motivation in itself. The development of infrastructure is one of Pakistan's major motivations, as in the northern regions of Balochistan and the mountain ranges of Karakoram have seen China fund a number of Pakistan's projects from coal mines to railways. The Chinese-Pakistan border is up north in Khunjerab which is close to Gilgit and Balochistan, constructing roadwork here allows people to travel to each different regions. Labor is cheap in Pakistan and so unemployed locals near the northern regions are now working on these projects, not only does this help China with using their own labor force, it also allows for employment to flourish and despite the harsh conditions of the mountain range, the locals are happy to work. Pakistan had also aided China during the Sichuan earthquake of 2008 by kindly donating over \$2 million worth of emergency aid and over 30,000 tents for those affected. Also, Mr Pasand Khan has said "China-Pakistan Economic Corridor is an important component of the Chinese vision for Eurasian connectivity popularly known as the "One Belt One Road (OBOR)" Initiative (yi dai yo lu)." (Khan, Pasand. Online interview. 9th May 2018)

Chinese and Pakistani trade

International trade between Pakistan and China began in the early 1950's as Pakistan cut all ties with the Republic of China/Taiwan and introduced diplomatic ties with the People's Republic of China (PRC). Although in recent times, China has aided Pakistan in terms of infrastructure, militia and technical assistance, Xi Jinping claims that trade and diplomatic ties are equal. (Dawn, 2017)

A free trade agreement (FTA) commenced in 2007. A free trade agreement is when two countries decide to trade without any government intervention. Prior to the agreement, Pakistan were still importing goods from China as in 2006, 9.6% of Pakistan's imports were coming solely from China. Over 16% of Pakistan's imports are Chinese goods currently. (ASEAN). (Britannica, 2018)

Pakistan is disadvantaged in both governed and non-governed trades; due to the sheer production power and diplomatic ties China has. Before the FTA, China's imports of Pakistani goods were (and still are) small scale. The tariffs for these imported goods were also quite high, resulting in higher prices and thus lower demand. This could potentially encourage local businesses to produce the same goods at cheaper prices and in result cut imports for that specific good from Pakistan. (Dawn 2018)

Over a 4 year gap spanning from 2012 to 2016, the imports of Chinese goods to Pakistan rose significantly. Electrical machinery, mechanical appliances along with iron and steel are amongst the most imported products from China. Those products

registered increases of \$1.56 billion, \$2.08 billion and \$1.03 billion respectively. In total, there has been a total increase of \$4.67 billion in import expenditure. In contrast, Pakistan's exports to China have seen decreases. Some of the main exports to China include cotton, fish and marble; all of which have reduced by \$0.64 billion, \$0.16 billion and \$0.12 billion respectively. Total overall decrease in exports totals up to almost \$1 billion. This sees a \$5.67 billion trade advantage in benefit for China which once again sums up how biased this trade is so far. Another factor to keep in mind is that Pakistan's top exporting products have less significance in the Chinese market whereas China's top exports have huge demand in the Pakistani market. (Dawn, 2018) (Tribune, 2017)

The Gwadar Port

Construction of the port finished in 2007 (the same year as the commencement of the FTA), The Gwadar Port construction took a total of 5 years under the CPEC agreement. The port is located at



the tail end of the Gwadar region which is along the lines of the Special Economic Zones of China (SEZ); "zones along mainland China in which the government has introduced free market oriented economic policies along with flexible governmental measures". (Dawn, 2018)

The port will be able to accommodate ships with up to 70,000 dead-weight tonnage (DWT) and can dock both bulk carriers and container vessels. Former president, Parvez Musharraf initially concluded a 40-year agreement with the Port of Singapore Authorities (PSA) to improve the port and help fund extensions. The PSA offered Pakistan a vast range of tax concessions, land for special economic zones as well as shared percentages of revenue from the port's incoming cargo and maritime services. Reports from several global new sources suggested that the commercial port was underused and soon after, more reports emerged this time stating that the Pakistani government had been negotiating with China for possible additions to the port, whilst still being on

the 40-year agreement with the PSA. (Greater Kashmir, 2017)

The total cost of the port amounted up to \$248 million in 2007, prior to the extensions made to connect the port to Western China. The cost of the initial extension cost \$1.2 billion and the most recent project which is to connect the port to the Gwadar-Nawabshah border in Iran will cost an estimated \$2.5 billion. China is currently leasing the Gwadar Port for 43 years which lasts until 2059.

The initial expansions of the port saw over 40,000 Pakistani employees working on the port which was one of the major benefits of the construction. Increased employment opportunities are a major benefit to Pakistan. Pakistani citizens were also employed to work on the Karakoram Highway, and as mentioned previously the Karakoram Highway was financed by the Chinese government entirely. The Gwadar Port is also partially being funded by the Chinese as Xi Jinping loaned \$757 million to help with the extension of transport links to the Chinese border. (Dawn, 2018) (ARY, 2018)

Pakistan's Economic and Political problems

Pakistan are looking at a major infrastructure project to help resolve their current economic and political issues. Some of the major problems that Pakistan is facing are discussed here as well as how the success of a functioning port will help achieve their goals.

Corruption

In 2015, an anonymous source leaked over 11 million documents regarding fraud, tax evasion and evasion of sanctions, it was soon known as the 'Panama Papers'. The papers showed that Nawaz Sharif had illegally gained ownership of offshore companies and properties in London, UK. Although he attempted to explain that his businesses were legal, he was eventually found guilty. (Valuewalk, 2017)

Along with the fiasco of the Prime Minister, who should supposedly be trusted with all revenue and taxes in order to benefit the country, many public services in the country are extremely corrupt too. According to Business-anti-corruption.com, 3 out of 4 policemen/women are corrupt in Pakistan due to low wages, poor training skills, lack of necessary equipment and most importantly (and unfortunately) excess amounts of bribery. Extortion from prisoners and their respective families are often the source of income for most police officers. Another factor to keep in mind is that the standard of security varies throughout the different cities and zones which makes it completely unfair on the unprivileged locals. (Business-Anti-Corruption, 2017)

Overpopulation

The second major issue that Pakistan is facing is overpopulation. A common issue that most LEDC's face. (World Bank, 2016) Overpopulation in Pakistan occurs due to a number of different reasons; here is a list of them:

Religious and cultural beliefs

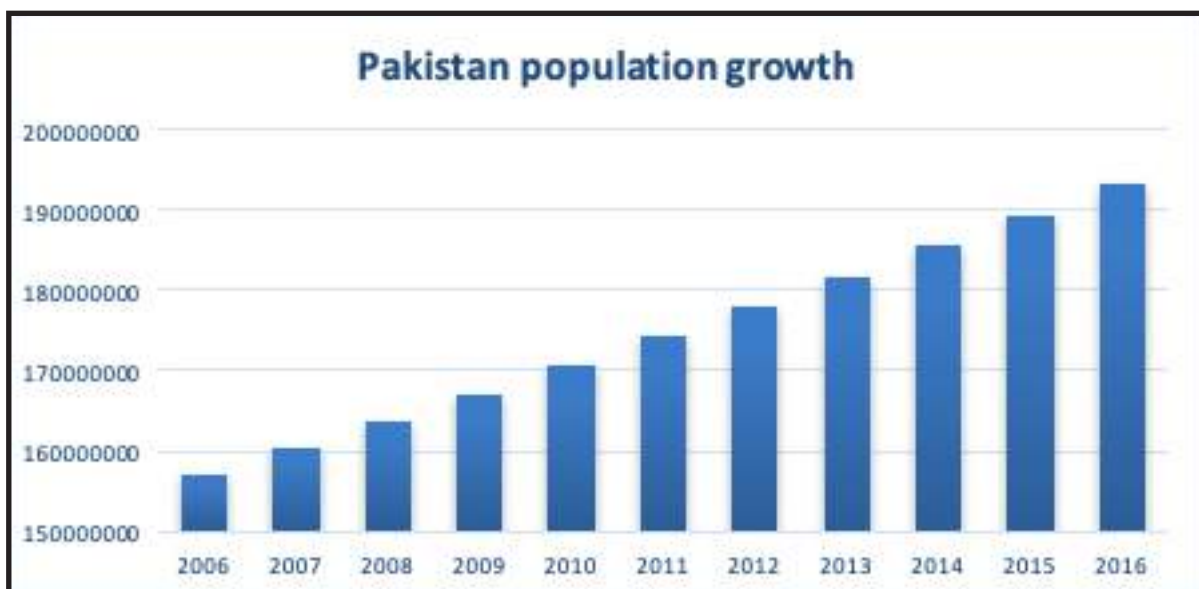
Pakistan being an Islamic Republic with over 96% of all people being Muslims plays a huge role in the overpopulation crisis. Most Muslims have a firm belief that Allah has the resources to prepare every living organism on Earth and although this is relevant to an extent it is not the major cause. It is traditional to have a large family and pass down genes; this shows authority and capability of sustaining a large family (Nation, 2017)

Female unemployment

Over 70% of Pakistan's working-class female population are currently not engaged in, or actively seeking employment. This lack of activity acts as a catalyst for overpopulation as women have nothing to focus on apart from making a family. Countries with low birth rates such as Germany and Japan bare low female unemployment rates, reason being that the women have jobs to focus on and so they prioritize their work. (Nation, 2017)

Literacy

According to the Nation, Pakistan's literacy rates has dropped from 60% to 58% in 2018, which means that just above half of the population are actually literate. The unequal share of literacy amongst the respective regions in Pakistan is another huge issue as



metropolitan cities like Islamabad and Karachi have literacy rates of over 87% and small regions such as the Kohlu district barely have over 30% of literate citizens. (Nation, 2017)

Plans of Port expansion

Whether or not the port will assist in overturning the aforementioned problems is entirely dependent on three aspects;

- if the second phase of the Gwadar Port can successfully diminish the tariff lines of Pakistan's imports for China
- the success of the Gwadar-Nawabshah segment extension between Pakistan and Iran
- the government spends the incoming revenue appropriately and corruption-free.

Phase II

The second phase of the Gwadar Port's development is the most crucial and expensive fragment of the port's expansion. The construction of the second phase began in 2007 and is currently still being worked on; the total cost for the expansion is an estimated \$1.2 billion. Some of the objectives they wish to fulfill include; 4 container berths across a 3.2 km shoreline, 2 oil terminals with a 200,000 DWT limit each, and a new international airport close to the port itself. These are just three of the laundry list of their objectives, and if they manage to accomplish even half of them, we can expect a huge increase of revenue. (Dawn, 2018)

Gwadar-Nawabshah extension

The extension between Pakistan and China has proven to be beneficial to Pakistan in the long run however immediate success is necessary, especially in the country's critical situation. Iran is most famous for its exporting of oil and gas however in recent times, tropical fruit has also been a significant export. The idea of fresh fruits being imported to Pakistan could relate to the country's nutrition issues. (Dawn, 2018)

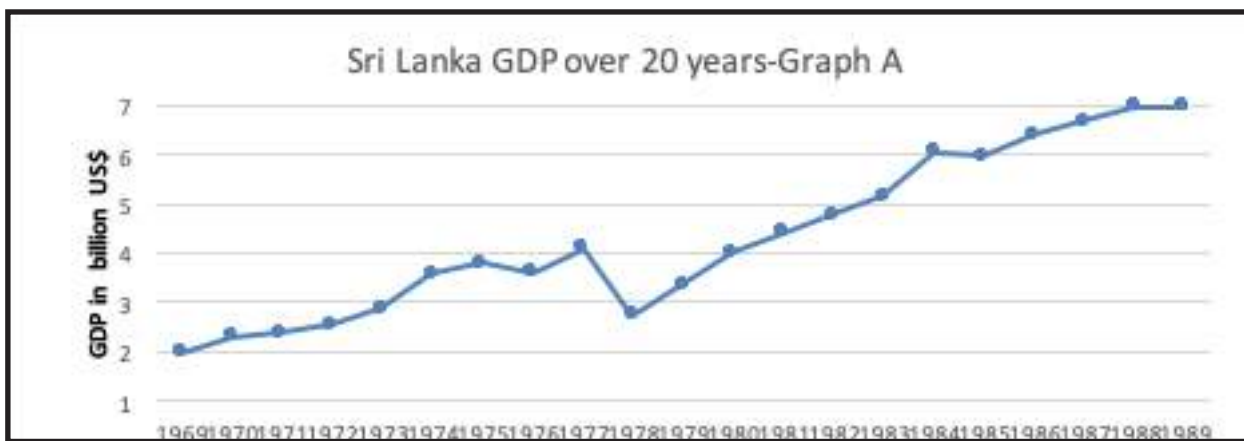
Election of Imran Khan as PM

With Nawaz Sharif's recent resignation as Prime Minister, the next elections take place on the 15th of July 2018 with cricket legend and politician, Imran Khan, being the firm favorite to become the new PM. In a conference in Islamabad held on the 7th of May 2017, Khan pledged to make CPEC a priority and also claimed that the project would make Pakistan one of the strongest economies in the world. (Nation, 2017)

Sri Lanka case study

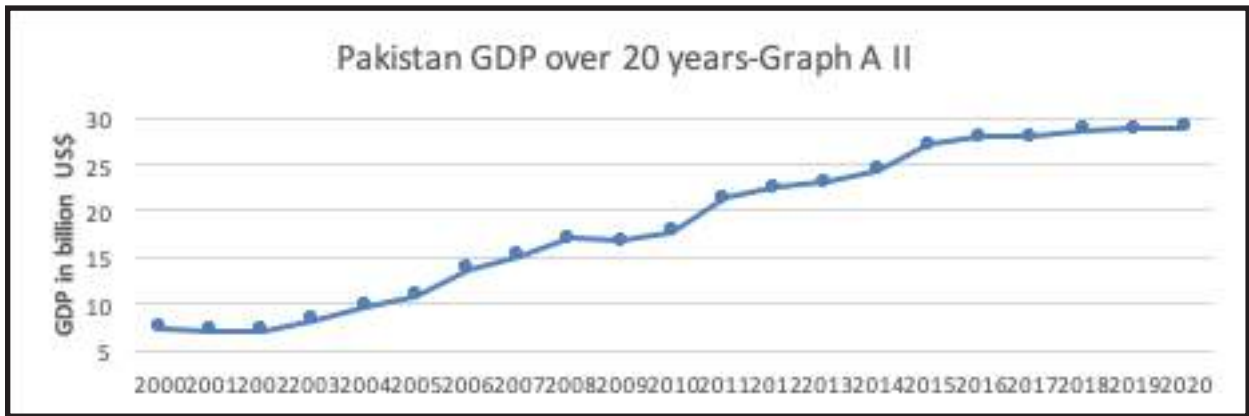


Rananyake



(World Bank, 2017)

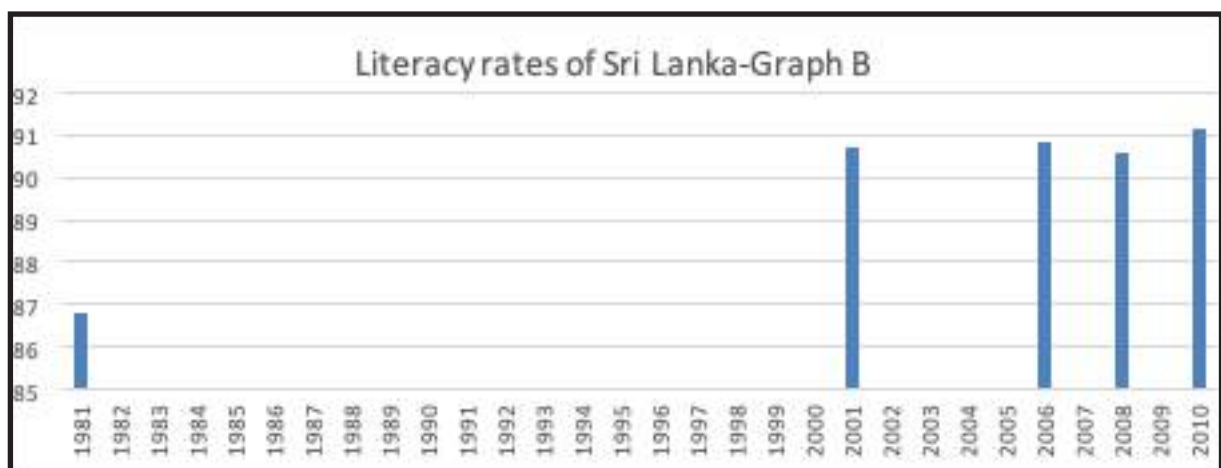
Graph A represents Sri Lanka's GDP 10 years prior (1969-1978) and post (1979-1989) port functionality. The Colombo Port which was officially opened in 1979 and underwent thorough modernization during the mid 1980's. From 1969 to 1977, Sri Lanka was developing fairly well, The GDP was at \$2 billion and had doubled over an 8 year period. In 1978, the government declared themselves as a socialist republic. Socialism is the concept that all business production, distribution and exchange must be owned by the public as a whole. The obvious disadvantage here is that the government is in full control and so to subsidize more businesses, higher tax rates would need to be put in place, thus the average salary of a working class person decreases and the GDP dramatically dropped back to just under \$3 billion, however from there onwards, an economic boom was to occur. As seen in the graph, in 1978 Sri Lanka's GDP was read at roughly \$2.8 billion and just 6 years later, that figure tripled to exceed just over \$6 billion. (World Bank, 2017)



Explanation of Graph A II

(World Bank, 2017)

From 2007 (official opening of Gwadar Port) to 2017, The GDP rates have increased by just over \$12 billion with a significant rise from 2009 to 2010 specifically. Pakistan have improved more than Sri Lanka in this aspect as in Graph A; GDP rates had increased by around \$4 billion dollars 10 years after the port had been opened. Data for 2018 onwards was created hypothetically, by using the patterns in Graph A; The GDP will still continue to grow but not by large margins.



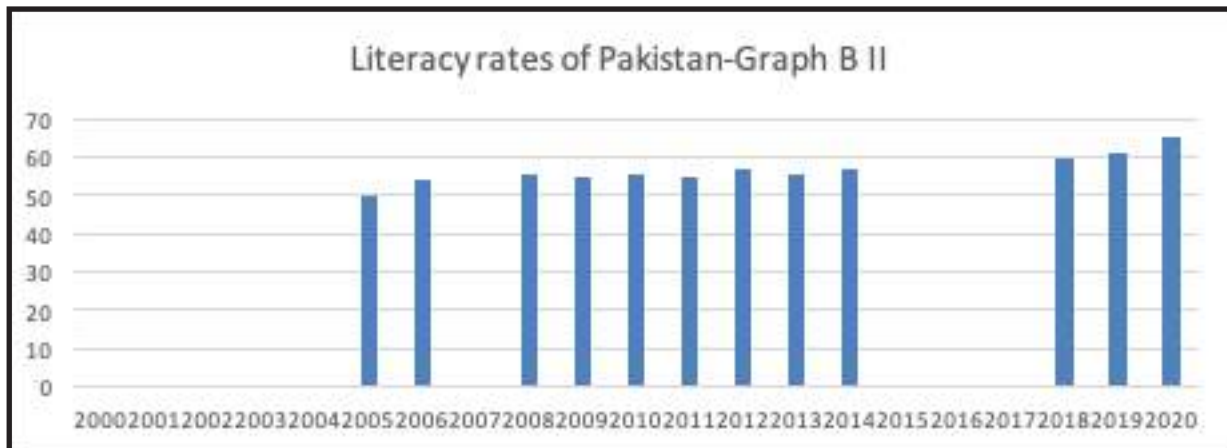
(World Bank, 2017)

Explanation of Graph B

Graph B represents Sri Lanka's Literacy from 2 years after the port's construction to 2010 and although much of the data is missing, a pattern is still recognizable. In 1981, the literacy rates were almost at 87% which is already very impressive considering Pakistan was at a measly 58%. The nature of the situation is that Sri Lanka's GDP has been of a non-stop improving pattern whereas Pakistan's literacy rate had dropped from 65% to 60% to 58% over the course of the last 3 years, putting Sri Lanka way ahead of Pakistan.

In 2017, port officials declared that the Colombo Port had made a profit approximately \$80 million, the most profit they have ever recorded. The Colombo Port has been a contributing factor to Sri Lanka's economic growth especially when you consider that

there are over 9,000 employees alone in the port.



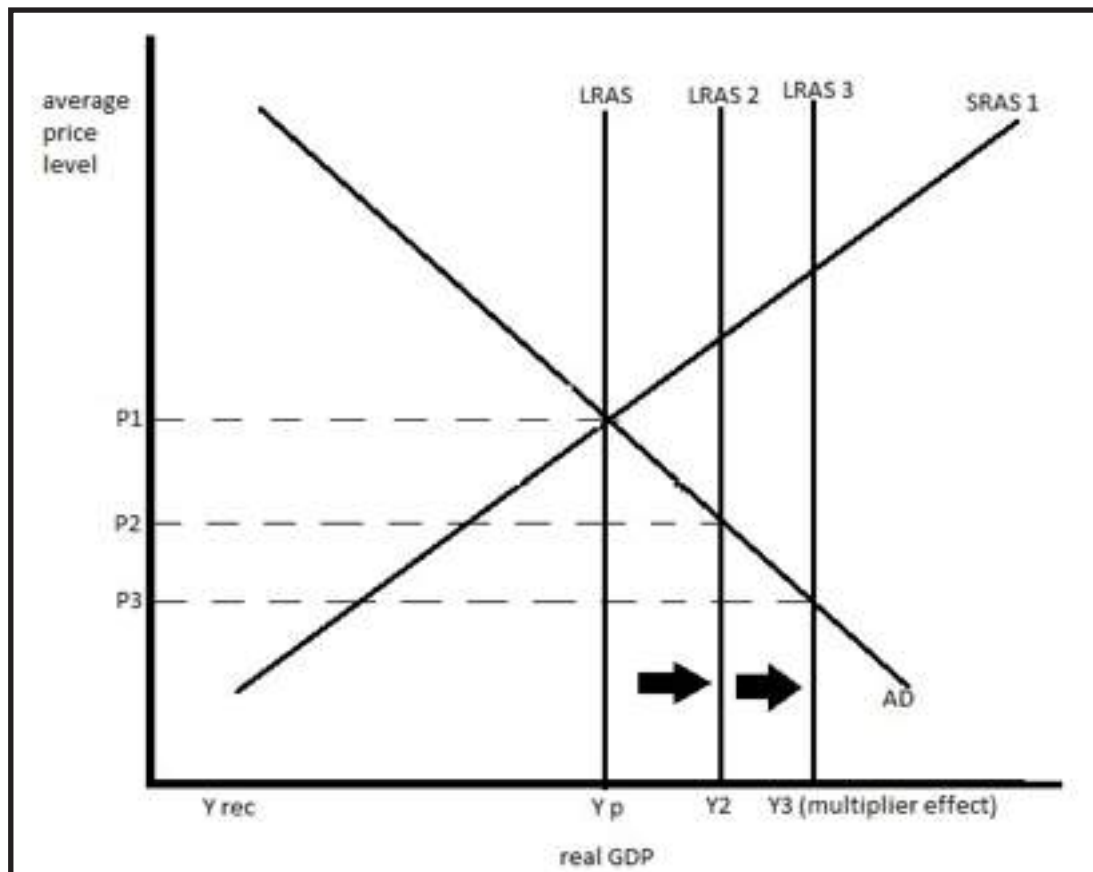
(World Bank, 2017)

Explanation of Graph B II

From 2007 (official opening of Gwadar Port) to 2014, literacy rates have been floating in the 50-60% range showing no great improvements. Unfortunately, this graph does not have a 30 years span as Graph B does, and that is because making predictions of data for over 13 years would be quite inaccurate even by following Sri Lanka's data patterns. War or natural disasters could make a huge difference in the literacy rates and these must be taken into consideration before making hypotheses. Data from 2018 onwards (which were my predictions), also do not show great improvement; barely breaking through the 60% mark. The reason for this is because of the overpopulation and having enough children being enrolled in higher education.

Graph C

The diagram above illustrates the outward shift of on the long-run aggregate supply curve from Y_p to Y_2 . When a country's GDP improves, it means that the country is producing more real output and the consumers are earning more money to spend; this change in result will see the average price level of goods decrease from P_1 to P_2 . Changes in the LRAS curve are dependent on the factors of production; if a country's cost of production decreases or employment levels rise, real output and GDP will increase too as the country will be able to produce a larger amount of quantity for a good. As lower unemployment rates will help improve factors of production; "The establishment of Economic zones, special economic zones and industrial zones etc. will certainly be bringing lot of employment opportunities, economic activities followed by progress and prosperity for the area and the region." (Khan, Pasand. Online interview. 9th May 2018). When a country's real GDP is not as great as their potential GDP due to factors of production, the process is known as the deflationary gap. (Trajakes)

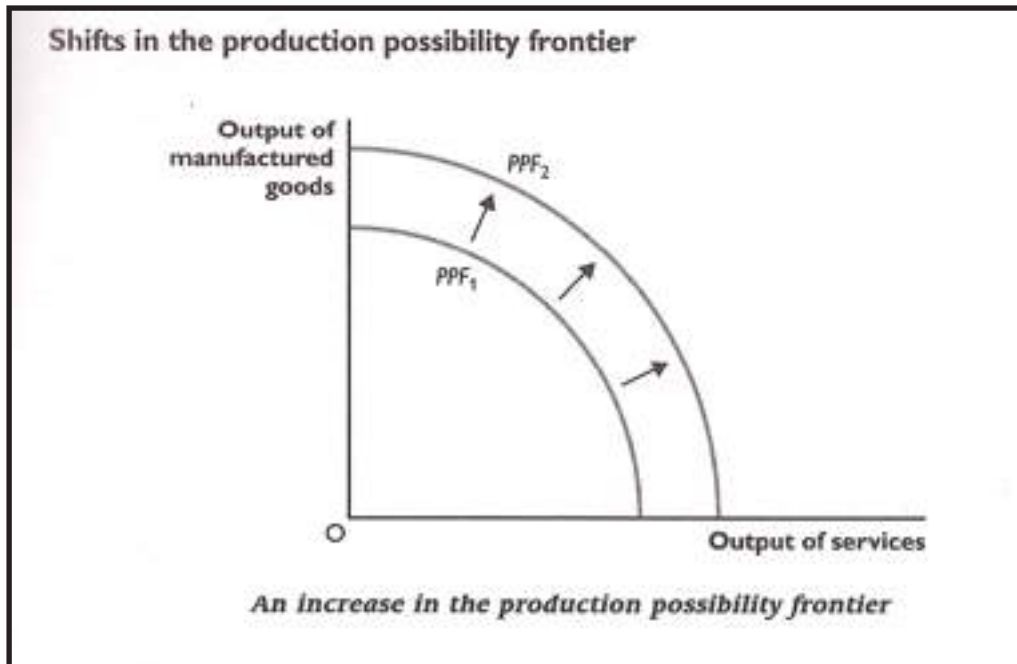


Multiplier effect

As seen in the diagram above, there is a further shift in the LRAS curve from Y2 to Y3 and in result a decrease in price level from P2 to P3. This happens because of the multiplier effect; "The impact on the real GDP of a change in any of the components of aggregate spending (C, I, G, X-M)" (Trajakes). When a government spends money on a new project, the funds are spread out amongst the factors of production; this money is income for those who have contributed i.e. engineers, architects etc. This income is now spent on imported or domestic goods and taxes, thus the more a government spends on a project, the more income is earned and used.

Graph D

The obvious advantage of the seaport is the augmentation of production. With more manufactured goods leaving and docking the port, the government will be able to generate more revenue to be spent of the wellbeing of the country. Theoretically, the revenue gained from the port should be used to improve infrastructure, public services etc. However, in Pakistan's context, the construction of schools, colleges and universities would be the most local forms of infrastructure. As we saw in the context of Sri Lanka, literacy rates were really affected positively and I would expect the same results to occur with Pakistan.



The other major advantage of a seaport is the fact that Pakistan borders India, Afghanistan, Iran and of course China. Although Pakistan trades with many countries,



the two I have primarily based this essay on are Iraq and China. Although Pakistan and India have poor long term relations, the two countries do trade. The concept of trading with other borders will improve diplomatic ties and will augment their trade deficits.

Graph E

The major consequence of a port is the CO₂ emissions that will follow with it. In 2008, Pakistan established in the UN Paris Agreement that they would cut their CO₂ emissions by half by 2025. I asked Mr. Pasand Khan of the IPCC in Pakistan if the government would abort this mission and instead focus entirely on the functionality of the port with his reply being; "Pakistan is not the only signatory to the Paris agreement to reduce the CO₂ emissions; besides this is 21st century with lot of eco and environment friendly technologies and legal frameworks that would ensure the least possible emissions of the CO₂ like elsewhere in around the globe."(Khan, Pasand. Online interview. 9th May 2018).

The other inconvenience of the port is its expenses. Extensions of a port would cost several of hundred millions and in some cases billions of US\$. As China is currently funding most of Pakistan's extensions, finances are not a problem especially with the long-term lease by China. A serious issue would be if there were to be a natural disaster along the shorelines of the coast, which would not only destroy the docks but also the resting containers and ships. Thankfully, aid for natural resources has become a formality and Pakistan will definitely receive financial aid from its trading partners.

Conclusion

To answer the research question I had proposed "What will be the effect on Pakistan's economy once Gwadar Port is functional?" I believe that the functionality of the port will definitely improve Pakistan's stature and economy, and all the factors that were covered in this essay prove so. Sri Lanka and Pakistan may be two different countries as one is a socialist republic while the other is a capitalist republic. The port will no doubt gain much more revenue for the government however this would be completely pointless if the government were to utilize the money wrongly. It is a cycle that needs the government to trust the port, and the citizens to trust the government. With the elections coming soon, Imran Khan is hotly tipped to win, the locals will be hoping to see a better future, after what has been a poor 5 years with Nawaz Sharif. The evidence in the Sri Lanka case study has shown that the Colombo Port was responsible for a large part of their economic development, and so the Gwadar Port can replicate this feat. However, issues regarding illiteracy, corruption, female inequality and religious intolerance could be major factors that could prevent it. Overall, economic development is highly expected; just not to the magnitude of Sri Lanka.

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Darren Brooks



ITGS

How can drones be used to provide advanced blood testing and health check ups through United Nations International Children's Emergency Fund (UNICEF) to rural areas in Malawi?

Introduction:

Technology is now advancing in our daily lives at a rapid rate it's influence is changing and shaping the world we live in today. ITGS (Information technology in a global society) is focused heavily around the ethical side of this impact and how it effects the ITGS triangle (Social and ethical significance, IT systems, Application to specific areas and stakeholders).

Drones have been widely used in the military for decades and most have heard of this numerous times, this however gives a somewhat negative connotation to drones which is then associated with the military and practices that are typically used for warfare purposes. However what does not get enough attention is the potential and current work that drones perform on a daily basis that benefit LEDC's (Less Economically Developed Countries) such as Malawi. This is done in a number of forms; humanitarian aid, geographical mapping, search and rescue operations etc. All of which prove to be beneficial in contributing to developing the country for both the short and long term. I have chosen to pursue the topic of drones in Malawi for my extended essay because of the issues aforementioned are all problems that drones are currently solving in Malawi, and should be recognised and considered as viable solutions worldwide. My RQ (Research Question): How can drones be used to provide advanced blood testing and health check ups through UNICEF to rural areas in Malawi? Would prove to be a useful RQ to anyone who seeks an insight into how and why drones are being used in Malawi a country with one of the worlds highest poverty rates. I intend to answer this RQ with a balance of both Primary and Secondary research.

I have gathered a wealth of primary research locally via UNICEF and its partners. I hope to use the statements/information Matthias Bowen (Head of the drones association at

UNICEF) has given me in our recent interview. Vast amounts of secondary information is also available to me via various PDF files regarding Malawi's drone regulations in combination with many BBC's articles that praise the current achievements of the drone program in Malawi as it is one of the first places for the drone project to be successfully implemented. This is then accompanied by all the research done on drones, and the technological components (Software & Hardware) that make them successful machines to carry out specified tasks effectively.

Historic Background & Application to Specific Scenarios

Technology and its advancements have now become the centre piece of progress in the world we live in today. Many of these advancements are done to improve the quality of life of those who cannot attain a sustainable stable life for themselves. This is where drones come into play. UNICEF currently operates its drones in Malawi, and has plans to include the drone program in Vanuatu . UNICEF is currently including drones into their programs as it is a rather new method of humanitarian aid. Currently Malawi is the only fully established drone program. From current results this represents the progress and the achievements the NGO has made through the usage of drones in rural areas. Drones in humanitarian aid are capable of fitting in tight spaces and flying through and over rough terrain, this makes them especially useful as they are completely expendable and will not put the life of any one individual in danger in the attempt to gather information, this will also prove to be helpful in the efficiency of communication and enables the NGO to view a crisis from a distance beyond the line of sight (Unmanned airborne units). The drones have also proven to be much more effective than previous methods which were deemed inefficient and were operating at high costing rates.

UNICEF's current humanitarian project is the transportation of blood samples and other medical information to rural areas in Malawi through drones, UNICEF has tested blood since 2015. My RQ is directly related to UNICEF's work and their achievements/limitations in the field of drones. In order for UNICEF to begin their humanitarian drone project in Malawi a large amount of work was put into negotiating and research to persuade the government of Malawi that is in their best interest to allow the drone corridor to occur in Malawi. Matthias B. stated that it took a "considerable amount of time for the drones association to get approval from Malawi's authoritative stakeholders, including; Police intelligence, House affairs, MDF (Malawi Defence Force), Ministry of Health and lastly the most important stake holder related to the topic civil aviation. Civil aviation is the green light when it comes to access to Malawi's airspace regardless of the cause.

March 2016 the Malawi government finally decided to approve advanced drone tests in rural areas in Malawi, after months of legal documents exchanged. This was due to the stigmatism around drones, and the potential for a misuse of the product which therefore may result in an invasion of privacy and/or affect national security. The process in order to achieve the legal documents involved UNICEF supporting and funding the civil aviation department to go to SA (South Africa) to study the regulations and legislations that are in place for drones, as-well as a trip to the US to own a license to inspect drones. This allowed UNICEF to acquire licensing, which intern helped persuade Malawian Government of their legitimacy . A company called Mother-net began testing flights, 93 test runs (All of which beyond the line of sight). Ultimately these tests led to the idea of introducing a drone corridor program as the governments support and interest of advanced technology grew to support the current health system in Malawi, which was then introduced on June 29th 2017.

UNICEF currently operate its drones in densely populated areas outside of the capital such as; Chinsapo, Lilueni Dandela ,Biwi and Salima. Matthias B. stated, “we hope to begin flying in Nkhata Bay district & Likoma district in the north” . His hopes are that NGO will be able to begin drone testing and usage when the modelling of the new drones are complete, which is estimated to be in 5 months time (Estimating completion date 25/06/2018) .

The drones operating in rural areas have effected the lives of the local Malawians drastically. On March 2016 a flash flood occurred and cut off villages from accessing necessities. Drones were able to locate and record footage of particular villages, then distribute this information to organisations which then were able to allocate their resources effectively to provide a quick response and relieve the locals. During this incident the drones proved effective in rough terrain and conditions. Additionally they provided reliable information as the video footage is accountable and accurate. Thus proving that in terms of humanitarian aid drones are able to successfully fulfil jobs and provide even better results than real life workers, as workers cannot achieve the perception of a birds eye viewpoint nor continuously travel such great distances without interruption.

IT Systems: Hardware

Drones are sophisticated pieces of technology and require many technological components to allow them to function to the standard they work at. UNICEF currently uses the ‘SenseFly eBee Plus’ and the ‘DJI Inspire 2’ amongst numerous other self built drones. This is authorised as UNICEF have agreed upon a non-disclosure agreement with its partners meaning that whilst UNICEF modify’s their drones they cannot share



any information regarding the drones and their functions/capabilities. The drone has various lights equipped on the body to help give an indication of the current status of the drone. The Drone is also equipped with a lighter sensor used for ground detection at the bottom.

Survey drones require some of the newest most cutting edge technology.

The highest price tag on these particular drones is the camera that is purchased with it, typically a 20 MegaPixel DSLR Camera which costs around \$8,000 and the total price of the drone being \$12,000 . A good camera is essential to these drones as it gives the drone full functionality out of the VLoS (Visual Line of Sight) the camera is called the "Payload" due to its expensive price as Rory B. described . Swappable payloads and different sensors are available so that the drone can suit the needs of a particular situation e.g Infrared sensors for geographical mapping .

UNICEF has modified the drone to fit a small cartridge underneath the device so that its MTOW (Maximum Take-Off weight) is 2.5 KG, this is more than enough weight to carry blood samples (or other medical information) from various individuals in a village. The estimated fly time for these drones began at 59 min, but as this was too small of a number UNICEF invested in upgrading these batteries to an average fly time of 2 hours, allowing the drone to cover 100-120 hectares of land. This proved to be a difficult task as many factors had to be taken into consideration when changing any part of the device e.g altitudes, varying wind conditions and camera power etc. These are all factors that would affect the weight or resistance of the device which would then intern require a higher level of energy output in order for the drone to maintain the drones speed/height/flight plan. The drone also houses a large range of sensors which help it carry out necessary functions to fly without crashing or coming into contact with immovable objects. This includes the ability for the drone to sense upward to scan obstacles as far as 16ft above.

Worldwide drones have evolved to suit a new frame which is evidently shown in the picture above this frame is known as



a quadcopter and uses four spaced out propellers. The frame is typically made out of carbon fibre as it is a durable and lightweight material meaning that the drone can fly efficiently. UNICEF also has implemented a micro transmitter on the drone to help provide it with a GPS system. The controller that is used to transmit information from and to the drone is described as a booster in which where it enables a higher transmission power output than standard devices. This is due to its directional antennas and advanced GPS. This signal then connects to a satellite in which it relays information to the drone from the controller.

I began conversing to Rory Barber (via E-mail), an associate of Matthias at UNICEF. He informed me that one of the biggest challenges with the drone program regarding hardware, is the accessibility of drone parts as all parts would be needed to be imported and due to transportation issues it would take considerable time to arrive . The parts are also subject specific meaning that particular companies produce parts for their specific drones, the manufactures for these drones are located in Europe and these materials are then shipped and flown around the world to be reassembled and then sold.

The drones are maintained by qualified technicians at UNICEF, and UNICEF currently employs local Malawian residents and helps educate them on the technological components of the drones so that the local community has access to knowledge on drones, and the systems in which they operate on. This would prove to be incredibly beneficial as this is a long term solution and ensures that even once foreign aid has left the country, citizens are still able to continue to manage and use drones.

IT Systems: Software

UNICEF currently operates using a variety of software that help provide them with the necessary components to carry out drone survey expeditions. Software after all is what dictates the processing and confirmation of data, and it is completely necessary that the drones have the most adequate and updated software so that they are able to operate using modern functions. One of the biggest game changing softwares of drone technology today would be flight management software. The SenseFly drones are now equipped with a new software that has been released this year (March, 2018) which is described by its owner as sensational; “eMotion is the most highly-regarded and powerful software of its kind in the professional drone space”, said Alexis Rose, owner of eMotion . eMotion works in unison with the hardware of the drone as this software allows the drone to nearly be fully autonomous as it allows the users to set up a flight plan; set parameters as far as the resolution goes, sensor being used, and the location. Additionally a radio modem is implemented on the ground which connects

to the drone and talks to it in real time throughout the whole duration of its flight. This software enables the drone to register different languages (With the hope to add more), the ability to detect and support live air traffic data. Both supporting the drones ability to deal with most international clients.

These functions will prove to be extremely applicable to Malawi as communicating instructions to locals in a foreign language would not promote understanding and may even cause confusion. This ensures that all information is conveyed coherently to any users of the medical drone program. Secondly the ability to detect air traffic whilst airborne will help open up doorways of communication amongst all individuals which enforces both efficient and safe flying for all operators in a airspace.

Lastly one of the biggest features new to the drone program is a function called 'mission resume', this feature seems most applicable to my topic and the humanitarian aid project , as the transportation of blood samples in such rural locations like Malawi could mean that the drones have a fly time longer then its current battery capacity. This would mean that the drone has to land to recharge or exchange battery, causing an interruption in the flight plan. Typically the flight plan would automatically restart as the device switches off and a user would have to input a course a manually. However what 'mission resume' offers is the ability for that flight plan to continue regardless of any interruptions until the device reaches its destination. This could prove to advance the program significantly and reduce any inconvenience the drone requires whilst on an expedition, this would also prove to be very time efficient.

Data & It's Users:

The data that is processed throughout a drone expedition would be both physical and technical data. The Input of data is rather simple in terms of the drones used by UNICEF as the user has preset instructions in place, along with algorithms to make inputting final justifications to a flight plan simple and easy. This then leads us to the outputting of data, the drone outputs data such as it's current location via GPS (Global Positioning System), footage currently recording (Video), battery percentage etc. These components process this information and store it on a permanent storage device, and transmit the information to other IT systems via network (examples mentioned above).

This information has to be managed with precautions and protocols in place to deal with a situation if it were to occur. All video footage should be kept entirely for UNICEF or any reliable organisation that may be reviewing the information recorded . If released the footage would cause issues and may effect the society negatively. This is because any individual in the recording of footage via aviation without any individuals consent is

an invasion of privacy and would constitute as an offence against aviation laws as seen in the RPA (Remotely Piloted Aircraft) booklet and would be prosecuted through civil aviation.

Stakeholders:

The stakeholders involved with the drone program in Malawi include its citizens, government, organisations such as UNICEF and finally the suppliers. It's important to notice that drones are a recent introduction into Malawi and there is still some controversy on the logistics and the usage of them. However this will fade as the country begins to develop and continues to see results.

The citizens have seen problems in the past with the drone program due to the problems that surround it. However it is evident in the UNICEF drone corridor promotional video that the stigmatism around drones is quickly fading as they continue to better lives and continue to distribute data amongst the relevant stakeholders. The government are seen as the main stakeholder as they ultimately have the power to determine success. For the time being the government endorse this technological advancement in Malawi as it would prove to better their country as-well as provide them with valuable evidence of any improvements that are made in Malawi. As mentioned, initially drones were unaccepted due to the lack of information around them and the potential impact they had to Malawi's security. The drone program effects the government positively as information is shared and approved before any form of submission of this data occurs. This is positive, because drone footage and drone statistics are hard copy evidence of development, this can then be relayed to citizens to prove that the government is making efforts to see Malawi Improve (funding and approving drones further).

The effect on the organisations that run the program is the responsibility of safe guarding and ensuring that information is transported with care and is stored appropriately. While this responsibility is to be regarded highly a lot of this information is spread amongst stakeholders, this is of utmost importance because if no information is spread then no solutions can be found e.g locations of epidemics or high rates of HIV could both be information that has been discovered through UNICEF this information would have to be relayed to medical facilities and military enforcement to deal with the matter . Supply stakehodlers have to be careful as their technology and image of brand has to be maintained, especially with drones coming into LEDC's (Less Economically Developed Countries). Suppliers also have to ensure that their products are not being copied or redistributed as that would damage their success.

Social and Ethical Significance:

The citizens of Malawi are diverse and a cultured people, however there is little knowledge on drones, and the technology that is used. A staggering amount of individuals still live in poverty and have limited resources available to them. Education and medical help are two necessities that many Malawians do not have access to, which is why UNICEF and many other organisations strive to help improve the quality of life for those individuals. However due to the absence of necessary education. Matthias informed me that some civilians disagree with the drone method entirely and that in the past there have been problems dealing with some of the ideology that the local population have. The drones cannot fly during the night as the citizens would see it as witchcraft, this is a strong belief here in Malawi. This was shortly resolved with exposure to the usage of drones during the day as Matthias B. stated, "We go on a community outreaches, and provide roadshow tracks and provide locals with information about their purpose." (A roadshow track is a track in which allows drones to feely fly above and demonstrate the abilities they process, similar to a demonstration/show) This Q&A gives a chance to improve the social issues surrounding drones, and gives opportunity to the locals to better their understanding of the drone program.

Drones pose ethical issues as they have the ability to record and retain information about individuals without their consents (Surveillance methods). Drones have incredible cameras as mentioned in the 'Hardware Section', these cameras can easily cause issues and pose problems with the safety of private information in the home in environment. This advanced technology should not be used to sabotage or monitor certain individuals for the personal gain of politicians and/or any other government enterprise . Drones also pose issues to the national security sector, as the drones may have recorded footage of a military base and it's defences/locations this information is fragile and could cause serious problems for the security of the country.

The transportation of blood and medical information is critical information and should be handled with care. This information is private and the patient/user expects the service to provide safety and take responsibility for their personal information. The organisation needs to ensure that blood samples and medical information is kept safe and stored in a secure archive. I discussed the standards and protocols that are in order to prevent the spread of information and what UNICEF does to secure their clients data. According to Matthias B. and Rory B. modifications have been made by UNICEF to enhance the drones capabilities in terms of both durability and security. Matthias B. Stated, "A protocol and set of instructions is in place in case that the drone encounters a problem e.g If the drone crashes, diverts from the designated flight plan or gets stolen. All situations will result in the cartridge/payload locking and not being

accessible unless authorised by a pin code.” It was then explained to me that If the device is somehow tampered with and the cartridge begins to be forced open (Which is unlikely) the system will automatically self destruct along with any information held inside of it.

Conclusion:

UNICEF has invested time, money and dedication to improve the life of local Malawians and their success is evident in both real life events and statistical reports. RQ: How can drones be used to provide advanced blood testing and health check ups through UNICEF to rural areas in Malawi? Through this essay I have discussed how drones have contributed drastically to the success of providing healthcare to rural areas in Malawi and the methods used to transport blood and medical information via aviation. This helps provide a quick and efficient method of relaying information between patients and doctors, in a way this can be seen as a lifeline as the distance between an individual in a rural location and a hospital may be too great or too vigorous for the journey. Procedures and the protection of any individual using the drone program has been carefully thought through thoroughly, and UNICEF holds information in a database which is archived and encrypted.

From my research and personal understanding through the ITGS triangle, I can infer that drones truly have provided relief to many areas of Malawi. My personal knowledge of living in Malawi from 2017-2018 as-well as my experience has shaped the way I view this knowledge question. I have seen serious poverty in some of the local districts and drones were able to manoeuver on this landscape with ease due to the usage of advanced GPS systems and implemented software; these drones needed minimal maintenance or manpower to operate.

Ultimately, technology is growing in the world around us. It simply comes down to how we use this technology to determine wether it’s use is positive or negative. In this essay I have researched and taken into account the biases and flaws of the drone program and have applied these scenarios to Malawi. It is evident through UNICEF’s success that drones are providing an impactful change on Malawi’s HIV/AIDS’s situation through blood testing and medical checkups.

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Aisling Cunningham



Literature

How does Baz Luhrmann adapt Tybalt Capulet into a modern villain in the film "ROMEO + JULIET"?

Introduction

In the 1996 film *Romeo + Juliet*, Baz Luhrmann, the director, attempts to adapt sections of Shakespeare's *"Romeo and Juliet"* (R&J). His intent is to entice the youth of the modern day, hoping they will comprehend messages which Shakespeare was trying to pass on, such as the consequences of hatred and the death of innocence.

To do this, Luhrmann takes the character of Tybalt Capulet and exaggerates his flaws to transform him into a modern villain, but what is a modern villain? Martin Del Campo states they are used to help the audience cope with problems of the modern day. They allow us to analyse an evil mind-set which the virtually good heroes cannot.

Thanks to Luhrmann's adaptation of Tybalt into a modern villain, we are able to see the effects of passing on a grudge along with other messages such as the consequences of acting rashly. By studying his adaptation of Tybalt, one can learn about effective ways to translate Shakespeare's characters for a modern audience. To understand Luhrmann's thought process, many sources must be looked at; interviews with Luhrmann and actors, his film compared to Shakespeare's original text, along with credible theatre papers. To truly analyse how Luhrmann does this, contextual research on Shakespeare, R+J and how it makes Tybalt out to be a villain must be done, as well as discovering Luhrmann's intentions and adaptation from text to screen.

An introduction to Shakespeare

Samuel Johnson described Shakespeare's plays as; "a map of life." Shakespeare wrote about personal experiences such as loss. We have no written record of Shakespeare's life between 1585 and 1592, one could assume this has left much of his work open

to interpretation. However, from studying the Elizabethan writer's work, we know he was one of the first Renaissance writers to use the vernacular, despite being taught through Latin. Therefore, it can be concluded if he lived in the 21st century, his plays would be possibly like Luhrmann's adaptation.



Figure 1: Folger Shakespeare Library

This reflects his intentions to connect with the audience. Similarly, one can assume Shakespeare would have used costuming from the modern day. For example, his play would feature clothing of the Elizabethan era because that was when he was writing and what the audience was accustomed to. It is clear that the Montagues and Capulets would have been dressed in expensive material, which can be seen in figure 1, sourced from Folger Shakespeare Library, due to the fact Shakespeare used a character's costuming to show their status.

Shakespeare's scripts have few stage directions because he would have been directing the play, so could tell actors what he expected in rehearsals. By not having the original stage directions documented, there is no way of knowing exactly how this would have looked originally. It also means modern directors have freedom with their directorial decisions. This results in great variations, which can be seen in the portrayal of Tybalt as a modern villain in Baz Luhrmann's "Romeo + Juliet".

Introduction to Romeo and Juliet

Shakespeare's original name for the play, R&J was; "The Most Excellent and Lamentable Tragedy of Romeo and Juliet." There is contrasting diction used in this title. "Excellent", which is seen as something happy, and "lamentable", which has a negative connotation. This juxtaposition is intriguing as it portrays the love of R&J and the feud between the families, represented through Tybalt Capulet.

At this time, theatre was performed in public houses, where the audience would be cramped and rowdy. These people were also known as the groundlings and were often uneducated. In order to keep them entertained, tragedies were mixed with comedies.

Therefore, R&J intertwines the genres of; romance, comedy, violence and tragedy.

The story of R&J is well known for having a strong theme of love, created by the characters, Romeo Montague and Juliet Capulet. This is contrasted by the evident hatred developed by their feuding families: The Capulets and Montagues. Tybalt Capulet is used effectively to personify the hatred between the two, equally powerful households. He, like the rest of his family has resentment against the Montagues.

Despite the apparent theme of “ancient grudge”, the reason for this feuding never seems to be confirmed. This perhaps could be due to Shakespeare not wishing for the audience to attempt to determine which side is correct. One may assume this is why Tybalt is given very little dialogue or backstory, so the audience doesn’t attempt to analyse him.

When researching this topic, there were never-ending sources on the play which simply described Tybalt as Juliet’s cousin. This was intriguing as he plays a key character and creates a huge impact on the plot. John Leguizamo who plays the Tybalt in Luhrmann’s adaptation states that Tybalt is; “the essence of the play, he makes everything spin around.” One can assume he represents upholding the feud by being the heir to the Capulets name. It is likely that had Tybalt not killed Mercutio, Romeo would not have stabbed him. Thus, Romeo would not have been exiled, resulting in the issue of miscommunications not arising and perhaps, a happy ending.

Although he plays an important character, Tybalt has little dialogue and backstory in the original text. One is led to wonder what has made Tybalt this way in life, whether he is potentially a victim. Jenkins states that a good villain must have a reason for doing bad things. Tybalt is clearly made a modern villain through Baz Luhrmann’s directorial decisions.

What in the script makes Tybalt the villain?

Shakespeare has made Tybalt an intriguing character in the script, we see this through his contrast with other characters, the conflict he is given, and his selfish ways. From the start, Shakespeare has made the character of Tybalt stand out from other characters through his name. Other male leads name’s end in a soft “O” noise, such as Mercutio. However, Tybalt’s name has a harsher tone. Tybalt is the Italian version of the name “Theobald” which means “bold person”. This may suggest that Shakespeare never intended him to be a moral character.

Tybalt’s maliciousness is apparent when Shakespeare compares him to characters such

as Benvolio. Benvolio is one of the more sensible characters and attempts to deal with the feud through peace, which one can see Tybalt does not. Shakespeare also does this by putting him in a feud with the protagonist, thus making Tybalt the antagonist, often seen as the villain.

Shakespeare has created a great deal of conflict for Tybalt, yet he has for many other characters, but while; "other characters are trying to use diplomacy to get on with their lives, Tybalt is never too far from his sword." As mentioned before, Tybalt does not shy away from a fight. This is what has led Romeo and Juliet to their death. Yet from prior research, Tybalt is rarely rooted as the cause, despite how he is the most determined to keep the feud going. However, had Tybalt not killed Mercutio - Romeo would never have felt the need to seek revenge leading him to be exiled.

Directly from the script, we can see negative aspects of Tybalt. These include how he is eager to start a fight, only concerned with how events will effect himself and he is unforgiving towards others. We can see these represented at the Capulet ball, when Tybalt's immediate reaction upon seeing Romeo is "fetch me my rapier." This demonstrates his automatic response is to start a fight, without any concern of the time nor place. His assumption is that Romeo is "flee[ing]" at their party. Tybalt believes that if he were to "strike him dead" he would be protecting his family, therefore having seemingly solid reasoning. He describes him as a villain, who only came in hatred, showing that Tybalt assumes others are fueled by the same rage which he is. This also paints him as being extremely closed minded, unable to look past this feud and assumes Romeo is as involved as he is.

Capulet mentions he doesn't want a scene: "I would not for the wealth of all the town... do him disparagement." This makes Tybalt seem selfish, he would rather duel with Romeo than endure his presence at his uncle's party. He intends to justify his anger; "it fits when such a villain is a guest." This portrays him as unforgiving because he would rather ruin his uncle's night by dramatically forcing Romeo to leave, than temporarily put their differences aside.

The audience is offered a new perspective when Capulet scolds Tybalt at the ball; "am I the man here or you?" This puts Tybalt into his place and reminds the audience of his youth and naivety. However, we can also see the effect which his death had on other characters, such as Lady Capulet. One can assume that despite his flaws he had his strengths. Of course, it could be interpreted as Tybalt's attempt to protect his family, believing that he is in the right. He is following what he has been taught his whole life. From Tybalt's interactions with other characters we can see he has a short temper and

is eager to engage in a fight with the Montagues. However, he is loyal to the Capulets. Shakespeare's play shows many of Tybalt's flaws, such as being amoral, selfish, closed minded and perhaps suggested that he is the antagonist and the reason for the death of the lovers. However, Luhrmann exaggerates these issues to portray him as a modern villain.

Luhrmann's intention in adapting the play

In an interview, Baz Luhrmann reflected on when he gave his pitch for the movie, "Romeo + Juliet" stating his intention; "As if Shakespeare were making a movie, today." His intention was to be able to connect to a modern audience, to pass on the messages which Shakespeare wrote. Luhrmann asks; "what is a director but a story teller?" He felt the need to retell R&J in a way the youth could relate to. One may assume this is important in allowing the audience to understand moral values such as the impact of grudges. Which can be seen effectively through the development of Tybalt as a modern villain whom the audience can identify. The modern villain tends to be used to evoke sympathy, despite the evil which they cause. By conveying the message of being passed on a grudge, Tybalt seems to do this.

In order to fit the entire script into a film, Luhrmann cut 40% of the text. The original language is used but adapted to fit in with modern society to aid the audience's interpretation. It was also decided that the actors would use American accents rather than doing Elizabethan accents. Interestingly, when talking about Shakespeare's plays, John Barton, a co-founder of the Royal Shakespeare Society, stated; "American is closer to [Elizabethan English] than our English." The impact of this in Luhrmann's film is that the characters all speak in an American tone apart from some of the Capulets such as Tybalt, allowing him to stand out from others, as the villain.

The purpose of costuming is to underline the personality of a character. It is evident that the Capulets' style is highly decorative, as their clothing has expensive features and is very ornamental. It is evident in the movie that both Capulet and Montague families are wealthy, and that money seems to equal a power as they seem to run the town.



Figure 2: Film Screenshot

Luhrmann's version of Tybalt embodies great

power through his expensive clothing. Despite how evil Tybalt may come across in this adaptation, Leguizamo makes him attractive through his well-designed clothing and cleanly groomed facial hair which can be seen in figure 2. This shows how Luhrmann is creating a physically attractive villain, who is perhaps able to portray a modern villain by stealing attention from the hero. Whereas in many films, the villain is physically flawed, one can see this in characters such as Jaws from James Bond. We can also see from figure 2, that Tybalt wears dark colours such as black and red. Both of these colours have negative connotations such as; blood, death and anger, which could represent the effect the feud has on the characters. In the opening scene at the Petrol Station, Tybalt wears a bullet proof vest to portray that gun fights are common for him. This is a modern costuming addition, which has been used to show the extent of the violence in the world Tybalt inhabits. Leading one to question how much of it that he creates.

Luhrmann cast John Leguizamo as Tybalt, which creates a very visual contrast. One may notice that he is the only Latino lead, as mentioned, his accent stands out from the other standard American accent. Leguizamo's voice creates a menacing atmosphere by creating suspense through the slow delivery of each line, thus, even his way of speaking menaces others. One may assume that due to the fear which he evokes in other characters, he is a modern villain who excites the audience.

It is clear that Luhrmann has used an attractive character who stands out from the other actors in order to retell a story which he believes that Shakespeare thought was important. This character allows a modern audience to engage with him and attempt to understand why he does what he does. In order to truly comprehend how Luhrmann has done this, one must look at the actual changes he made.

How has Luhrmann modified the original text to portray Tybalt as a modern villain?

Luhrmann's film is extremely loyal to R&J, so it is easy to spot any alterations which he has made in order to portray Tybalt as a modern villain. In order to analyse them, both scenes in which he appears must be looked at compared to the text. Tybalt's portrayal as a modern villain is made evident through extravagant costuming, confident movements, sinister voice and interaction with other characters.

Act 1 scene 1

Luhrmann developed Shakespeare's Act 1, Scene 1 from the original stage direction; "they fight". Luhrmann used foreshadow and interaction with other characters to aid his portrayal of Tybalt as a modern villain.

A director's use of props is very important in creating symbolism. Tybalt's appearance

is foreshadowed by an “add more fuel to your fire” sign at the petrol station. This could be alluding to Tybalt as a source of fuel to the evil, and perhaps that he is the one maintaining the feud.

His first appearance is mid-fight, amongst screaming of civilians, but this chaos quiets upon his arrival. This shows his influence on the public, and if this were a modern Marvel superhero movie, it could be assumed he is the villain ready to cause mayhem. Our introduction to Tybalt in this film is his clinking silver boots putting out a match stick on the pavement. Perhaps this imagery could allude to his power and ability to extinguish any flame, such as the feud, yet he chooses not to.

Luhrmann also adapts the script in order to create a more sinister tone for Tybalt by simply changing the meter and rephrasing certain lines. Tybalt refuses to help keep the peace between the families when asked by Benvolio. The line in iambic pentameter from the original script is; “what drawn, and talk of peace? I hate the word as I hate hell, all Montagues, and thee.” One notices it become a menacing question where stress is put on the each of the syllables and the concept of peace is repeated as though Tybalt is trying to comprehend it; “Peace? Peace? I hate the word... as I hate hell.. All Montagues... (grinds cigarette into the floor) and thee”. This question is expressed slowly, which builds suspense as the audience wonders what his next action will be. In the play he is commenting on how Benvolio is talking about peace while his sword is drawn, showing Tybalt has an understanding of hypocrisy. Luhrmann instead showed Benvolio fearfully putting away a gun, fearing the wrath of Tybalt. One can clearly see in the script, Benvolio wasn’t intimidated and stood up to Tybalt. However, in the film is in fear of Tybalt’s words, expressed through facial expression, suggesting that Tybalt is now the feared modern villain.

Luhrmann also intensifies the bad intentions of Tybalt by creating a child who has interrupted Tybalt, which was not seen in Shakespeare’s play. This child, seen in figure 3, innocently holds a toy gun and says “bang, bang”. Tybalt responds by pointing his gun at the child and saying “bang”. From Leguizamo’s ‘high status’ posture and his intentional movements it is clear he doesn’t see it as a game, but



Figure 4: Alamy

the child naively does. In the image we can also see a nervous mother attempting to protect the child by pulling him away. One can assume that she has also heard of Tybalt and his fights. He seems to not have any form of conscience that would prevent him from traumatising this child. This interaction with a child makes one wonder whether this could be representing Tybalt's youth and how violence was introduced to him. This portrays the world Tybalt sees, where gunplay is not fun and games and he no longer respects the youth's innocence, which one may assume is been due to this feud. This is helpful in creating a modern villain as they are often used evoke the audiences sympathy, which Tybalt does.

The first scene which he appears shows his immoral and powerful character to prove what he is capable of, illustrating him as a modern villain who gives an understanding of gun violence and how it affects the youth. However, Act 3 shows Tybalt in a more dangerous and violent manner.

Act 3 scene 1

Tybalt went to the Spanish school of fighting in the original play, which is very important to his character, but Luhrmann modernised this by replacing swords with guns. Luhrmann portrays him disregarding some of these rules which he must have, such as you must be provoked in order to shoot. Mercutio attempts to provoke Tybalt in the film, talking to him with over the top arm gestures. Tybalt proves how willing he would be if the opportunity were given; "You shall find me apt enough to that, sir." Yet, he fights his urge to engage. This is emphasized to achieve suspense before Tybalt loses control. The climax is seen as he runs at the Montague gang after Romeo has refused to fight. He attacks Romeo from behind, although he has not provoked by him. One can see how Tybalt chooses to follow the rules as it suits him but will do whatever it takes to achieve his goals, regardless of anyone else.

He also defies this while encouraging him to turn and draw while kicking Romeos face as he lies on the floor. A close up of Romeo's bloodied face is used to evoke a feeling of sympathy for Romeo and anger towards the violent character of Tybalt. This is present again as Tybalt uses a shard of glass to stab at Mercutio who is being restrained by Romeo, causing no danger to anyone. In the play it is never mentioned that Mercutio is being restrained. By doing this, Luhrmann shows Tybalt killing an innocent man, exaggerating his love of fights to portray him as a modern with no consideration for anyone but himself.

From showing his worst side through violence and selfishness, Luhrmann then shows then uses the death of Tybalt to allow him to reach the point of being a modern villain

where he is defeated by the hero and is forgiven.

Luhrmann achieved the most directorial freedom in the end of Act 3, scene 1. From just the line; "they fight, Tybalt falls" we see perhaps the most intense moment of the movie. Every superhero movie shows the protagonist defeat the villain. In this example we see the good hit the bad after a high speed car chase, where the "villain's" car can be seen flipping. Luhrmann uses slow motion to add suspense. In this, one can see Tybalt seemingly seeing all his life flash before his eyes through his blank stare towards the camera.

As Tybalt holds a gun to a kneeling Romeo's head, a look of confusion passes across Tybalt's face as Romeo explains; "either thou or I, both, must go with him [Mercutio]". Meaning Romeo will not let Mercutio die in vain. One may assume that represents how Tybalt doesn't understand loyalty as he has not ever had someone show it to him, not even his own uncle would agree with him at the Capulet ball. It could be assumed at this point he is questioning all his assumptions against Romeo for a moment and perhaps rethinking his life choices as it is too late. Once again, evoking sympathy for the audience as many modern villains do.

Luhrmann quite possibly gave Tybalt the most dramatic death in the movie, stealing the attention from the hero as many modern villain's do. Romeo shoots him and he falls into a fountain. This final moment could be showing him being forgiven for his sins, the water alluding to baptism, where someone is submerged into water. Perhaps using the concept that the audience forgives the modern villain despite all of the evil which they have done.

By having Romeo and Tybalt head to head, one can see the great contrasts between the two; Romeo's loyalty and level head juxtaposed by Tybalt's quick temper and selfishness. A villain can be described as someone who shows all of what the hero could have become, but didn't. This is true for Romeo, they were both in the same position with the feud. However Tybalt chose not to take the moral path, instead became the modern villain.

One can look at Baz Luhrmann to discover how Shakespeare can be modernized through archetypes such as villain or hero, to engage the audience in something they are familiar with. It also requires little back story, so more attention can be paid to their actions, without having preconceptions of them.

Baz Luhrmann's adaptation caricatures qualities already visible in Shakespeare's

misguided Tybalt, such as being hot tempered and unforgiving, despite having few of the original stage directions. Luhrmann successfully transforms Tybalt into a modern villain through his ornate clothing, his slow speech, his actions towards others and through his defeat. This creates scenes of suspense and action in "Romeo + Juliet", which drastically transform William Shakespeare's writing into a powerful movie. This allows the film to pass on important morals which even Shakespeare was attempting to teach in the 1500's such as, good versus bad and the pressure of expectations. Yet we see them in a more relatable sense to the 21st Centuries context. This attempts to show the mistakes of others and their consequences, as well as the consequences of a closed minded.

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Mohammed Zain Farooq



Geography

To what extent does the quality of life vary in the major residential areas in Lilongwe?

Introduction

Lilongwe, the capital city of Malawi, is known to be one of the fastest growing cities in the world.(Massy-Beresford) In the past few years Lilongwe has expanded vastly and though the city is growing at a rapid rate, the development of infrastructure and improvement of the quality of life has not kept up with the pace at which the city is growing. Malawi is ranked as the poorest country in the world with its GDP/capita being only \$226.50 as of 2017("10 Poorest Countries In The World In The World 2017").

This Extended Essay is grounded in Geography and the research question of this extended essay is "To what extent does the quality of life vary in the major residential areas in Lilongwe Malawi?" Quality of life (QOL) is not an aggregated measure; it encompasses a lot of different dimension. ("Quality Of Life Indicators - Measuring Quality Of Life - Statistics Explained"). Analysing these aspects that contribute to the improvement of the quality of life and investigating how the quality of life varies in the different areas in Lilongwe Malawi, would be a be a significant study as this has not been done before. It would open up new dimension to carry out further studies and provide scope for the welfare of the areas/city.

This Essay will comprise a summary of what quality of life is by outlining all the different indicators of QOL. It will encompass an overview of the general QOL in Malawi, by evaluating the measured indicators, in accordance to the QOL measures. And to answer the research question an analysis of the extent to which the QOL varies in the major residential areas in Lilongwe will be done through surveying and evaluating the collected data.

What is quality of life?

According to Crispin Jenkins, 'quality of life is the degree to which an individual is healthy, comfortable, and able to participate in or enjoy life events' (Encyclopaedia Britannica, 2018). This makes the Quality of life an ambiguous measure as it could be referring to the experience an individual has of his or her own life or the living conditions in which individuals find themselves in. What constitutes as good quality of life varies from person to person as each individual has different needs and interests making it very subjective. In this extended essay, the focus will be on the analysing the QOL by evaluating the living conditions of individuals in the major residential areas. The aspect QOL based on individual experience, needs, and interests will be overlooked at in the is essay as it very subjective to be measured or to be used to evaluate the QOL of a collective group of people in an area.

However, there are several indicators of QOL that help establish a general measure that can be used to assess the QOL. The social progress index is one of the measures that rank the QOL in countries by taking into account of up to 50 social and environmental indicators of wellbeing. The social progress index provides perspective on the QOL beyond just income.

Social progress index

The 'social progress index' (SPI) is used to quantify the QOL in that country as the SPI provides a quantified measure of the extent to which countries provide for the social and environmental needs of their citizens. Two key features of the Social Progress Index are; the exclusion of economic variables and the use of outcome measures rather than inputs. For example rather than looking at the investment made into development of infrastructure to improve the QOL, it would look at the improvement as a result of the investment (The Economist, 2018). The social progress index collates the scores of three main indexes: Basic Human Needs, which includes medical care, sanitation, and shelter. Foundations of Wellbeing, which covers education, access to technology, and life expectancy. Opportunity, which looks at personal rights, freedom of choice, and general tolerance. (World Economic Forum, 2018)

Indicators

As outlined in a publication on Eurostat the indicators of QOL are:

- Health

Health is a very important indicator as poor health can affect the general progress of the society. Health conditions are mainly measured using objective health outcome indicators such as; life expectancy, infant mortality, and the number of healthy life years.

- Education

Education is a significant factor in determining how far an individual can progress in life. Levels of education can determine the job an individual will have and individuals with limited skills and competences are usually excluded from a wide range of jobs. The literacy rate of a country will provide an overview of the education levels of its citizens.

- Economic activity

This indicator measures both the quantity and the quality of jobs available by accounting for aspects like; working hours, balance between working and non-working life, and safety and ethics of employment.

- Economic and physical safety

Security is a crucial aspect of citizens' lives. Having the ability to overcome any sudden deterioration in their economic or the environment one is living in has a substantial impact on their quality of life. Measure of financial economic stability such as the variance in the GDP/capita over a period of time can be used to measure the aspect of economic safety, and measure like the number of homicide per year can be used to measure the aspect of physical safety.

- Leisure

This indicator directly influences life satisfaction. It is measured in terms of how often citizens spend time with people at sporting or cultural events or retreats.

- Material living conditions

This is measured on the basis of the three different dimensions: income, consumption and material living conditions (eg. Housing, deprivations).

The following indicators offer a degree that can be used to measure the QOL that constitutes for the social progress of the society, rather than an economic progress which is measured through GDP/capita. The gross domestic product only provides a measure of economic performance and does not account for the living standards of the people. The listed QOL indicators provide an overarching framework of the wellbeing of the people in the society. ("Quality Of Life Indicators - Measuring Quality Of Life - Statistics Explained").

These indicators are interlinked with one another with factors from one indicator having a knock on effect on other indicators. For example, education is a significant factor that provides skills for competency in economic production and determines the people's earnings and productivity. Typically the well educated people are less prone to unemployment, have good health conditions, and demonstrate greater engagement in civic and political issues. Health is also an essential part that influences the quality of life of people, as it directly denotes to the "wellbeing" of an individual. Similarly as to how educated people have a good health status, health has an impact on the education of people, for example; sick children would not attend school and that would have

an effect on their education. The quality of life indicators, all together form a nexus influencing one another in various aspects.

Aspects of quality of life

In assessing the QOL, the approach of evaluating the level of contentment in life to define the quality of life would work only for an individual as their satisfaction with life is subjective to them. When evaluating the QOL for masses of people in different areas, this approach of analysing contentment would not work because for each person different things provide satisfaction and content in their respective lives. To answer the Extended Essay question it is important to have standard generalised measure of the quality of life, which can be used to quantify the QOL for a group of people or in an area. Hence the more logical way to go about it is by using the quality of life indicators that provide an overview that provide a basic outline of the aspects that play a role in providing a more general boundary for what could be defined as a good quality of life.

Approaches to measuring quality of life in Lilongwe

The method used to collect data on the QOL in the major residential areas was a mass public survey, as this would provide primary source data from the public. As everyone would be responding to the same survey the data collected will represent statistics of a standard quality of life that is outlined in the survey. This gives an opportunity to set boundaries to what does and does not qualify to be good quality of life, analyse the general trends and compare the statistics of different areas for the quality of life.

Survey formulation

The questions asked in the survey were general question that the public can answer and would apply to all of the target recipients. The questions link back to the QOL indicators and should be able to provide a picture of the QOL in the target areas of the survey.

Keeping these factors in mind, the formulated survey (Appendix A) takes into account majority of the quality of life indicators and the questions are oriented to quantify the quality of life indicators. It was essential to quantify the data in some way because it provides an opportunity to do a statistical analysis of the obtained responses through the survey.

The first question is what area do you live in? And this is to know what area rest of the responses relate to. Each of the other questions in the survey is intended to address at least one quality of life indicator if not more. For example, "how many people work in your family?" relates to the quality of life indicator- economic activity. The number

of economically active people indicates that 2 aspects; one showing that they could be poor and require more people to work in order to sustain their family, or the family members are well educated and due this fact they are economically active and earn sufficient money.

It is to be noted that not all the questions are solely based upon just the quality of life indicators, and some questions are derived from the knowledge gained in the IB geography syllabus. They still link back to the topic to quality of life hence making them relevant to include in the survey. An example of this is, “do you have a washing machine at your home?” This question is extract from the Ted talk by Hans Rosling that talks about the quality of life on a global scale and talks about the poverty line is drawn by the ability of family to afford a washing machine for laundry. This links back to the quality of life indicator of material living conditions. Having a washing machine indicates a good financial status especially in Malawi, which is an underdeveloped country and labour is very cheap. Some obvious factors surrounding this question are the availability of water and electricity. This contributes to the enhancement of the material living conditions indicating a good quality of life.

Data collection

The survey was distributed to students in different schools. The schools that the survey was distributed in were private schools and international schools like Bishop McKenzie International School. The purpose of targeting high school student from private and international schools to be the recipients of the survey is because it narrows down the range from receiving data from random areas in Lilongwe, Malawi to only the major residential areas in Lilongwe, Malawi. This is a rational decision as only children living in the “major”(affluent) residential areas in Lilongwe, Malawi would have an opportunity to attend schools private and international schools, and the children living in the poorer areas of Lilongwe would not be fortunate enough to attend schools.

The high schools that received the surveys are pinned in the map below. As seen on the map the recipient schools are all within the city limits and all reside close to the centre of the town.

General Quality of life in Malawi

Malawi is a landlocked, third world country. It is expected for the QOL to be low in Malawi. It is ranked on 100th position on the SPI scoring 53.09 out of 100 for the social progress imperative (Socialprogressindex.com, 2018). Though Malawi is the poorest country in the world, it still ranked 100 out of 128, because it is able to achieve significantly higher levels of social progress with more aggressive policies than other countries, toward



Figure 1: Location of high schools that received the survey (Google Earth pro)

meeting the basic human needs and foundations of wellbeing of their citizens.

Data analysis

Received Data

The majority of the respondents of the survey were from 6 main areas that showed up repeatedly. There were:

- Area 3 and 9
- Area 43
- Area 12
- Area 47
- Area 25
- Area 49

These areas pinned on the map are the more affluent areas in Lilongwe, Malawi as they have a population that can afford to pay school fees and send their children to high schools. Majority of these are populated by immigrants, government officials, and diplomats. In the responses, majority of the respondents from area 3, 9, and 12 were foreigners. The responses collected from the rest of the areas like area 43, 47, 25, and 49 were predominantly from Malawians. On this map it is also visible that the

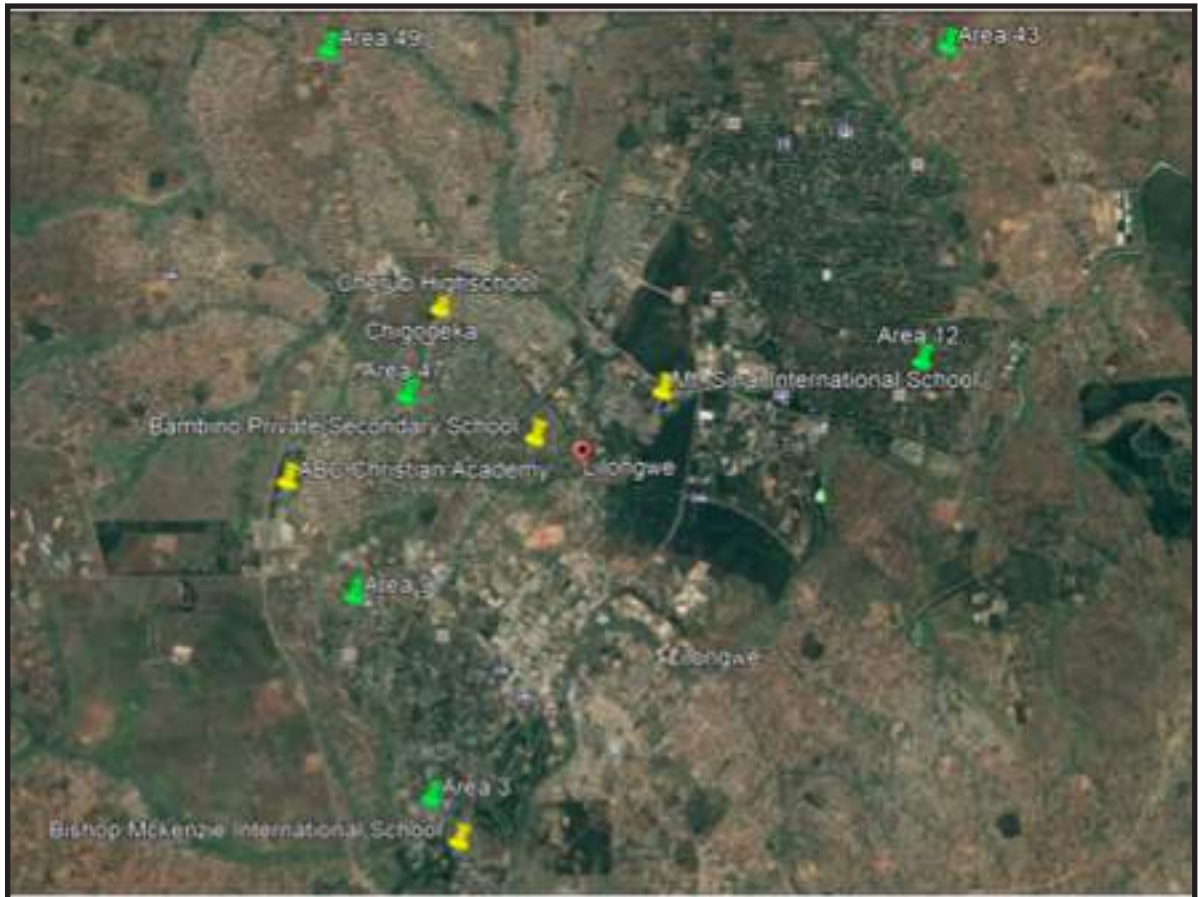


Figure 2: Location of areas from which survey responses were gathered (Google Earth Pro)

schools are located within the circle of the wealthy areas and there is a trend present in the data with areas closer to the school like area 3, 9, 47, and 12 have an overall better QOL that areas further away from the schools such as area 49, 43, and 25.

Analysis

From the results collected through the survey the following data was presented:

Area	Average family size	Average number of people working	Average number of bedrooms
3	5	3	5
9	5	3	5
12	5	2	4
43	4	2	4
47	7	4	4
49	5	3	4
25	7	2	4

Table 1: Results collected from survey

The results in the table are averages and the data values rounded to the nearest whole number.

As seen in the results area 3 and area 9 have the average family size, number of people working, and number of bedrooms. They are geographically located right next to each other in Bwaila West. In comparison, these two areas are very similar to each other in many aspects.

Area 47 and Area 25 have the largest average family size and 100% of the respondents were Malawians and this shows that Malawians tend to have larger family sizes. However, the average number of people working in area 47 is twice as much as the average number of people working in a family in area 25. This could be due to two reasons; it can either be that the population in area 25 is very rich, in the sense that with a small number of working people per family, on average, can manage to sustain a large family. Or the population is not very wealthy or educated as uneducated people are more prone to unemployment and lack family planning leading to big family sizes. This might be the case for the population in area 25 because area 25 is in the outskirts of the town and it is far away from any school. This indicates that the population in that area does not have easy access to education and is very likely to be less educated than the population in the other major residential areas.

Area 3 and area 9 have bigger houses with having 5 bedrooms on average. But this means that they have to spend more on maintenance. Bigger houses also points toward bigger plot sizes in the area and indicating a wealthier population who can afford big houses, would have a better health status, and better material living conditions.

Area	Average number of staff members	Average number of vehicles	Average number of guards
3	3	3	2
9	3	3	2
12	4	3	2
43	2	3	2
47	3	3	2
49	2	2	3
25	1	3	1

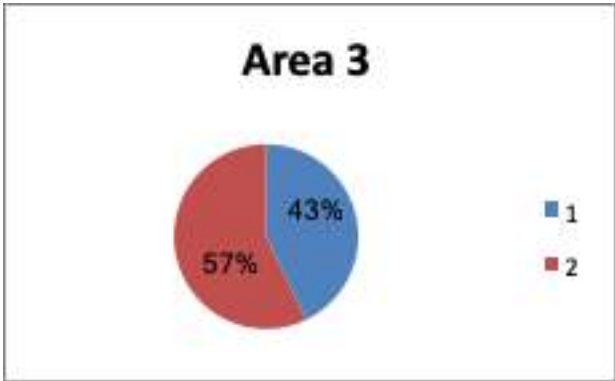
Table 2: Results collected from survey

The results in the table are averages and the data values rounded to the nearest whole number.

As seen in the table above the average number of vehicles in all the following areas is about 3, but in area 49 there is an average of only 2 vehicles per family and this is could be due to the extremely poor quality of roads in this area. Because of this people would have fewer cars because it would be cost more to maintain more cars in good conditions when the roads are of poor quality.

The average number of staff members in the in the different areas varies from a maximum of 4 staff member per family in area 12 to only 1 staff member per family on average in area 25. The number of staff members indicates the economic activity in family, as if there are more economically active people in the family they require more staff for maintenance of their lifestyle as they themselves would be busy to do so. It is the same case in the area 25 where there is only an average of 1 staff member per family, but in table 1 it was evident there are very big families in that area. However, it also had the lowest number of people working on average which shows that a lot of the people are economically inactive and they would they would not be able to afford to a lot of domestic staff members.

Looking at the average number of night guards in the different areas on average there are 2 guards per family, but area 49 has an average of 3 and area 25 has an average of 1 guard. This indicates that in area 25 people would be more physically safe than the other major residential areas in Lilongwe as they hire fewer night guards to feel a sense of safety. This would make sense as the population in this area is not as rich as that in the other major residential areas, so it would be less like for people in this area to be targets of robbery or theft. The level of physical safety in area 49 would be poorer compared to the other area as they hire more night guards on compared to the other areas which means that they are more prone to be victims of robbery.



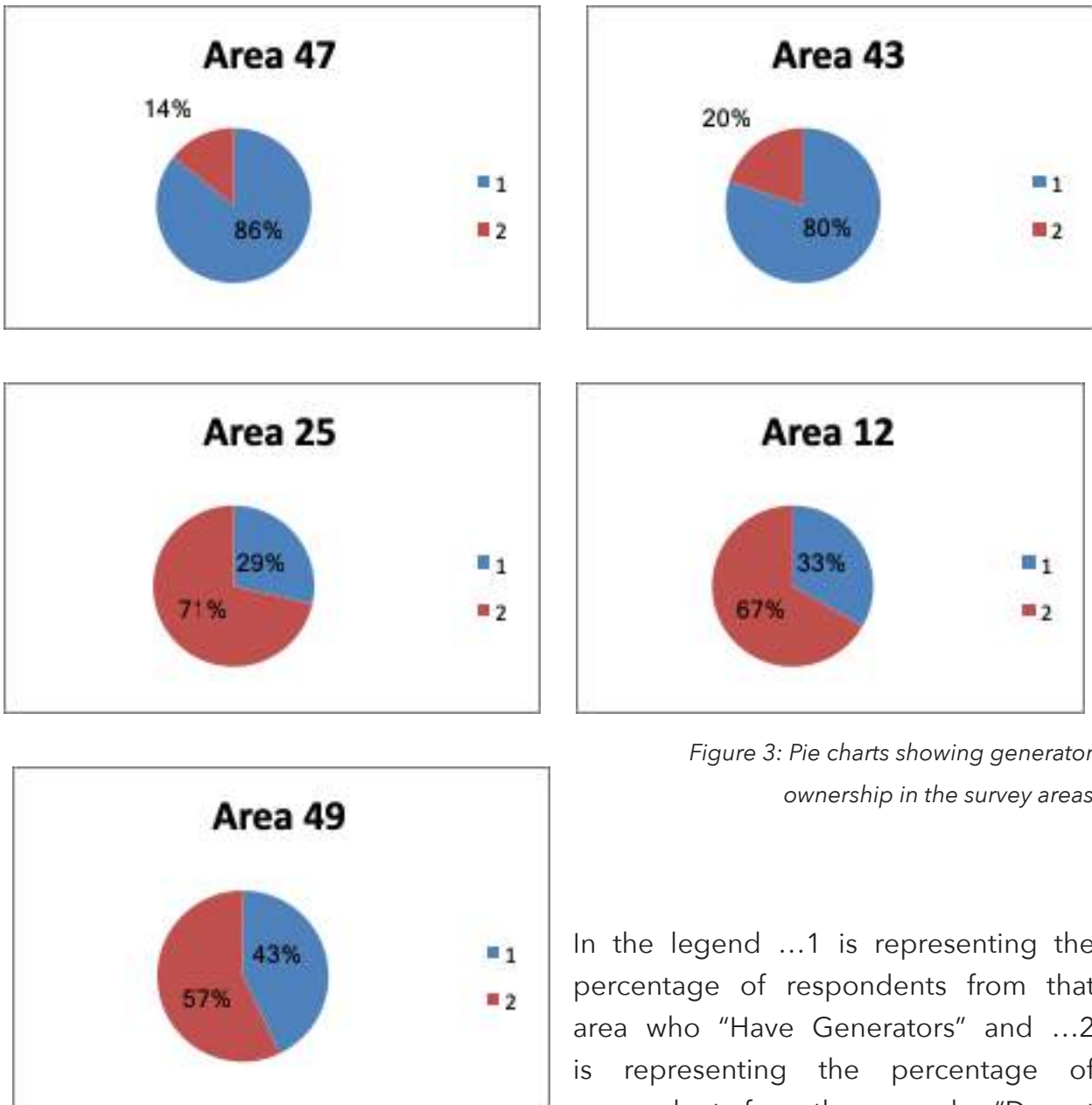


Figure 3: Pie charts showing generator ownership in the survey areas

In the legend ...1 is representing the percentage of respondents from that area who "Have Generators" and ...2 is representing the percentage of respondents from the area who "Do not have Generators".

The pie charts above present data collected from the surveys on the percentage of families that have and don't have Generators in the different areas. This data contributes to providing insight on the material living conditions in the different areas as the higher the percentage of people having generators indicates higher blackouts in the area. From the data present, area 9 has highest percentage of families who have a generator, and area 25 having the smallest percentage. This indicates that area 9 has the most blackouts and area 25 the least. However, that could not be the case and the statistic points out that the population in area is wealthier than the population of area 25 as they can compensate themselves that if they have a blackout with material objects, in this case generators.

In the legend ...1 is representing the percentage of respondents from that area who "Have Washing Machines" and ...2 is representing the percentage of respondents from the area who "Do not have Washing Machines"

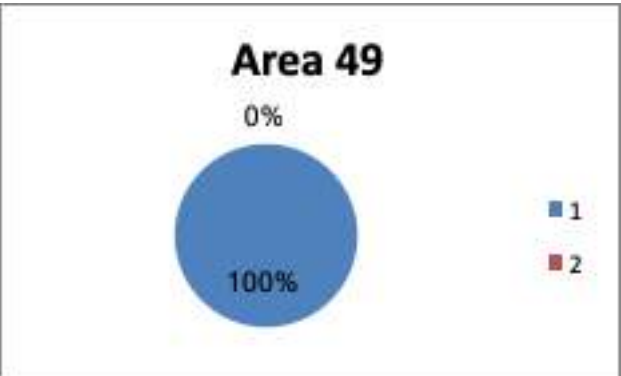
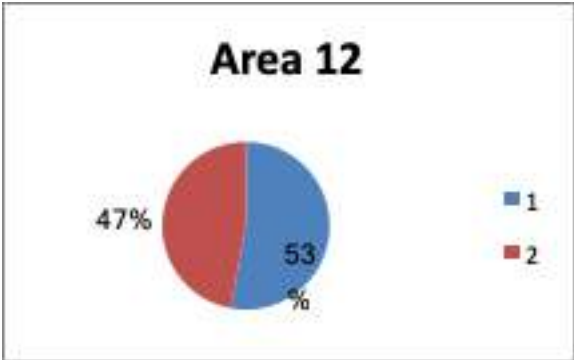
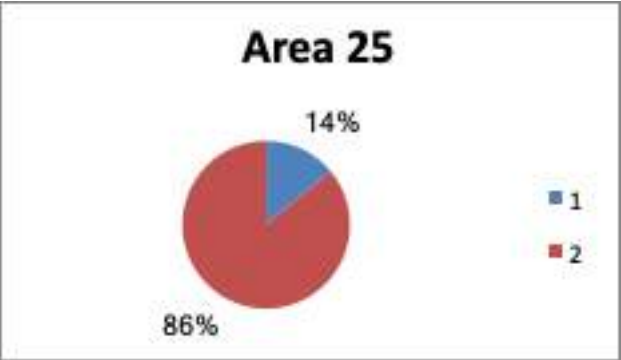
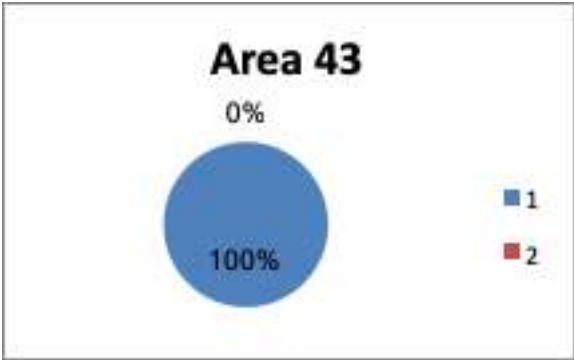
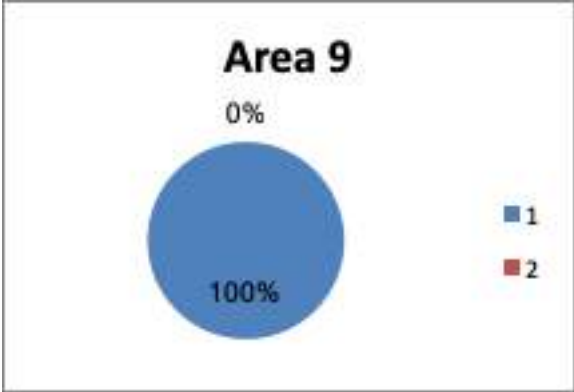
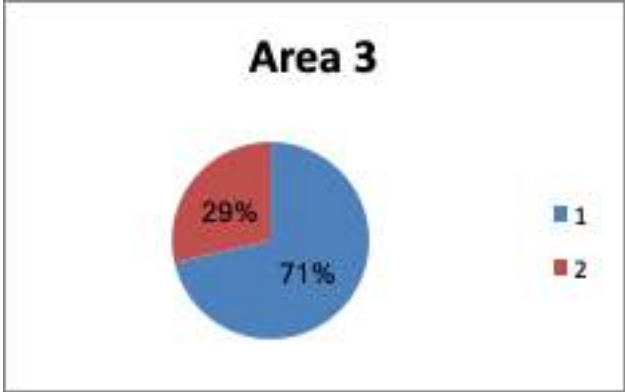


Figure 4: Pie charts showing washing machine ownership in the survey areas

According to Hans Rosling, the washing machine is a machine that is use by everyone above the poverty line and they spend up to 40\$ a day on their consumption. The poverty line that defines if an individual is poor is drawn by distinguishing between, if they are living under or over 2\$ a day.

The following pie charts above present data collected from the surveys on the percentage of families that have and don't have a Washing Machine at their home in the different areas. The higher the percentage of homes that have washing machines, the better the quality of life is, in that area. Laundry by hand is a very laborious task and its outcome is of very low productivity.

Respondents from Area 9, 47, 43, and 49 all had washing machines at their homes which represents that these areas have and higher QOL than areas such as area 25, 3 and area 12. Area 25 has the lowest percentage of homes that have washing machines, which ranks it as having the poorest quality of life out of all the other listed areas.

Conclusion

All these representations and statistics in formulated from the information received through the survey provide quantitative data that was used to analyse the extent to which the QOL varies in the major areas in Lilongwe, Malawi. From the data obtained from the survey, it was evident that the major residential areas in Lilongwe, Malawi are; area 3, 9, 12, 43, 47, 49, and area 25. From among these areas, it is noticeable that area 9 has the greatest QOL as seen throughout the analysis with the population being wealthy, and having better material living conditions providing them with a better quality of life. From comparing the QOL of the areas in table 1 and 2, it seems like area 9 and area 6 have the greatest QOL in Lilongwe, but by analysing the pie charts in figure 3 and 4 it is visible that the population in area 9 is more materialistically equipped with 100% of the respondents from area 9 having generators and washing machines (figure 3 and 4). From the analysis in this essay it was deducible that overall area 9 has the greatest QOL and area 25 has the lowest QOL out of the 7 major affluent areas in Lilongwe Malawi. From a geographical aspect, the simple reason for area 9 to having the highest QOL and area 25 having the lowest QOL is that area 9 is in the centre of the city as seen in figure 1 and area 25 being in the outskirts of the town. This makes area 9 to be a prime location for affluent people to settle in due to the factor of accessibility within town and area 25 being located outside of town making accessibility to commercial areas and domestic resources limited. Hence, it is populated by less affluent people who are living in a lower quality of life.

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Lucca Gentili



Geography

What socio-economic impacts does bilharzia have in Malawi?

Introduction

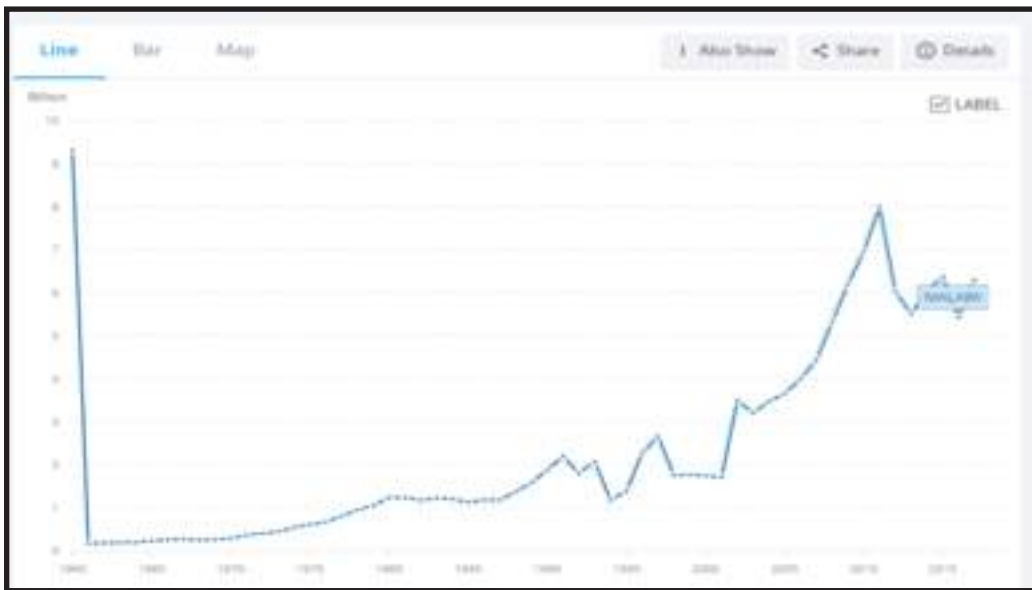
Bilharzia is the second biggest parasite after malaria in a number of African countries; it is a parasite that uses a fresh water snail as its host much like how malaria uses a mosquito, when the parasite is on the snail it has no effect on it what so ever however it can be deadly to anybody who is infected by the parasite. However, in Malawi it has one of the highest infection rates at 60-80 percent (DW) . Malawi has one of the biggest fresh water lakes at its disposal, it is its biggest provider of local fish and fresh water apart from being the biggest tourist attraction Malawi has. These are factors why in the past the Malawian Government created a scandal stating that Lake Malawi was bilharzia free, the main of this was to try and increase their tourism revenue.

The socio economic impacts of bilharzia in Malawi; is a relevant and important topic in Malawi now, because the bilharzia parasite has a massive effect on the production of agriculture, amount of infant deaths, life expectancy, fertility rates and their GDP (NCBI).

7 million people in Malawi have had to receive treatment for bilharzia, with 22.1 percent being already treated of bilharzia once in the past (Deutsche Welle). These factors are all important towards Malawi as a developing country as a whole. This topic links into geography because it looks into how the bilharzia parasite has an impact on the socio-economic factors that allow for Malawi to develop faster.

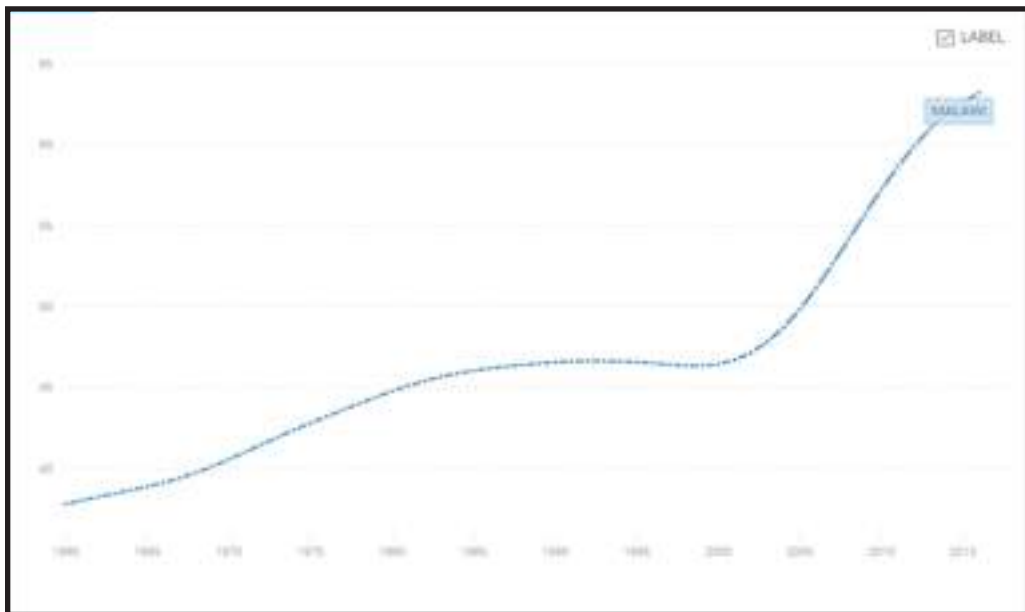
The research question that this essay is based on is "What are the socio-economic impacts of bilharzia in Malawi" the essay will target several different aspects of how bilharzia has a negative and positive impact on Malawi's socio economic growth, the

GDP (current USD)



The World Bank

Life Expectancy at birth total (years)



The World Bank

research question will be answered through a number of case studies supporting or not supporting any arguments in the essay. Some Arguments that will be used in the essay are the percentage of the work force affected by bilharzia, which areas of the lake are more infected by bilharzia and how bilharzia affects the life expectancy of Malawians.

Brief History of bilharzia

Bilharzia infection rates are now increasing in Malawi by 15 % in the last 18 years (Deutsche Welle), in particular in the southern regions; the bilharzia parasite has always been prevalent in Malawi however there has been a dramatic increase ever since the turn of the century, this is tragically linked to the increase of population in Malawi by 7 million over the past 18 years (worldometer), this large increase has led to a number of crises that Malawi is experiencing such as, starvation, lack of jobs and a lack of services, these three aspects is what has allowed bilharzia to spread easily along with the rapid increase of population, this has led to people overfishing the lake which allows for the snail that carries the parasite to reproduce at an increased rate, due to the fact the predatory fish has largely decreased in population, and when people are infected is it very rare that they are diagnosed and treated with medication to kill the parasite.

Symptoms of bilharzia

Bilharzia can create a range of symptoms which is why it is so dangerous because if someone is self diagnosing it can easily be mistaken as a cold, malaria or just fatigue:

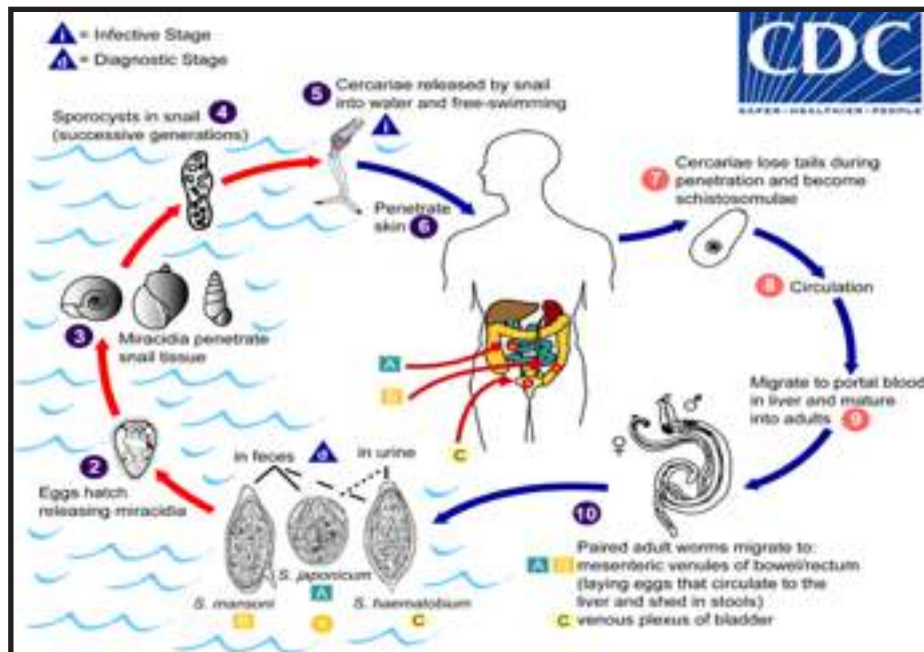
- A Rash
- Itchy skin
- Fever
- Abdominal pain
- Blood in urine or frequent urination
- Coughing
- Headache
- Fatigue
- Weight loss

NHS

Due to the wide range of symptoms a number of people have never discovered the bilharzia parasite within them and have died from treating the parasite incorrectly, however unlike malaria this parasite takes much longer before the patient starts to feel any of the above symptoms, Due to this slow rate of infection a vast number of tourists travelling to see lake Malawi often only feel the symptoms once they have returned to their mother countries where most doctors have not experienced the parasite before because it is only located in certain tropical and subtropical countries.

Furthermore due to the lack of education in Malawi lots of patients who carry the parasite tend to mistreat the parasite when they experience the symptoms because they believe that they are infected with malaria. This complication can become very dangerous if the patient isn't tested because it could lead to death.

The life cycle of bilharzia



CDC

Like most other parasites and living beings bilharzia has a life cycle:

1. In step one the eggs are located in fesses and urine and are then eliminated and then under only certain conditions the eggs are hatched and release miracidia.
2. Once the miracidia is released it swims in fresh water hunting for a snail or worm as its host.
3. Once the snail is infected the parasite tries to undergo a successful regeneration of cercariae.
4. Once released the cercariae penetrates a human host through any open pours.
5. Once inside a human host the parasite mutates into a schistosomulae.
6. Schistosomulae takes residence in the veins of the human body.
7. Then through the blood stream it finds its way to the liver.
8. Two adult parasites pair and reproduce eggs
9. The eggs are carried to the bladder and then urinated out.

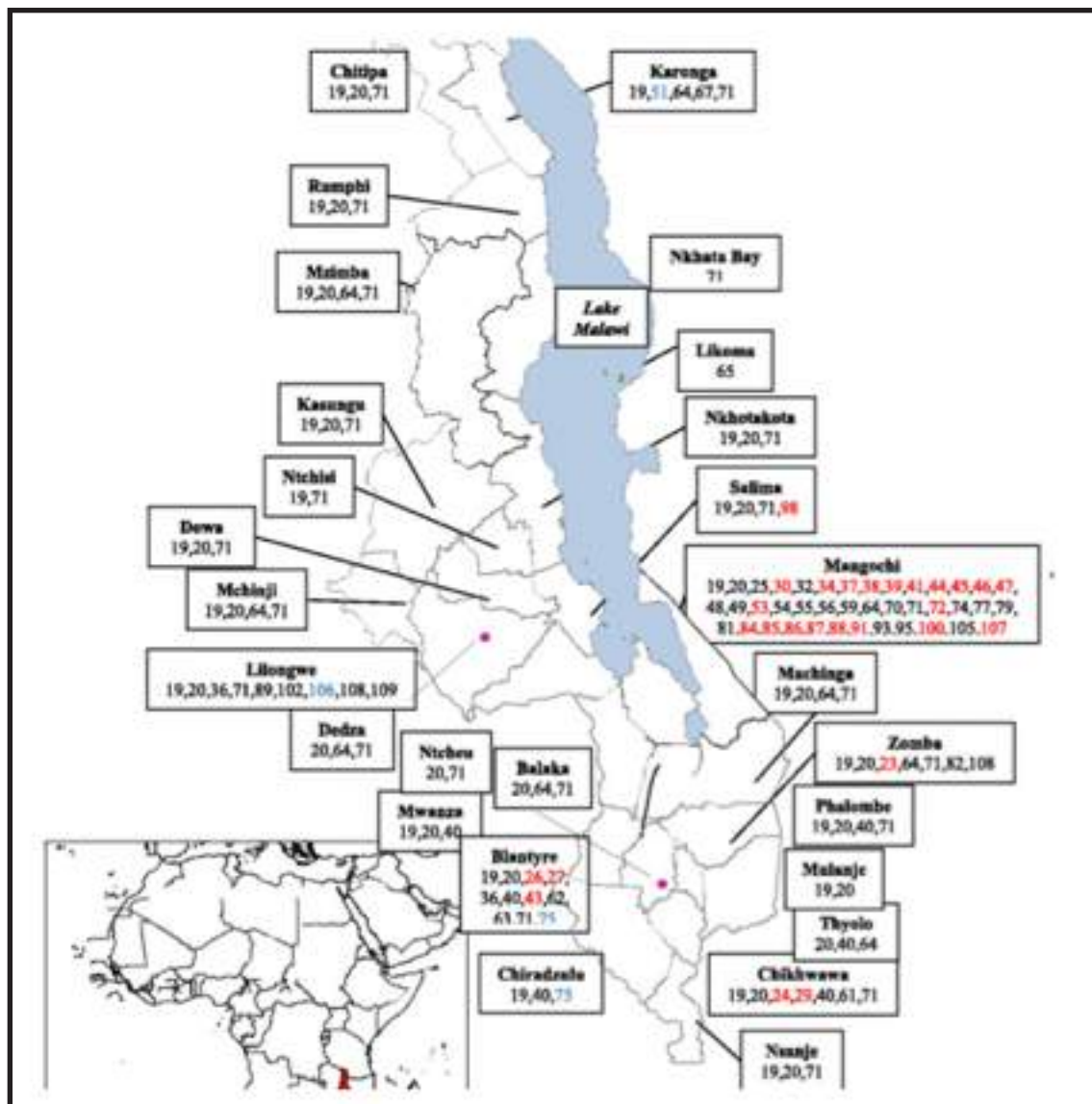
The parasite is not contagious from human to human however the parasite can be passed on if an infected person excretes into water the parasite can now infect another body.

CDC

All the lakeside regions near the lake have a very high infection rate compared to non-lakeside regions as well as townships along the Shire River have high infection rates. The shire river also has high infection rates because the snails also inhabit fresh water rivers, which allows for people to get infected through drinking the water or showering

in the water they get from the river. The map clearly shows that the distribution is showing that most lakeside areas of the lake are more infected since their population encounters bilharzia more often than population from other regions.

Distribution of bilharzia in Malawi



Key:

Red numbers = urinary Bilharzia Blue Numbers= intestinal Bilharzia

Black Numbers= both urinary and intestinal Bilharzia (NCBI)

The Map however shows that particular lake side regions such as Karonga, Nakotakota and Mangochi each have higher infection rates. Geographically this is because each of these major towns are located near three of the lakes biggest river mouths, Mangochi is near the shire river, Nakotakota is near the Bua river and Karonga is near the Karonga river. This is relevant because these rivers allow for reeds to grow along the mouth of the rivers; the reeds that grow attract the snails along with the bilharzia parasite. Moreover these towns are the three biggest along the lakeshore which means that there are more people that can potentially get infected from the parasite. (Mapsof.net). However with this information given it is to be noted that these three major lakeside towns have had more research conducted in to find out infection rates in local towns however the smaller townships have had less testing and some have had no testing, this inaccuracy in the data could leave out a large amount of the population when looking at infection rates.

On the other hand the reason there is nearly no data on bilharzia infections in some of the villages because they are very remote and lack the technology to conduct tests, this is very common in Malawi considering that it is a less economically developed country (LEDC), moreover, because Malawi is an LEDC it has a major factor in the transmission of the disease is, sanitation is very poor in most rural villages and it commonly known for people to excrete into their own water supply such as the lake or nearby rivers, this allows for the bilharzia parasite to reproduce near townships or villages. Furthermore, because poverty is so wide spread in Malawi there is no regulation on fishing in the lake allowing for locals to overfish, which in turn affects the food chain, allowing for the snails that are hosts to bilharzia to breed out of control.

The effects of bilharzia on tourism

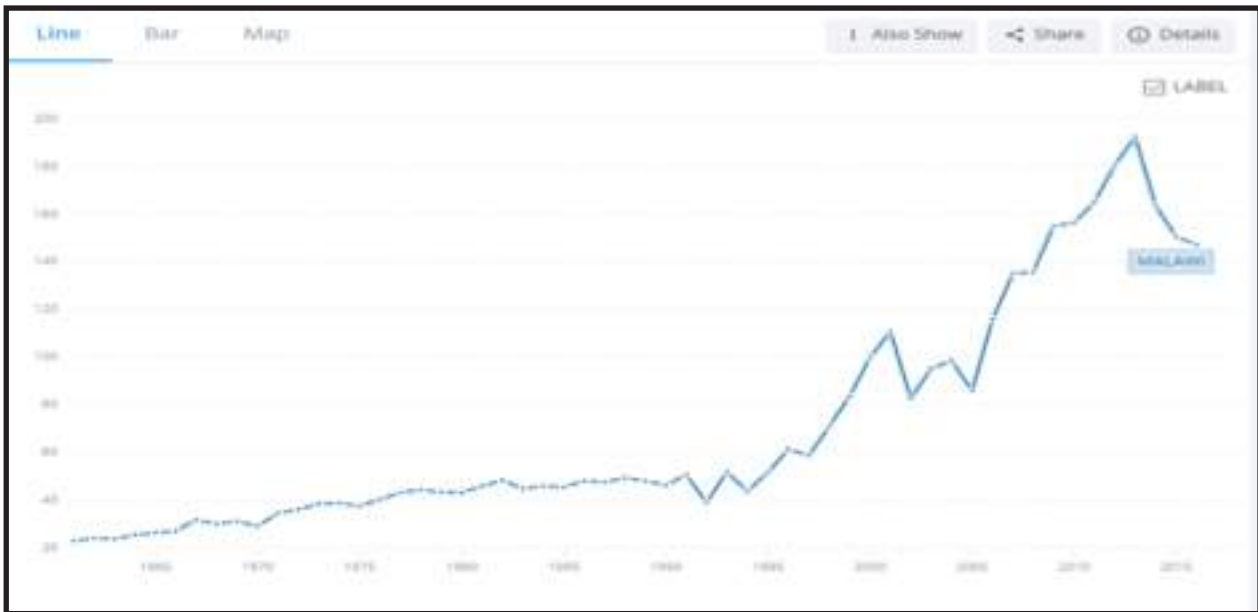
Due to the fact that Malawi has had a dramatic increase of bilharzia infections from Lake Malawi this has created a major dilemma. The infection rates may have led to a decrease in tourism revenue from lodges on the lake; in 1992 was the first recorded case against bilharzia in Lake Malawi, however after this first case bilharzia infection rates have increased at alarming rates over the past 26 years. Lodge owners along the lake have admitted that they have needed to invest in swimming pools (Pollard), and or alternative places for their guests to swim because at least 30 % of their guests annually refuse to swim in the lake at all even though that the parasite is only located between depths of 1 to 10 meters where the snails inhabit. Lake Malawi creates the largest revenue from tourism; this in the future could lead to detrimental effect on Malawi's economy considering that tourism provides 7.3 % of Malawi's annual revenue (Turner). Furthermore, because of Malawi's lack of natural resources to export, tourism revenue would be regard as an easy source of annual income however if the bilharzia

infection rates are not controlled it could lead to a decrease in the revenue by 3 % which would also lead to lodge owner's revenues decreasing considering that 40 % of their customers come as tourists from a foreign country. This heavy reliance on foreign tourists could have a negative impact on Malawi's tourism revenues if the parasite infection rates were to increase yet again, this could cause for tourism revenues to decrease due to a fear of catching the bilharzia parasite when visiting lake side lodges.

Before the first recorded case of bilharzia in 1992 (Mapsof.net) the Malawi government initially made claims that the lake was free of the bilharzia parasite, globally this information was perceived as accurate however, according to recent tests the bilharzia parasite has inhabited the lake for thousands of years (Deutsche Welle), this has been proven because the snails that carry the parasite have always inhabited the lake. However even though knowing that Lake Malawi contained the bilharzia parasite, they announced that it was free of bilharzia to encourage tourists to come to the 'warm heart of Africa' to explore the second biggest fresh water lake in the world, it contains 500-1000 different species of fish, and the majority of them can only be found in lake Malawi (Zathu). When the government made the announcement, it was to try and increase their tourism revenues since then it has increased by 2.6% (Jassi), now that it is evident that the bilharzia parasite inhabits lake Malawi this could be the reason as to why there has been a decrease of 0.6 %, because of an increase of infection rates which has seen tourists avoiding the lake because of the fear of catching the parasite.

Bilharzia Medication

Thus with the increase of tourists catching bilharzia foreign doctors are starting to encounter the parasite at an increasing rate this is because in our present day millions of people travel from country to country everyday, which makes it easier for disease to spread, because Bilharzia is not contagious from human to human if someone was to drink untreated water they can be infected by the parasite. Due to the fact that the parasite has only ever been found in the southern hemisphere, especially in sub Saharan Africa and south East Asia explains as to why most doctors in Europe and America, tend to misdiagnose a patient with bilharzia or do not have the medications to treat the parasite. There are number of preventatives that people could take such as boiling water, not excreting in the lake or swimming in the lake with any open cuts or wounds. These preventatives if followed can be highly effective in reducing the infection rates. Furthermore if you are to be infected there are anti parasite medications that attack and kill the parasite, however these medications are usually not available in rural areas.



The World Bank

How has overfishing caused a rise of bilharzia?

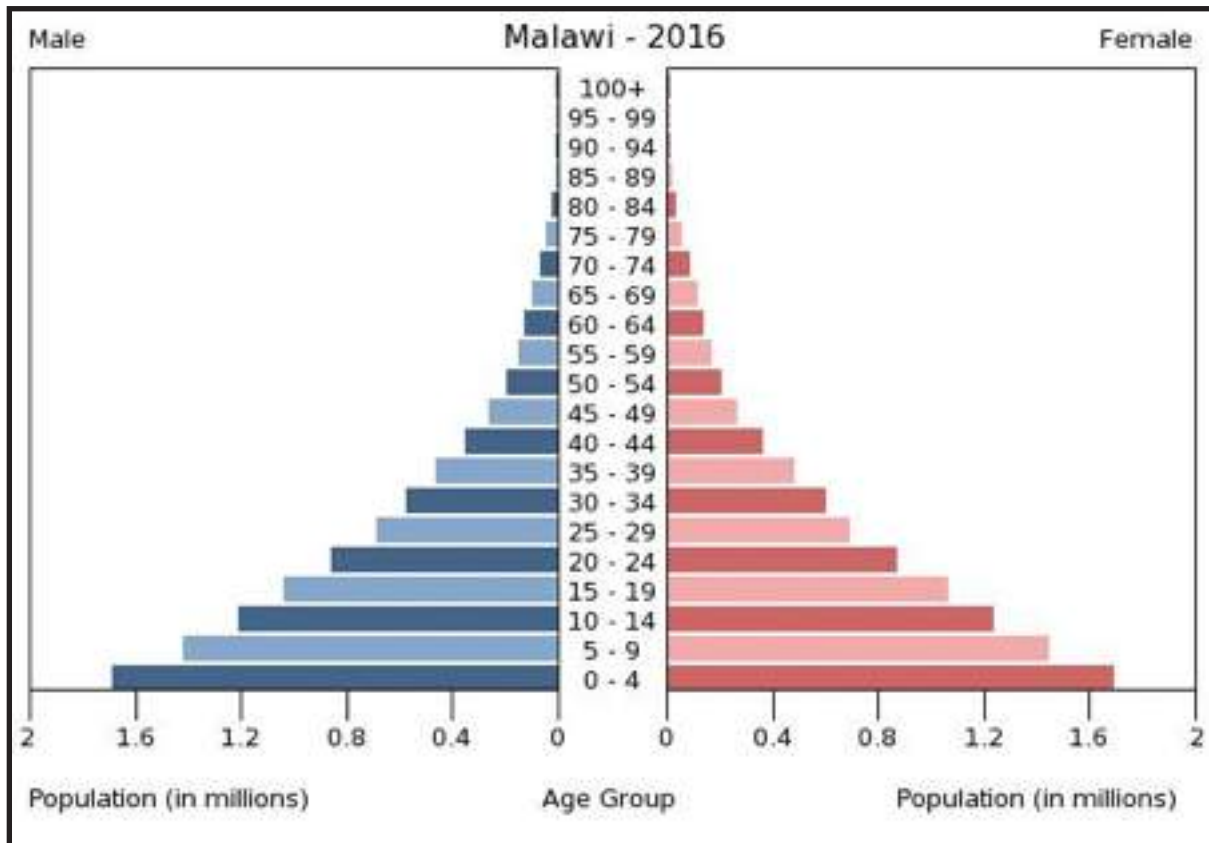
Malawi's population has been increasing at an alarming rate, in the past 20 years it has had an increase of 7 million people (worldometer), because the population has doubled in 20 years Lake Malawi has been heavily overfished to try and supply the current population with enough food.

However even though famine is still very prevalent in Malawi, the uncontrolled overfishing could lead to an increase of bilharzia infection rates this being that the Chambo fish that preys on the bilharzia snails are going to quickly fall into the endangered species list because there are no regulations on how many fish a fisherman can catch in a day or what sizes are appropriate to keep. This lack of sustainable fishing could be linked to the fact that Malawi's enrolment in schools is as low as 65% (Ripple Africa). With a lack of education in rural areas it is found that the majority of fishermen are unaware that they are overfishing and what impact this could have on their livelihoods in the future.

What effect does bilharzia have on schooling

With the rising increase of bilharzia it could lead to a decrease of attendances rates at school because students might be finding themselves infected with the parasite, which would cause them to be lethargic and not physically able to attend, this could have a heavy influence on Malawi economy because with 20 % of students being infected every year (Deutsche Welle), it could lead to Malawi not being able to develop at its full potential rate.

Children under the age of 15 have shown to be more susceptible to the parasite since



their bodies are not fully developed, which allows for the parasite *Index Mundhi* to infect their bodies much more easily, furthermore there is being researched conducted on the possibilities of the bilharzia parasite influencing a fetus in a mother womb. Considering that 40 % (worldometer) of Malawi's population is youthful this could detrimental effect on life expectancy in Malawi which currently sitting around 40 years of age.

Development in Malawi

In lake side regions of Malawi the infections stand between 30% at a low and 40% at a high, this high percentage restricts at least 20% of the work force considering that 10% of the total is children (Deutsche Welle). Having 20% of the work force infected creates a lack of work intensity especially in lakeside regions of the lake considering that is where the highest infection rates are, as well as because Malawi has a very youthful population it affects school enrolment in lakeside regions. This then restrains Malawi's development in these regions because with highly infected work force this causes for a reduced amount food farm annually, reduced hours at work, less infrastructure. This can be seen due to the fact that because of the rising increase in bilharzia in Malawi there have not been any major developments.

In regions such as Mangochi where infection rates are as high as 50 % (DW) are more undeveloped then regions that aren't lake side such as Zomba, Mzuzu and Lilongwe

where infection rates are only 15%. The Mangochi region struggles to keep a stable supply of food annually due to this high infection rate a high number of the population die from malnourishment, because Mangochi is lakeside it encourages for the locals to fish more because it is consider an easier way to acquire food, because of the increase in overfishing it has caused for the parasite to spread even more. The parasite is allowed to spread because the Chambo fish that preys on the snails is a local delicacy and is very popular in all regions of Malawi.



Norwich - Dedza Partnership

In lake side regions where bilharzia is prolific it is evident that this could link to a huge percentage of the general work force to not be able to work or commit to any labour, this lack of able bodied workers makes it harder for rural lake side villages to develop any further without any foreign aid or government aid, This dilemma could lead to rural villages depending on aid to come and help them, which in the short term has a positive impact on the livelihoods, But external aid will not be provided for ever.

In the long term it could lead to a lack of perseverance to solve problems themselves, as well as it could encourage the able bodied worked force not to work. On the other hand if a sustainable project is set up in the rural lake side areas it could have long lasting positive impacts such as teaching certain locals how to diagnose bilharzia, or setting up learning centres to educate them on how bilharzia can be passed on. This type of development projects are led by a number of NGO's such as VSO, DIFID, Pact and Us Aid who are looking to create a long term solution to reducing infection rates of bilharzia in Malawi, these long term solutions of NGO's in the country might have a negative influence on the government in Malawi because the government might find themselves in the situation where they have to rely on external aid instead of fixing their problems with their own resources.

Conclusion

To conclude, bilharzia has a negative effect on Malawi's socio economic development, this can be said because of the high infection rates that Malawi currently has as well as, when looking at Malawi's economic growth it is safe to be said that there are no short-term solutions to the current bilharzia infection rates. It can be seen that bilharzia is causing for a negative impact on the work rates, which shows direct correlations to life expectancy, infant mortality rates and agricultural production. In the long term and short term these rates have detrimental effects on the general development of Malawi because with more infants dying it means there will be less able people to work, low life expectancy causes for people to retire at younger ages, due to the fact that the life expectancy is also at the age of 40 this at least cuts out 15 years of labour that each person could work and both these rates are one of the main causes of low agricultural rates which leads to malnourishment, this only but a mere taste of Malawi's everyday challenges that it faces.

Bilharzia could also influence Malawi's tourism revenue and agricultural revenue; this could see two of Malawi's biggest incomes fall under scrutiny causing for there to be a ripple effect on Malawi's economy which could lead to further deductions Malawi's income affecting the money they have to pay for health services for Malawian citizens, with these potential deductions this could reverse Malawi's development and effect it's socio economic status. This outcome is very unlikely to happen due to current aid being implanted into regions that struggle to deal with bilharzia infection rates, because with this aid Malawi should be able to accelerate their development in lakeside regions that are struggling from high bilharzia infection rates.

The reference that I have used for this essay have primarily been secondary resources due to the fact that it is hard to conduct my own primary research on a epidemic that effects Malawi as whole, this is why my primary research was restricted to questionnaires and surveys to local communities that I could reach. However I found that this was not too much of restriction when writing the essay in the end due to the fact the primary research was sufficient enough to support my claims, but this could lead to some inaccuracies in the evidence I use to support my claims.

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Mtendere Horea



ITGS

How has internet banking has affected Malawian Standard Bank, and its customers?

Introduction

For the extended essay, the chosen subject focused on is Information Technology in a Global Society (ITGS), my interests in technology initiated my aspirations in the subject as a whole as it focuses on the way technology impacts our day to day lives which is what the basis of the ITGS course focuses on. As Information Technology (IT) keeps advancing day by day the impact it has on people's lives also increases. Furthermore, IT is continuously improving, as new technologies are being discovered and created. IT has not only had a huge impact on people's lives but it has also made a huge impact to how people work and operate today.

This extended essay will be focusing on the effect Internet banking has had at the Malawian Standard Bank, and its customers. The topic focuses on this aspect of ITGS as the introduction of Internet banking is generally a new service for Standard Bank Malawi customers. This then brought to my attention how they are so many opportunities and threats to bringing such a service to Standard Bank customers in Malawi. This has inspired for a more in-depth analysis into the topic in order to gain a better understanding of Internet banking and how it has affected those that use the service.

The essay will cover the ITGS triangle; the social and ethical significance, the application to specific areas, the IT systems, and the stakeholders in order to get a better understanding of the topic to enhance my knowledge. It will also make conclusions on the overall effect the Internet banking has had on Standard Bank Malawi and its customers.

For my primary research, I surveyed 16 Standard Bank customers about their use of Internet Banking. In order to get a better understanding I contacted a notable Standard Bank employee that specializes in the area of Internet Banking: Daniel Mbozi the operations manager for Internet Banking at Standard Bank Malawi. Whereas for my secondary research I looked into notable reports, and websites on banking systems and Internet banking in general such as the AfDB (African Development Bank) report which looked into the facts and challenges the African banking system is facing.

IT and Background of Internet Banking

Internet Banking is an alternative to traditional banking customs through the use of the Worldwide Web; this enables customers to control what happens to their bank accounts from anywhere as long as there is access to the Internet. The system uses the Internet in order to communicate dealings to the bank accounts database through the client's activities from their bank account. In order for the system to be as secure as possible, it is required to have SSL (Secure Sockets Layer) which ensures that private information is kept secured through encryption so that interception is not done by third parties (Global Sign).

Internet banking started to develop during the late 1990's due to the fact the significance of the Worldwide Web began expand as tens of millions of users worldwide were accessing the Internet (Mia, Rahman and Uddin). Pre-internet accessible mobile phones customers had to phone their bank computer systems in order to access their accounts and preform transactions in which came upon the term 'E-Banking' (Mia, Rahman and Uddin).

But customers were also able to perform transactions through their PCs (Personal Computers), which was the preferred mode of using Internet Banking as it allowed customers to interact with their bank through their computer with an Internet connection. Shortly after the Deutsche Bank in 1996 launched the very first Internet Banking project in Latin America which is known as the beginning of the use of Internet banking (Mia, Rahman and Uddin).

Today, Internet Banking has seen an increasing amount of users due to its accessibility and ability to perform simple and complex transactions which allow customers to manage what happens with their bank accounts and how it is managed from anywhere. From making deposits, paying bills, to transferring funds to other accounts. Which is all possible as long as an internet connection is available, on a device which allows the function.

The Internet Banking system relies on the internet, without it there would not be any Internet Banking. This is due to the connection the Internet has to the desired banks' servers which stores all customers' information in one place, and this is then easily accessible to customers as they are required to enter their account details which grants them access. Beforehand customers are required to register their account online in order to grant them the ability to perform transactions with their bank accounts at any time anywhere. This accessibility is what has helped increase the use of Internet Banking making it more and more widespread.

Use of Internet Banking

Internet Banking for Banks and Employees

Internet Banking is used in order for banks to know and communicate what their customers are doing with their money. This enables the bank to monitor their customers' activities such as; inquiry facilities, assisting the bank in business and development and follow-up (Ghaziri), replies to their client queries without reference to ledger-keeper (Ghaziri), and fast and up to date information transfer enabling speedier decisions by interconnecting computerized branches and controlling offices (Ghaziri). Through monitoring it also allows banks to back track if Customers' have experienced hacking from third parties in such a case someone transfers money from their account to elsewhere, which can be dealt with through inquiry to the bank and police with the monitored evidence.

The use of Internet banking at Standard Bank allows the bank and bankers to enhance their way of working. Through the use of accurate computer programs which operate time consuming jobs such as balancing and interest calculations on due dates, assists bankers by decreasing their workload as it is very time consuming (Ghaziri). The implementation of IT increases their productivity by doing tasks such as; covering schedules, putting deposit receipts and pass books into an online format which is then easily accessible for both the bank and the client (Ghaziri), this then enables bankers to give more time to their customers' needs as technology frees them from such time-consuming tasks.

The addition of the service at Standard Bank Malawi have enabled the bank to expand in more ways, with the addition of the service they have brought in a 24/7 customer support centre (call centre), which is there to help customers with challenges they face. Such as; with their password resets, confirmation of changes, special requests etc. The bank has been able to reduce the number of cheque payment with the introduction of Internet Bank even though it has been done at a "albeit at a slow pace because of

low penetration of internet banking” according to Daniel Mbozi – head of operations at Standard Banks’ branch in Lilongwe, Malawi.

Internet Banking for Customers

Customers have made use of Internet banking due to its convenience. Due its easy accessibility 24/7 (Scott), it provides customers with the convenience of being able to do their business anywhere, at any time especially when they are unable to access banks on weekends when banks are traditionally closed. Furthermore, the inclusion of Internet Banking gives customers more services which banks directly would not be able to provide due to the advancement of technology. Features may include functional budgeting, forecasting tools, financial planning capabilities, loan calculators among the long list of features available (Michael).

Furthermore, the service allows customers to access various information quicker, this is because banks are able to make scanned copies of cleared checks (Michael), pervious account transactions and provide the information for their customers online. In addition, it also makes it easier to identify fraud (Michael). Customers are able to deposit money to other accounts faster, pay bills `through the use of their Internet Banking account, this has made transactions for customers’ “cheap[er] and quick[er] on the internet with beneficiaries getting immediate value” according to Daniel Mbozi.

The Internet Banking service has become really crucial for some customers, as they may be travelling abroad or travelling to a remote area where it is hard to access a Standard Bank branch, the use of Internet Banking helps tremendously, especially when customers are in need of an overdraft they are able to use the 24/7 customer support (call centre) to communicate the issues they are facing when needing further assistance. Technologies advancement over the years has proven to be vital, as it has permitted not only computers to access the service, but smartphones and other mobile devices have got the capability to access the service through the installation of desired bank applications or website modes making it more accessible (Michael).

Implications of Internet Banking

Implications on the Bank

At Standard Bank Malawi, the use of Internet Banking has been a well received and highly appreciated service for bankers. This is due to the fact that the productivity of working in the bank has increased in certain areas, “Bank back office staff have had to go for upskilling to support processing, reconciliations and settlement of digital

transactions as opposed to processing cash transactions on counter or cheques.” According to Daniel Mbozi, the productivity of bankers’ means there is increased teaching in computer skills and basic use of the new Internet Banking service from the banks side as it is crucial the use of the service is known by those using it to assistance customers. For front desk staff this means further attendance to customers’ needs and through the use of technology it is then done promptly but to the best of the bankers’ capabilities.

Furthermore, the use the use of the service therefore means a less crowded bank on a daily basis as customers using the service will be able to perform transactions from the comfort of their homes and offices.

Nevertheless, the reliability on Internet Banking can also have a damaging effect on the Bank, this is due to overall network breakdowns, theft from servers, damage of computers, and also hacking of the network. Using Internet Banking does have its increased vulnerabilities, as the theft of customer information or/and money could jeopardise the bank and customers (Khrais). This could ultimately cost the bank tremendously, as the exposure to very valuable information could cost its reputation, in order to avoid such incidents Standard Bank values their customers information as 24/7 protection of the bank is required with additional security measures such as CCTV cameras in order to make sure the banks information is accessed with authorised access for the information not to be used in malicious way.

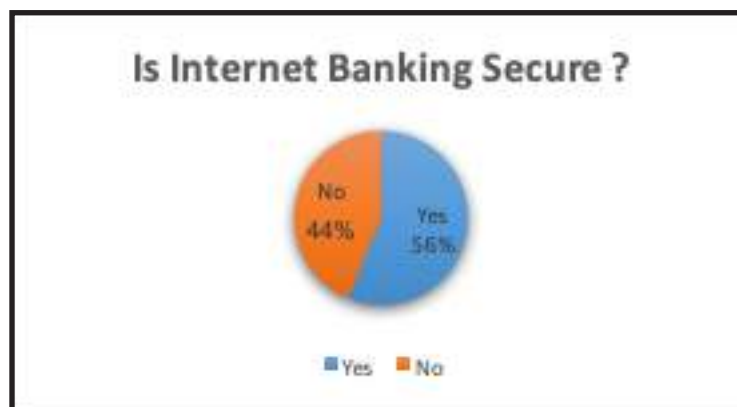
Implications on Customers

Internet Banking is a very high-end service/technology which is recent addition for Standard Bank Malawi. Customers ultimately put their trust in their bank and also the internet. The bank ensures that the safety of their customers is not compromised as safety measures are taken into account. However, 44% of Standard Bank customers surveyed, opted that the Internet Banking is not secure (see figure 1). This is due to the fear of their information being comprised by third parties, and also mainly because the Standard Bank Internet Banking login page has a one-step login verification stage in order to access account.

The easy accessibility being able to connect to their bank account from anywhere at any time, requires security to then be enforced for customers information to not be compromised as it is very dangerous to do so. Many Internet Banking services operated by banks ensure their customers information is accessed correctly by increasing the safety measures, through placing security checks when customers are logging into their accounts by having a 2-3 step log in verification process (Eaglescliffe);

- A username is required

- A password (which is only known by the customer)
- A captcha in order to differentiate human from machine input
- A text/message to your phone/ email with a one-time password
- Answer to a security question



As customers are using the service more they are significantly under more threat due to the fact money is involved. Customers using the service are more likely to come under attack than the bank itself, this is due to the high security the bank has to offer in order for all their customers information not to be abused and for their money not to be stolen. Therefore, the bank ensures it has the necessary safety precautions to protect their customers' from "the risk of fraudsters hacking Internet banking accounts and defrauding customers" due to cybercrime being one of the biggest issues customers would come against when using the service, according to Daniel Mbozi.

Economic Implications of Internet Banking

Implications on the Bank

As the development of Internet Banking is currently ongoing at Standard Banking, the reinforcement of the service could have an ultimate effect on the banks offered services. This is due to the fact that the more customers that make use of the Internet Banking service, will then decrease the number of customers that go into the banking hall to do transactions and the like. This could lead to reduction in support costs for customers in banks (Shevlin), meaning the bank saves money as they will not have to accommodate large amounts of customers therefore not requiring a large number bankers to operate at the bank full time, as customers can do their transactions online. Furthermore, this then reduces the costs of supporting the bank, as less money is spent on the payment of staff. This is specifically crucial when it comes to month ends due to most Malawians salaries coming in between the last week and the first two weeks of the month, as customers usually cause commotion at banks such as Standard Bank as they attempt to deposit money into their accounts as it is the traditional period which most employers pay their employees within Malawi. Ultimately making the use of Internet Banking vital at a time period such as that. In addition, the bank also benefits from the service as less money is taken out of the bank therefore cutting the costs of having printed money out being used, and making money more digital (Eaglescliffe). Which also saves

the environment as less money would essentially need to be printed out saving paper, eventually cutting down the costs needed to be spent by the government to print out money. Contrary to all the beneficial factors of the implementation of Internet Banking, there are factors which could lead to the compromise banks business, due to the fact the banks servers could get hacked which would mean the customers trust towards the bank would be lost (Khrais). Leading towards the reduction of users using the Internet Banking service, and also the loss of customers which would decrease the input of money going into the bank therefore decreasing the banks' profits as it is a commercial bank.

Implications on Customers

The introduction of Internet banking not only saves banks time and money, but it also saves customers more money. Due to the mobility of access from anywhere at any time as long as there is an internet connection, allows customers to do their banking from the comfort of their homes, offices, etc. This ultimately saves those using the service costs on money and time, as it is not obligatory to go to the bank to deposit money into other accounts as they are able to do so from the Internet Banking service provided by the bank (Pritchard). This then makes the service of Internet Banking an end-to-end saving scheme, but then when information is compromised through information being misused or taken advantage of e.g. through hacking, this would then mean major losses for customers as their information could be used to scam them of their money and also other personal details which the customer provides the bank with.

Effects of Internet Banking

Less Economically Developed Countries

As Malawi is in Africa, and is considered one of the poorest nations in the world the introduction of Internet Banking is an incredibly new dimension, this is due to the fact that here in Malawi there are more Mobile Banking users compared to Internet Banking. They are roughly around 2.5 million Mobile Banking users which account for a large part of the population, whereas compared to Internet Banking they are 55,000 users as Standard Bank. Due to Malawi being an LEDC, there are major factors to why Mobile Banking is having a higher population using it compared to Internet banking, as there is more reliability and the process on withholding a Mobile Banking account is easier than creating a bank account. The progression of Internet Banking has relatively been centred on Lilongwe (the capital) and Blantyre (the commercial city) which the wealthier people are located, opposing to the rise of Mobile Banking where it allows for mobility anywhere especially in the rural areas where the least educated and lack to proper health care access, and struggling families are finding it hard to create a

means for a family day to day. Creating a bank account is then an additional hassle, as the requirements such as; proof of employment, national identification, and passport could be hard to meet (Nyantaky and Sy).

More Economically Developed Countries

Contrary to LEDC's MEDC 's are well off, as the education levels are way higher, access to proper healthcare, and also due to countries being more developed it means that the number of bank account holders compared to Malawi is at a higher rate. Ultimately meaning more Internet Banking users making the service more and more used, in term of use economically developed countries are better off due to technologies becoming a widespread between them, then spreading towards LEDC as it takes time for adaptation.

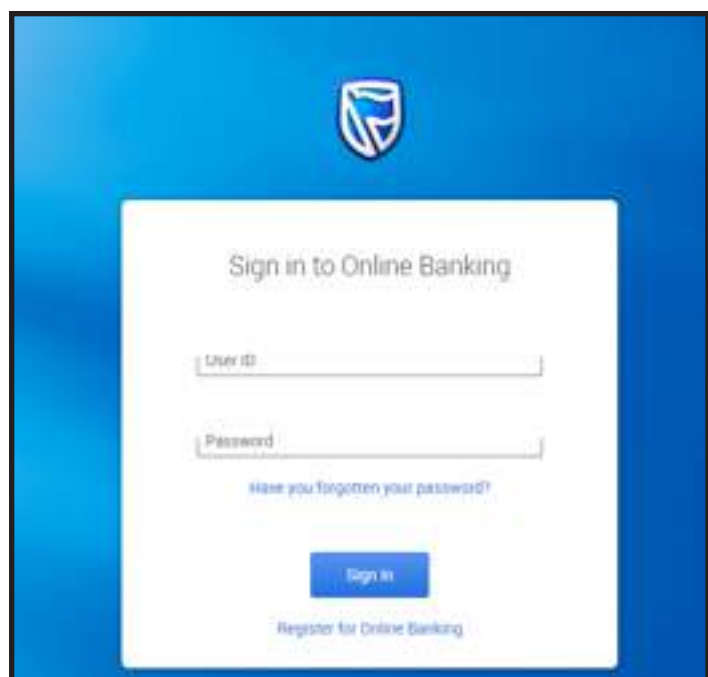
Solutions for Security

Encryption

As banks and customers are wary of the security risks of using Internet Banking has, banks use encryption software which is when text is encoded in order for unauthorized persons should not access a customer's account and is one the main safety measures a bank takes for services such as Internet Banking (Michael). In order to protect information from being accessed by unauthorised third parties e.g. hackers, as the information accessed is private and also could be damaging if access is granted when permission from an account holder is not granted, which would ultimately ruin the banks reputation. This software is then implemented in order to protect customer's accounts from phishing when sensitive information is stolen through someone pretending to be someone or something they are not, malware where and malware where viruses, corrupt information, or software is sent through hackers, and other unauthorised activity (Michael).

Customers' Accounts

When customers are using the internet banking service, they require for their information to be protected as it is valuable information for the bank as it is for



the customers. This then requires Standard bank to take the necessary measures in ensuring their customers' information is kept secure, so that there is no information damaged or misused.

However, from the survey conducted, majority indicated they do not find the Internet Banking service provided by Standard Bank to be secure. Which is an indication on some of the fears that customers have when using the services, as the login for Standard Banks' Internet Banking service only consists of a one-step verification measure (see figure 2). The service needs users to enter their User ID and password in order to grant access into their bank account, which is considered not as secure as a password can be hacked easily if not kept secretive and also, as other banks ensure they have additional steps in order for customers to gain access to their bank accounts through other verification methods.

In order to ensure customers' bank accounts are kept as safe as possible on the Internet Banking server, to avoid hackers, malware or any unauthorised access to gain access to accounts. Standard Bank will have to increase their safety measure for when customers are logging into their bank accounts via Internet Banking, as it will help ensure accounts are kept as secure as possible. By taking these measures such as including a captcha and text/email notification of a one-time password could help avoid customers' accounts from having computer systems hacking into their accounts and also it will allow for customers to be notified. In addition, having customers connect their emails and mobile phone numbers for them to receive notifications every time their account has been logged into, will ensure they are notified whenever there is activity happening within their accounts e.g. logins into accounts and transactions. Which then helps with customers identifying account unauthorised breaches enabling them to take action by contacting the bank and then referring the matter to the police of the breach, depending on if the magnitude.

Conclusion

Subsequently looking at the benefits and the limitations of Internet Banking, for Standard Bank Malawi employees and customers. The service is a huge breakthrough in making digital money more useful, as it allows for customers to do their transactions from anywhere at any time as long as an internet connection is present.

As the service begins to becoming more utilized by Standard Bank customers, the service has many beneficial factors which outweigh the risks in terms of mobility but on the other hand the security of the system does raise some concerns. As there are still some safety measures which the bank will have to take in order to make sure the

Internet Banking service is kept as secure as possible for both employees at Standard Bank and its customers, such as including; a captcha or a security question.

Even though the Internet Banking has not had a huge success for Standard Bank users, there are factors which have to be taken into consideration as Malawi is an LEDC, with only 1.3 million bank account holders (including those that are multi-banked), whereas there are 6.3 million mobile phone users with 40% using mobile money services such as TNM Mpamba and Airtel Money (Mbozi). As Mobile Banking continues to make a breakthrough as the setting up process for accounts, are not as complex for Internet Banking it allows those living in rural areas to have accounts. Furthermore, due to the fact Internet Banking requires users to have an internet access it then causes a limitation, compared to Mobile banking it does not require the same as all it requires is a mobile signal in order to do transactions. Making it more appropriate for those living in rural areas, thus having a larger population using it compared to Internet Banking.

In conclusion, it is clear that the benefits of Internet Banking do outweigh the risk when using the service; however, when looking at the numbers for other alternatives such as mobile money, it highlights the reasons to why Internet Banking has not had such a success due to the fact Malawi is an LEDC. On the other hand, through the research conducted, Internet Banking as a service in Malawi does not play a huge role and probably will not in the near future. Firstly, this is due to Malawi being and LEDC leading to only a small population of Malawians to be able to have access to bank accounts, secondly, as mobile money is easily accessible through two of the main mobile service providers in Malawi, Airtel and TNM. Which require no paperwork only proof of identification through an ID, meaning more and more Malawians are using this service in order to make payments, send or receive money through their respective mobile money services.

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Uzair Kasmani



Economics

What is the market structure of car hires in Lilongwe?

Introduction

The car hire market in Lilongwe Malawi is one of the most prominent sectors in terms of economic development and tourism in the country. They strive to supply vehicles to tourists in the country which boosts the tourist industry in the country as the tourists have the assurance that they will be able to get transport in the country. As well as this car hires play a crucial role in economic development as they supply vehicles to organizations such as Red Cross, World health organization and UNICEF which contribute to economic development. Not only do they supply vehicles to NGO's however to governmental organizations such as Electricity Supply Corporation of Malawi (ESCOM) and water bored which further contributes to economic development.

After taking a closer look at the market, most of the companies provide similar services as well as similar cars. The main cars that they provide are 4x4's as well as saloon cars, trucks and buses. After linking the knowledge gained in class about the theory of the firm with the car hire market in Lilongwe I have realized that all of the car hires in Lilongwe provide similar products which can be directly substituted with one another. This leads to several questions being raised:

1. How many businesses are there in the market?
2. How do the businesses separate themselves apart from all of the other businesses?
3. What makes customers pick one company over the other?
4. How do the businesses compete?
5. Why do all businesses provide similar products?
6. How do the businesses make profit if they all provide similar products?

These questions lead to my research question which is what is the market structure of

car hires in Lilongwe, Malawi? This essay will evaluate this question as well as focus on how the companies operate and how the customers decide what company they will use to hire a car and why.

Hypothesis

With basic observations of the market, the following hypothesis will be investigated:

1. I believe that the Car hire market will closely resemble an oligopoly market ('brief definition, a small number of firms which control the majority of the market where products have no or slight differentiation') (Tragakes, Ellie. Pp. 91-158)
2. In addition to this, customers will choose the company they are purchasing from based on price, quality, company reputation and finally customer loyalty.
3. The main form of competition in the car hire market in Lilongwe would be the quality of the vehicles as prices are similar.

Methodology

Primary and secondary research will be conducted throughout the course of the essay. As there is not much information online or in books about the car hire market in Lilongwe, my research will predominantly consist of primary research. The secondary research will be conducted online and will comprise of the theory of the firm, advertisements published by firms as well as articles on websites about certain firms.

As there are a fairly large number of firms in the market only a few of the main firms will be studied. The purpose of doing this is because it would be difficult to investigate all of the firms in the market. Some of the main firms that I will be investigating will include Avis, Apex rent-a-car, countrywide car hire, SS rent a car, Modern car hire and finally Royal car hire.

The prices that each of these firms charge for each of their products will be recorded. As well as this I will ask for the companies profile as well as any product differentiation there is. I will also take into consideration where the companies are located and if that has any effect on how much business they are receiving and who their targeted customers are.

Surveys and interviews will be conducted. A total of 50 customers will be surveyed at random. The aim of the survey is to find out the opinion of the customers' behavior when renting a vehicle as well as their reason as to why they would choose a particular company over another. The surveys will be conducted at places where there could be a high population of tourists for example hotels and tourism companies as well as the offices for NGO's.

There will be interviews with at least 3 of the company's owners/managing directors. The aim of these interviews will be to find out the price competition in the market, barriers of entry, what they believe sets them aside from other firms in the market and finally profitability in the market.

Data research and analysis

Secondary research - Theory

There are four different market structures and they are illustrated on the diagram below.



economicsonline, 2018

Perfect competition:

Perfect competition is the most competitive market structure. It includes the following characteristics:

- There is a very large number of firms in the industry.
- Each firm has no control over the price at which it sells the product; because of the large number of firms, each firm's output only contributes to a very small fraction of the total output of the industry so it can't influence the price.
- All of the firms in the industry sell standardized or identical products; from the consumers point of view it makes no difference from which firm they buy their product, as it is exactly the same in all firms; there are no brand names.
- There are no barriers to entry in the industry; any firm that would like to enter in the industry and begin producing and selling the good or service can do so freely.

Monopolistic competition:

Monopolistic competition is still competitive however it is less competitive than perfect competition. Monopolistic competition has the following characteristics:

- There is a fairly large number of firms in the industry (but not as large as perfect competition)
- Each firm has a substantial amount of control over what price the product is sold.

- There is product differentiation; this means that each firm in the industry tries to make its product different from those in the industry; these differences may be in the many characteristics of the product, the quality, the servicing or the packaging.
- There are very low barriers to entry in the industry; any new firm can easily enter in the industry and begin producing and selling the good or service.

Oligopoly:

Oligopoly is a market structure where competitiveness is lower than monopolistic competition however higher than monopoly. Oligopoly has the following characteristics:

- There is a small number of large firms in the industry.
- Firms have significant control over the price at which a product or service is sold, but this only occurs when they realize that because of their small number their actions are interdependent.
- The products may be either differentiated or undifferentiated.
- There are high barriers to entry; it is not easy for a new firm to enter the market and begin producing and selling in the industry.

Monopoly:

Monopoly is a market structure without any competition, it is the opposite of perfect competition. It has the following characteristics:

- There is a single firm in the industry.
- The firm has significant control over the price at which its product is sold in the market. The firm produces or sells a unique good or service, which cannot be purchased elsewhere.
- There are high barriers to entry. If a new firm wants to enter the market it cannot do so." (Tragakes, Ellie. Pp. 91-158)

After studying the characteristics of the market structures the car hire market falls in between monopolistic competition and oligopoly however it is more towards oligopoly as shown in the spectrum below:



economicsonline, 2018

Secondary research - background information

As the market of car hires is not acknowledged internationally as one of the larger markets in Malawi there were no books or websites online that were existing to use for background research. Instead the research was conducted as primary research.

Primary research

Number and size of firms

After counting the number of registered car hire companies in Lilongwe the results showed that there are 30 car hire companies within Lilongwe. This suggests that the market features characteristics of monopolistic competition.

Many of these companies have an average fleet of 20-30 vehicles however there are six firms which have many more vehicles in their fleet. This includes Avis Malawi which is an international car hire company and they stated on their website "we have a fleet of 100 vehicles in Lilongwe across our multiple branches." As well as Avis there is another company called Apex rent-a-car which has the biggest fleet of vehicles in Lilongwe with around 150 vehicles. SS rent a car claimed to have a fleet of 100 vehicles, country wide car hire has claimed to have 100 vehicles and finally Modern car hire and Royal car hire both have 80 vehicles in their fleet.

Type of products

The vehicles that are offered for hire by most of the companies include saloons (Toyota corolla or similar), single cabin pick-up trucks (Nissan hard body or similar), double cabin pick-ups (such as Toyota Hilux), large 4x4's (Toyota land cruiser or similar), buses, trucks and only Avis, SS rent a car and ocean car hire have luxury saloons (Mercedes Benz C-class or similar). This shows product differentiation as some companies have more luxury cars such as Mercedes and some companies have more 4x4 vehicles such as Toyota land cruisers or similar. Product differentiation is a characteristic of monopolistic competition as well as oligopoly.

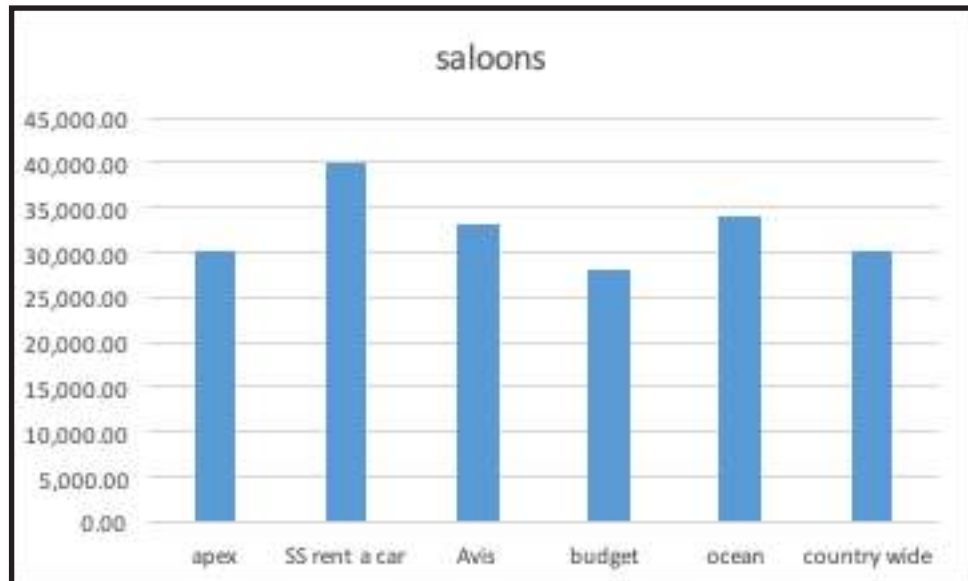
Price of products

Recording the price of products is crucial in determining the market structure of car hires in Lilongwe. This is because it will help determine if there is any major differentiation in the prices of the products which will then be a part of deciding the market structure of the car hire industry in Lilongwe.

The data is represented in bar charts. The Y axis will include the price and the X axis will have the company's names along the bottom. (All prices are in Malawi Kwacha at current time of interviews) all of the prices are according to the companies' flat rates

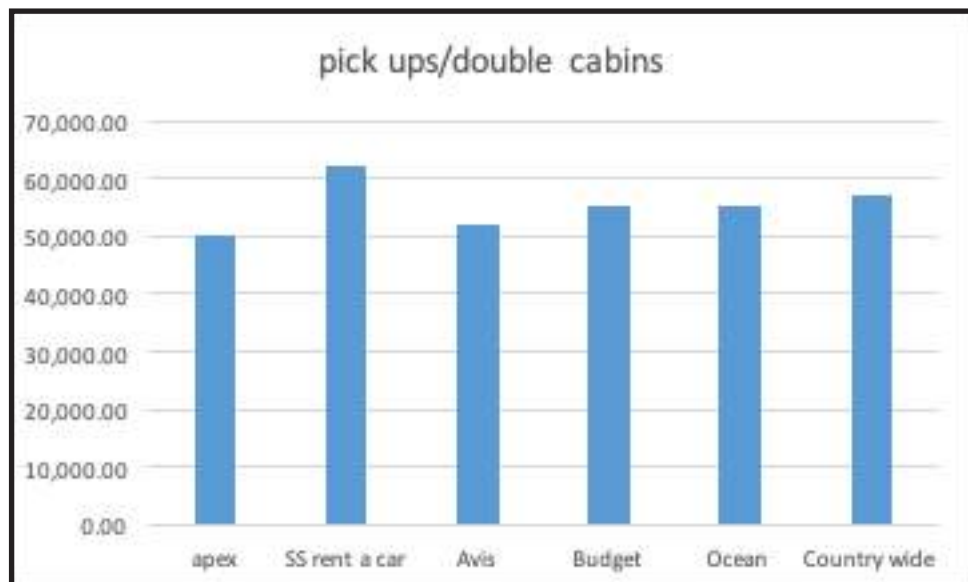
which means it's the price for one day without the charge per KM.

Prices for saloon vehicles are similar in most of the companies at a price point looming around 30,000.00 MWK with the



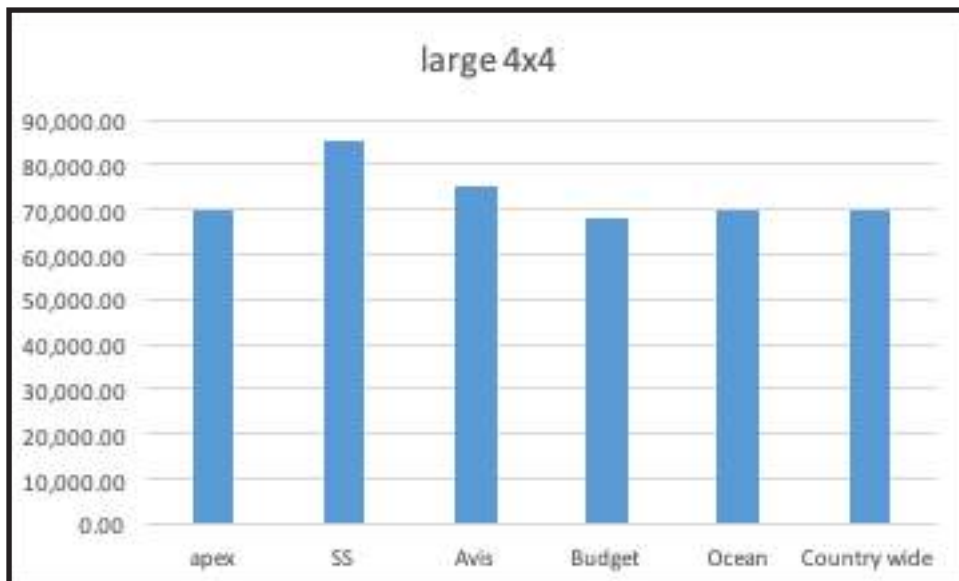
exception of SS rent a car which hires its saloon vehicles at the price point of 40,000.00 MWK. When the staff at SS rent a car were asked why the prices were considerably higher than the other companies their response was that the higher price was due to the fact that they have new saloons in the fleet.

Comparing the prices for pick-ups/double cabin vehicles (Toyota Hilux or similar) we can see that the prices are much closer. The reason for this is because double cabins are one of the most hired vehicles after the large 4x4's. This



results in the companies being price competitive and that is why most of them have similar prices with the largest difference being 10,000.00 MWK which amounts to 13.3 USD.

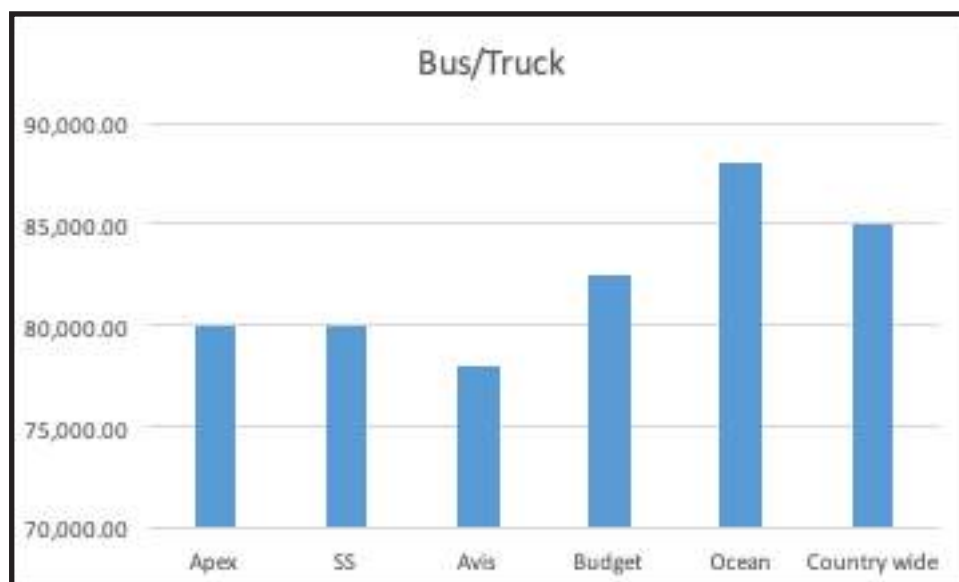
The large 4x4 segment is the closest in terms of price. This is one of the characteristics of Oligopoly. The similar prices are because 4x4's have the highest demand in terms of



being hired. This is because most of the NGO's such as UNICEF and other companies go to less developed districts in order to complete their projects so they need vehicles that can cope with the harsh routes

that they take. Three of the companies hire the vehicles at the same price with budget hiring at a lower rate however not by much. Only SS rent a car have a substantially higher price than the rest of the companies.

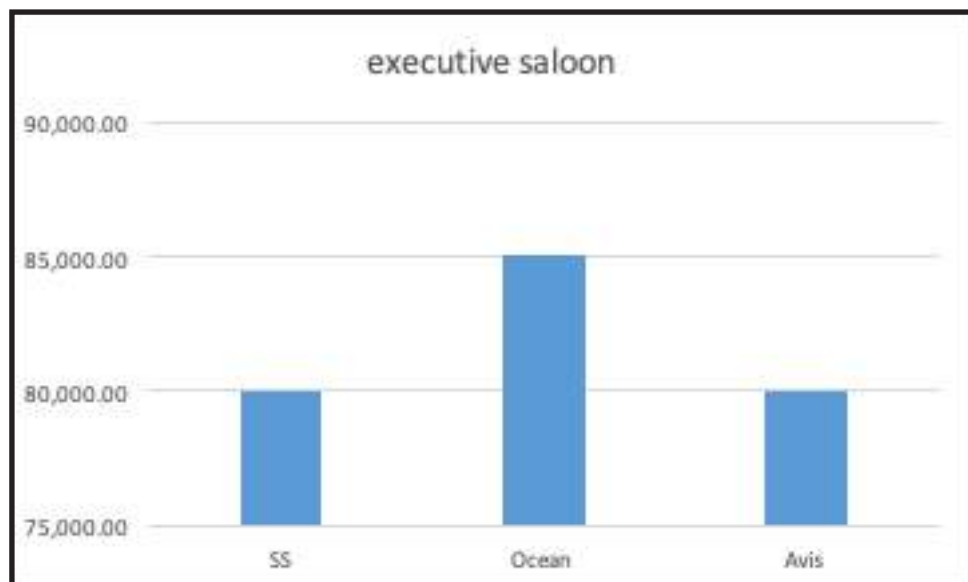
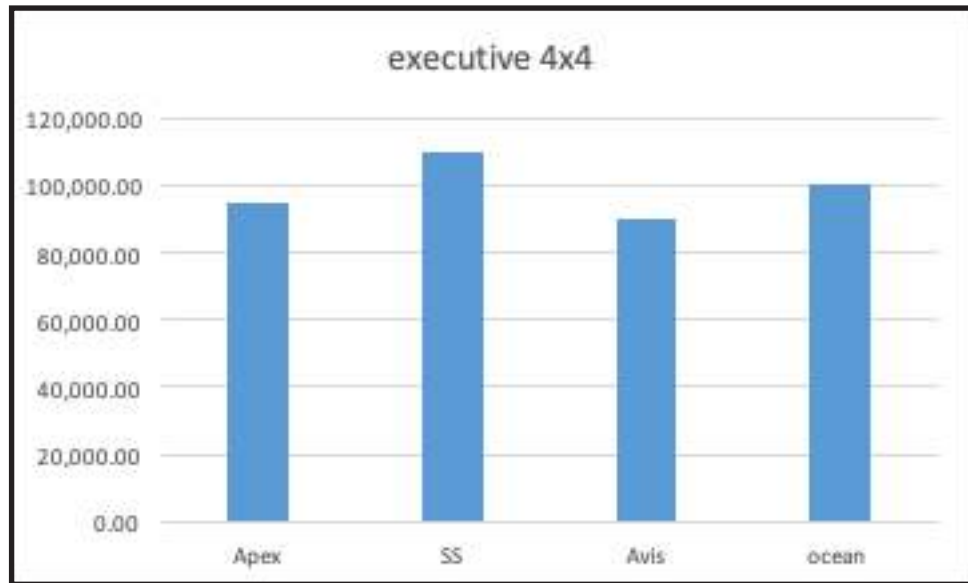
The prices for the bus/truck vary with most of the companies. Apex, SS rent a car, Avis and budget all have similar prices however ocean and countrywide are noticeably higher. And this is due to product differentiation because Ocean and countrywide claim that



they have larger trucks compared to the other companies and ocean claim to have larger buses than the standard Toyota coaster which is the most common bus in the car hire industry in Lilongwe.

In the executive 4x4 segment only four of the six companies have executive 4x4 vehicles. The prices are reasonably close with each of the companies renting the vehicles out between 90,000.00MWK and 110,000.00 MWK. The difference is only 20,000.00 however that could be due to the fact that SS rent a car may have newer vehicles than the other companies.

In the executive saloon segment only three companies can qualify. This is because the other companies do not have executive vehicles. All of these three companies have similar prices with AVIS and SS rent a car having the same price. The difference between the highest price and the lowest price is 5,000.00 MWK which equates to 6.6 USD which isn't a big difference.



Summary and analysis of price survey

The prices of most of the vehicle segments seems to be similar between the companies. However there are segments where there is a lot of difference in price. This can be evidenced in the bus/truck segment where there is a considerably higher difference than in the other segments. This is due to the fact that Ocean car hire state that they have larger busses than other companies and Countrywide claim to have larger capacity trucks in their fleet. The price difference in the other segments is dependent on the age of the vehicles or the brand of the vehicle. The trend that is identified in the price survey suggests that the prices of hiring a vehicle are fairly close. This suggests that wither the firms do not compete with one another in price, or they are extremely price competitive and react to another companies change in price quickly. This is an example of non-collusive, price competitive oligopoly.

An important factor to consider when reviewing the prices of the car hire market is that

the prices which I have made the graphs on do not include extra charges such as 16.5 % VAT, 1% tourism levy and finally insurance charges which vary from 2,500 MWK - 5,000 MWK per day depending on whether the insurance is comprehensive or third party on the vehicle. (note: only some companies charge insurance per day). In addition to this the rates which I have used are flat rates in which the companies do not charge per KM as well as the daily hire (10,000 - 20,000 MWK per day and an additional 150 - 200 MWK per KM). This type of pricing is not as relevant because, according to my customer surveys and interviews most of the customers drive allot of miles during the course of the hire and this would workout cheaper for them.

Interview with company owners

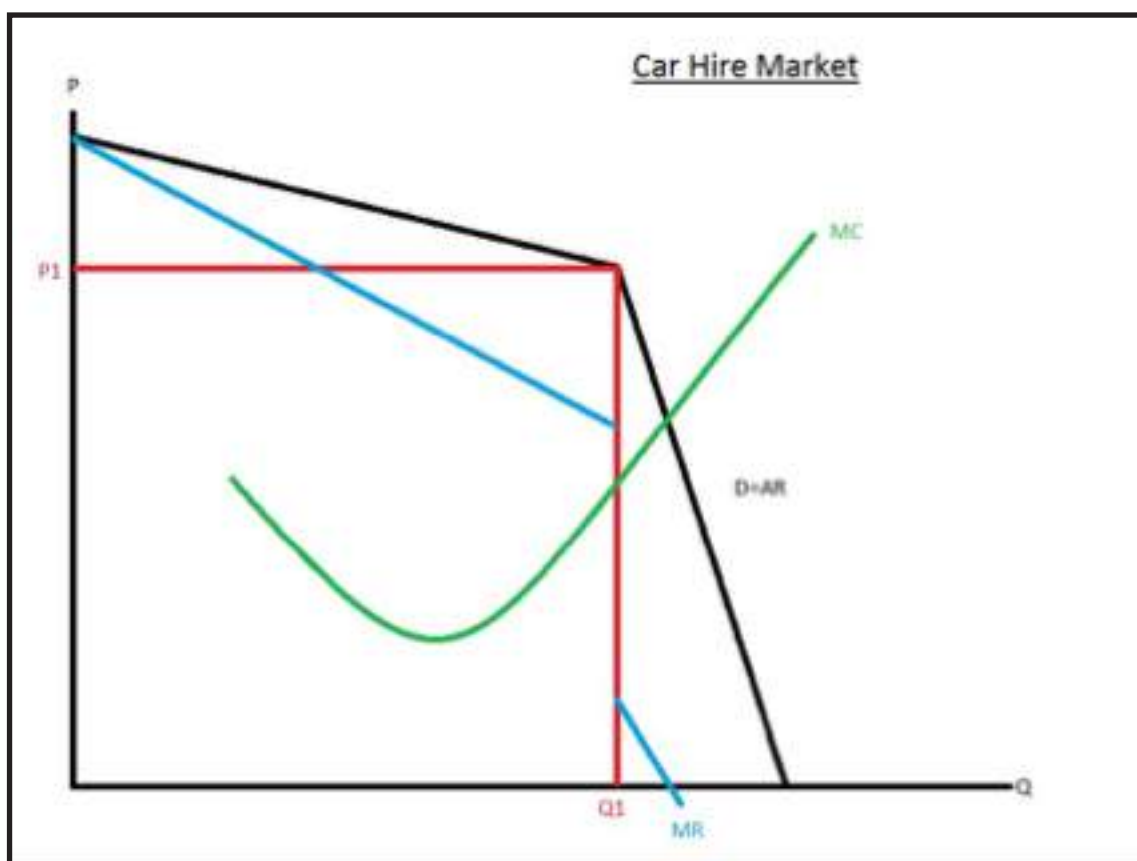
In the interview the owners were asked some questions about the market. The purpose of these interviews is to see what response the owners would give and if their responses were similar or not. The responses are in Appendix A.

Summary and analysis of interviews with company owners

Interviews were conducted with Mr. Kasmani (Apex Rent A Car), Royal car hire and Modern car hire (owner preferred to stay anonymous). All of the company owners said that their main customers such as NGO's are all regular customers. This indicates brand loyalty towards the companies from certain customers. The owners of the companies all stated that price is not usually the deciding factor for companies looking to hire vehicles unless there is a large difference in price especially for a short-term hire. If it is a long term hire they look for the cheaper options as over the course of a month, 5,000 MWK extra per day will result in an extra 155,000.00 MWK. The companies/NGO's also take into consideration the reputation of the company, what type of vehicle it is, the age of the vehicle, if the vehicle is maintained and the mileage on the vehicle.

However, for a tourist coming into the country the price of the daily hire does make a difference as they might be looking to save money or they have little experience with the car hire market in Malawi and will not know that many companies do not maintain their vehicles and are not trustworthy hence the low price. Many of these characteristics are features of monopolistic competition in which there is brand loyalty and product differentiation to an extent.

When asked about collusion all of the owners of the companies denied any form of collusion. "It is the complete opposite of collusion, companies compete with each other, decreasing prices when their competitor decreases prices and we prefer to not share the market with one another" said Mr Kasmani.



As companies in the market are looking to maximize profits they will produce where $MC=MR$. Companies in competition would not usually follow a raise in price when one company raises its prices however it is more likely that a company would lower its prices when another car hire company lowers its prices as the market is fairly inelastic to a minor decrease or increase in price however it is elastic to a larger increase in price. However, prices tend to stay stable in markets which follow the kinked demand curve. This is because if most firms have settled for a price which is similar to that of other companies there will be little point in changing the price slightly if we are following the model for the kinked demand curve. This can even be evidenced from the interview with Mr Kasmani in which he said "the prices which most companies charge are attached to the Dollar. However, we will only change the price if the rate changes significantly. Over the past few years the dollar to MWK rate has been stable and as a result the prices for most companies are stable. We will only consider dropping prices if it is a long-term hire in which customers will look for cheaper rates. We will not go below a certain point as if that occurs even if the customer takes a few extra cars we will end up losing money." This extract shows that the market closely follows similar principals to the kinked demand curve. This shows that the market is leaning towards a non-collusive oligopoly.

When asked about selling points companies such as Apex Rent a car and Avis provided

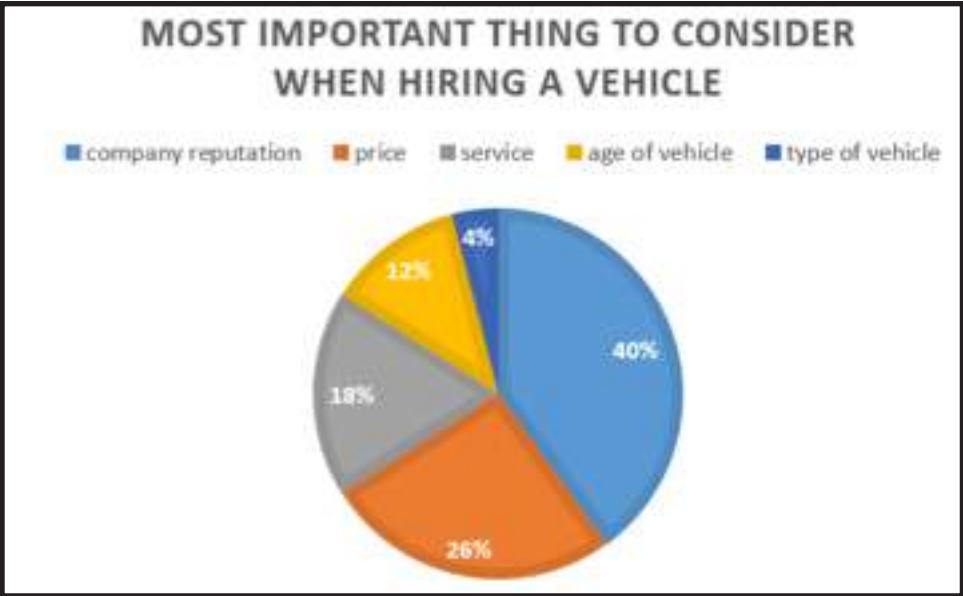
fairly new vehicles however Apex rent a car was the only car hire to offer a replacement vehicle if the vehicle you were using had any problems with it.

In terms of paid advertisement most of the companies had websites, billboards, flyers/ leaflets in areas where there are a lot of tourists (hotels, resorts etc...) As well as this companies have stickers on their vehicles to advertise what company that vehicle is from. Even though the firms are not in collusion non-price competition is a direct result from the fact that the prices in the industry are stable.

All three owners said that one major selling point was that the firms had to provide good service in order to gain customer loyalty. Most of the market is organizations such as NGO's and most of the car hire companies rely on them returning to their firm and hiring from them again as well as recommending the car hire to other people and organizations. This is a characteristic of monopolistic competition.

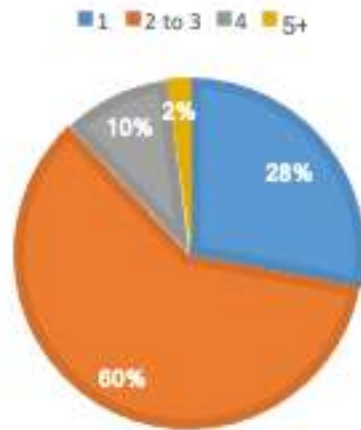
According to the three owners many of the car hires have been open for over 10 years and have gradually gained customer loyalty over the course of 10 years or longer. This creates another barrier for entry for new businesses looking to enter the market. This is because many of the experienced businesses in the field would have already had good relationships with customers and many of their customers are brand loyal customers. The customers would find it extremely difficult to trust the new businesses in the market and as a result would not change the firm they are going to even if the prices are cheaper.

Customer survey. A total of 50 customers were surveyed in the target area. The questions were made so that we could find out the behavior of customers in different scenarios.



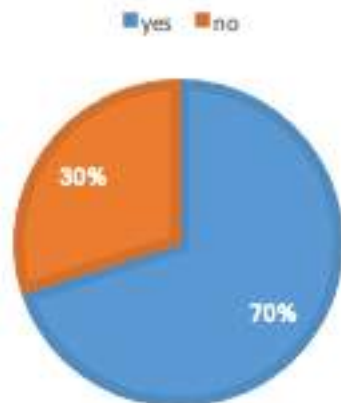
As we can see from the graph, most people look at the company reputation (40%), price (26%) and the service (18%) they are getting for their money. The customers tend to not really mind the age of the vehicle (12%) and type of vehicle (4%) as much.

HOW MANY COMAPNIES DO YOU VISIT BEFORE DECIDING ON WHERE YOU WILL HIRE THE VEHICLE FROM?



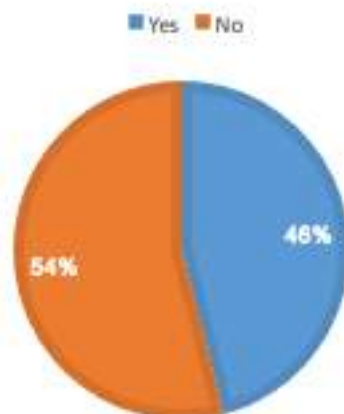
As we can see from the graph, most people go to 2-3 companies before they decide. The second highest is going to only one company. This is obviously through brand loyalty. Few people decide to go to more than 4 companies.

ARE YOU AWARE OF THE MOST EXPENSIVE AND THE CHEAPEST CAR HIRES?



According to the customers the majority of them know the most expensive and the cheapest places to rent out cars from.

WOULD YOU STILL GO TO THE SAME COMPANY IF THEY INCREASED THEIR PRICES BY 5,000.00 MWK?



According to the graph on the side, the customers who said yes are clearly going for brand loyalty however the customers who say no understand that in the long term it will work out allot more expensive for them.

It appears that the customers have a strong brand loyalty. This could be due to a number of reasons for example they could trust the company because the company's cars have never given them a problem before or the customer service may always be good. However, the trend still follows the kinked demand curve with more than half of the people saying they would change the company if the price rose by 5,000.00 MWK.

Conclusion

Hypothesis 1 states "I believe that the Car hire market will closely resemble an oligopoly market."

The evidence suggests that the first thesis statement was correct to an extent as the market had many features from oligopoly such as high barriers to entry which is due to the high capital required to buy enough vehicles, as well as hire staff and customer loyalty. The stable prices in the market as evidenced by the price survey as well as interviews with the owners of the companies. The companies compete in non-price wars. Finally, the market closely follows the kinked curve.

However, there are also some features from monopolistic competition for example, there are many firms in the industry. In addition to the interview, the other data collected show that there is product differentiation and companies are competing against each other in order to make their company stand out from the crowd.

Hypothesis 2 states "customers will choose the company they are purchasing from based on price, quality, company reputation and finally customer loyalty." According to the surveys this hypothesis was correct as there is evidence of customer loyalty due to the company's reputation which has become good because of the quality of their products.

Hypothesis 3 states "The main form of competition in the car hire market in Lilongwe would be the quality of the vehicles as prices are similar." As we have discovered in the research stage, the quality of the vehicle is important however it is not the main form of competition. It is overcome by prices, company reputation and customer loyalty.

The investigation has proven that most of the hypothesis' were correct and on the spectrum the car hire market falls in between oligopoly and monopolistic competition however more closely resembled with non-collusive oligopoly.



Relating back to the question: 'what is the market structure of car hires in Lilongwe, Malawi?' according to the investigation carried out the dried seafood market closely resembles an oligopoly however with a few features from monopolistic competition.

This has demonstrated how theory would be able to explain a real life market with high accuracy. It was amazing to see how the theory of the kinked diagram was applied to a real life market and it was accurate in explaining what was actually happening in the market and what would happen if a firm increased its prices.

However, there were some limitations to the investigation. The first being that not many of the owners were willing to have an interview with me, none of the owners wanted to give me a list of all of the organizations that they worked with and finally none of the main NGO's were willing to have personal meetings with me.

Throughout the investigation one major question that has arisen is 'at what specific price points does the kink in the demand curve lie on?' I believe this is an extremely challenging question as we can't know the price points through theory as many other factors contribute such as customer loyalty, number of firms that have that specific vehicle and many more factors.

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Imamah Kassam



Biology

How does sugarcane consumption affect the dental hygiene of Malawians?

Introduction

I came to this topic as I am very passionate about dentistry and it is a profession I would like to pursue. As part of my Creativity, Activity and Service Program (CAS), I volunteered at the dental department of one of Malawi's main government hospitals Kamuzu Central Hospital (KCH) which gave me the inspiration of focusing my research question on the oral healthcare issues in Malawi. Before finalizing my research question, some guiding questions that helped me construct my research question were:

Do Malawians who live in rural areas with access to sugarcane have better or worse oral hygiene than those who don't?

Does chewing sugarcane multiple times a day have an effect on teeth or does the bagasse (inner flesh of sugarcane) remove any bacteria from the teeth thus cleansing the mouth?

Since Malawi produces sugar locally through cultivating sugarcane, does this give Malawians access to more sugar thus deteriorating their oral hygiene?

These questions aided me in the formation of my research question which is; 'How does sugarcane consumption affect the dental hygiene of Malawians?'

One of the main sources for my research was a dentist who works at KCH by the name of Dr. Nathan Lungu. I interviewed Dr. Lungu many times formally and informally asking him major and minor questions that I had regarding my topic. He also helped me translate my survey into Chichewa thus eliminating the language barrier between me and the patients. Apart from Dr. Lungu, I surveyed 100 Malawians to get raw data for my extended essay answering questions that will be discussed in the 'Investigation' stage of the essay as well as increase the credibility of my analysis. I constructed a lab on the

effect of sugarcane juice on teeth. I also compared and contrasted two other similar experiments done in South Africa and Tanzania.

Hypothesis

I predict that sugarcane consumption will have a negative effect on the oral hygiene of Malawians as sugar is one of the main factors that allow formation of dental caries. Caries (or cavities) are formed as a result of high intake of sugar that is caused by bacteria known as Mutans Streptococci (Rosenberg), the micro organisms use sugar as a source of energy which results into a byproduct formed by microbes in the mouth known as lactic acid. The bacteria themselves are resistant to this acid however the tooth enamel is not, thus allowing it to corrode and form cavities (Rosenberg).

Investigation

The concept of my research was to determine the effect of sugarcane juice on teeth. The sweetness of the juice is what will affect the formation of caries. The bacteria in the mouth digest sugars and carbohydrates that are consumed through the intake of food. Whilst digesting these foods, the bacteria release acids, when mixed with saliva they form plaque which leads to tooth decay if not removed through the brushing of teeth or floss (LiveScience, 2018). As Malawi is a less economically developed country (LEDC), everyday sources such as toothpaste and a toothbrush are not affordable items for the rural dwellers thus allowing for a greater formation of caries.

As part of my research, I decided to conduct a lab that would determine the direct effect of sugarcane juice on teeth. This was managed by putting 3 teeth of different masses into different concentrations of sugarcane juice for a week. Similar studies were conducted in South Africa and Tanzania.

The study conducted in South Africa was done by the Dental Research Unit of the South African Medical Research Council and the University of the Witwatersrand in Johannesburg, South Africa in 2001(Harris, Cleaton-Jones). In South Africa, 98 sugar cane chewers were observed for their dental hygiene and the results revealed that 35.7% of the subjects mainly adolescents and elderly were caries free (Harris, Cleaton-Jones). The main reason for tooth loss in the older age group was by periodontal disease which occurs when bacteria enters the gum and causes redness, tooth loss, tooth sensitivity and if not treated in time can destroy the jaw bone (Mayo Clinic). This study found that caries were mostly seen in adult men and women (Harris, Cleaton-Jones).

The study taken place in Tanzania compared the oral healthcare of farmers (who grew

and chewed sugarcane) to that of the sellers of the crop who lived in the urban areas of Tanzania. The Tanzanian study showed that the farmers had worse dental hygiene than the sellers. This is due to the farmer's lack of brushing teeth and their high sugar consumption (Frencken, Rugarabamu).

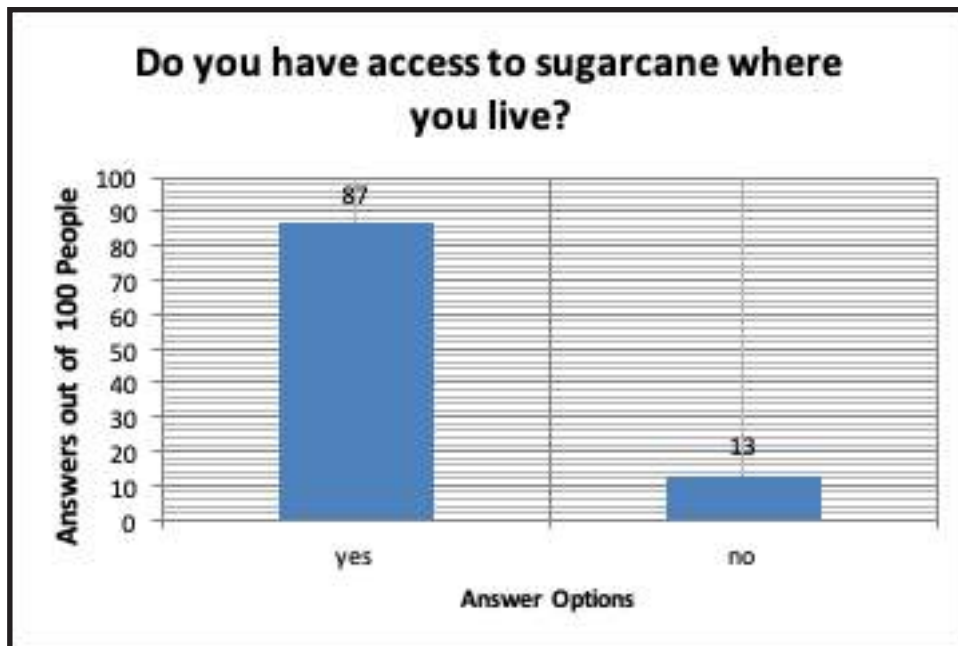
I have included these studies as part of my research as they have guided me whilst I was pondering on a hypothesis to write. They have given me an idea as to what I am to expect in my experiment i.e. that sugarcane juice will have a negative impact on teeth, considering the two countries share the same continent as Malawi. The base of my topic may be similar to other studies; however the uniqueness of my research is that I will perform an experiment which directly relates to the biological aspect of the effect of sugarcane juice on teeth. As part of the research stage of the essay, I have also set out a survey of 100 Malawians from different socioeconomic backgrounds querying where in Malawi they live, how often they chew sugarcane, why they came to the dentist and how often they brush their teeth. The questions and a copy of the survey can be seen in Appendix i. A copy of the answers can be seen in Appendix iii.

Data outline and analysis:

The data collected was from a group of 100 Malawians who came to the Kamuzu Central Hospital's Dental Department. The collection of data was done verbally by a Chichewa translated version of the survey. The translation was then double checked by the Head of Department, Dr. Moyo. Before initiating the surveying process, each respondent was clearly told that none of their personal information will be harmed in this survey and all responses will be kept anonymous, however they were given the option to decline from taking part in the survey if they felt uncomfortable. The people who chose to respond were also told that I was a student at Bishop Mackenzie International School and this information was for an essay that I was going to write on the effects of sugarcane on teeth.

Graphs 1-4 depict different questions and answers that were in my survey, which are depicted in percentage and the results will be easy to visualize since the number of participants is 100. Furthermore it will be accurate since I will be working in round figure which is 1 person per 1%.

Graph 1: Do you have access to sugarcane where you live?



Outline:

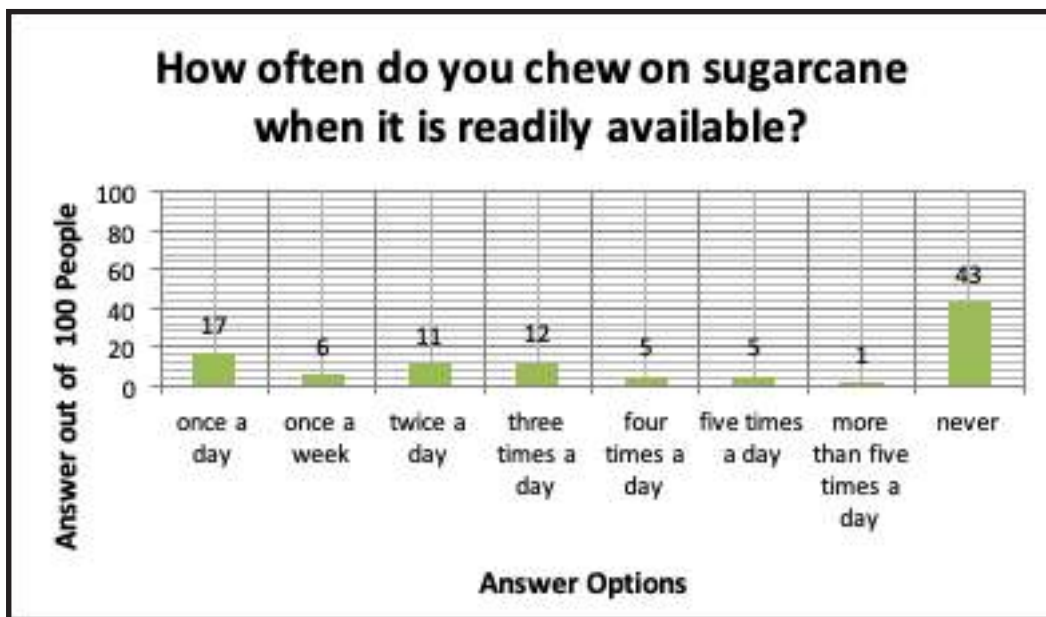
As can be seen by Graph 1, 87% of the Malawians that were interviewed do in fact have access to sugarcane whereas only 13 % do not. This data shows that most Malawians do live within close proximity to sugarcane fields so one can assume that there may be a correlation between living near a plantation and the consumption of the vegetable.

Analysis:

Out of the 13% of people who do not live in close proximity of sugarcane fields , 5% consume sugarcane at least once a week and of these 5%, 3% came to the dentist due to tooth sensitivity: therefore, there could be a correlation between sugarcane consumption and tooth sensitivity. Other factors such as how many times they brush their teeth need to be assessed as well, and from the data collected, only 1% out of the 13% brush their teeth only twice a week, whereas the others brush their teeth twice a day (Graph 4). Both groups consume sugarcane once a week (Graph 2).

On the other hand, 2% of the 13% consume sugarcane 3 times a week (Graph 2). One of them came for a regular check up whereas the other came for an extraction. The rest of the 6 never eat sugarcane. From this data, it can be seen that the majority of the 13% eat sugarcane and have come to the dentist because they have felt some sort of sensitivity and as a result had to have their teeth extracted. Though these figures are from a small number of people surveyed, the data is still something that could help me answer the research question.

Graph 2: How often do you chew on sugarcane when it is readily available?



Outline:

Graph 2: Illustrates the investigation on how often Malawians chew on sugarcane when it is readily available. I was wrong in thinking that majority of my surveyed group were consuming the vegetable when it is easily available however nearly 43% said that they did not consume sugarcane but visited the dental department for their oral hygiene. On the other hand 57% confirmed that they consumed sugarcane on a regular basis. Such feedback left me to ponder to investigate on a reason for their visit to the dentist.

Analysis:

Out of the total 100 people that were surveyed, 43% do not consume sugarcane when it is readily available however out of those 43, 29 people came for an extraction (Graph 3). Moreover, the astonishing fact is that all 57 people who do consume sugarcane came to the dentist for a tooth extraction !!! This statistic proves that there is an effect of sugarcane juice on teeth which points that my hypothesis could be correct. However, as stated before, factors such as how many times the persons brush their teeth and their oral care have not been included as of yet.

Graph 3: Why have you come to the dentist today?



Outline:

Graph 3: Demonstrates that 86% of the people came to the dentist for extractions due to pain and or sensitivity they felt in their teeth which is generally caused by cavities. This leads one to assume that Malawians have poor oral hygiene in the sense that they do not brush their teeth as recommended. The second most common reason people came to the dentist was 'other' this could mean anything from cleft pallet surgery to getting a filling done so this reason will not have any major impact on the relevance to my question. Three percent of the people came for loose teeth issues; this generally implies older people that are having trouble with their teeth and need to get them removed.

Graph 4: How often do you brush your teeth?

Outline:

In Graph 3, I had discussed that it can be assumed 86% of Malawians had their teeth extracted due to tooth sensitivity. However, Graph 4 notes that 55% brush their teeth



three times a day (which is more than half); this led me to inquire why they still have cavities? This point will be talked about in more depth later. Looking at the data, only 2% of the people never brushed their teeth, which is much lower than my expectation.

Analysis:

One of the 57 people only brush their teeth twice a week (though this is not an option to choose from, the patient verbally mentioned this so I included this in my analysis)—this could be a reason for the tooth sensitivity as they are not removing bacteria from the mouth therefore allowing caries to form. The majority of the people brush their teeth twice a day which is the recommended number of times to brush your teeth.

The data received somewhat implies that my hypothesis, sugarcane consumption will negatively affect oral healthcare is incorrect. Though sugarcane is readily available to Malawians, a lot of people do not consume the product therefore my hypothesis stating that sugarcane juice does have an impact on the oral hygiene of Malawians is debatable.

This then brought up the question that if people are brushing their teeth more than once a day, removing bacteria from the mouth and preventing the formation of caries--which is what causes sensitivity, then why do they still have tooth sensitivity? One of the pollsters was a lady who lived in a rural town called Dedza, she was waiting for her son, who was being treated by the dentist to drain the puss from his abscess. I asked her how many times they both brush their teeth and she said she brushes her teeth 3 times a day, and assuming her economic status, I was doubtful to the fact that she could afford to buy a tube of toothpaste. So I then inquired if she brushed her teeth with Colgate by pointing at a poster that was hanging up in the room. Her response is what I had assumed—she said that she did not use Colgate but she had a worn out toothbrush that her and her son shared to clean their mouths. First of all sharing a toothbrush is unhygienic which is probably what led to her sons abscess. Secondly, they do not use any fluoride based product which kills the bacteria in the mouth—I am convinced that such practice is common amongst the masses and now made sense as to why 57 Malawians—more than half of who were surveyed—came to the dentist due to tooth sensitivity.

With reference to a previous question which targeted whether the bagasse (inner flesh) of the sugarcane removes any bacteria from the teeth, the bagasse itself does clean teeth; however it is only effective once all the sweetness is removed from it. If the sweetness is not removed, it is just as equivalent as using a toothbrush that is dipped in sugar, this will clean the teeth but bacteria in your mouth will be fed which causes cavities (Chadel, da Silva, Singh). Globally it is a known habit that people spit out the

bagasse after consuming all the sweetness of the juice, and Malawians are no different to this practice as I have witnessed this on various occasions (Appendix ii).

Another form of research I have done to determine how sugarcane consumption affects the dental hygiene of Malawians, was a lab experiment I conducted which will be explained in detail.

Before I got access to human periodontal teeth, I focused on using egg shells as they are of similar texture to teeth so in the set up, I included the eggshells as well; however, this experiment was shelved since I managed to obtain human teeth. The main aim of the experiment was to determine the effect of sugarcane juice on teeth. For the experiment, I used periodontal human teeth that I managed to get from the dentists at KCH, in order to get the teeth I had to check in the IB EE guidelines if I was allowed to use extracted teeth in my experiment, I saw no regulations against it, as there would be no harm to anyone by asking for extracted teeth. Secondly, I sought approval from the dentists if I could use real teeth in my experiment, followed up with the consent from the patients whose teeth I obtained, some declined but I managed to get four teeth which were enough for my experiment.

I took safety precautions when handling the teeth as I wore gloves and glasses whenever I had to touch them. The next section in this essay is about how I conducted my experiment to aid me in answering my research question and depicting whether or not sugarcane juice has an effect on teeth.

Experiment

Aim: To see the effect of sugarcane juice on human teeth

Hypothesis: as the sugarcane concentration increases, the teeth will experience more decay as more dental carries form thus weakening the tooth enamel which will eventually demolish the tooth.

Materials:

- Beakers x4
- Periodontal teeth x4
- Latex gloves to handle the teeth
- 500 mL fresh sugarcane juice
- 500 mL water
- Masking tape and a sharpie for labeling
- Graduated cylinder

Method:

- Start off by weighing each tooth

Note down the masses in a data table

Fill 100 mL of water in a graduated cylinder and add it into a beaker

Label the beaker 'control' and add a tooth in the control beaker

Fill 20 mL of sugarcane juice into a beaker and label '1'

In beaker 1 add 80 mL water to make concentration of 20:80

Do the same for the other 2 concentrations (60:40 and 100:0)

Add the weighed teeth in the concentrated beakers

Wait a week for the results

After a week, take out the teeth and dry them off with tissue paper and weigh

Record the difference.

Set up:



Variables:

Independent:

Sugar concentration—20%, 60% and 100%

Dependent:

Mass of tooth (grams)

Control:

Variable:	Effect on results:	Method of control:
Concentration of sugarcane juice and water	If I use the same graduated cylinder, for both the water and the juice, then the concentration will not be accurate because not all of the juice will be out of the beaker before I put in the water	I will use two different beakers and label them both. 1 for water and 1 for the juice. This will avoid cross contamination of the two sources before mixing them together in their beakers according to the correct concentrations.
Controlled tooth	If I do not have anything to compare my results to in terms of qualitative data, then I will not know if there has been a change that has occurred.	I will have one of the periodontal teeth in 100% water so that at the end of the experiment I can compare the control to the teeth in the different concentrations of the juice.
Excess bacteria on tooth	If there is any excess bacteria on the tooth before I put the tooth in the juice, this will affect my results as they will not be 100% accurate	I will always handle the teeth with latex gloves to avoid contact with anything else.

Results

Teeth: % concentration of juice ± 0.1 Initial mass of tooth (g) ± 0.01 Final mass of tooth (g) ± 0.01 change in mass (g) ± 0.02

Control	0%	0.82	0.82	0
Tooth 1	20%	1.73	1.68	-0.05 ± 0.00085
Tooth 2	60%	2.61	2.49	-0.12 ± 0.0012
Tooth 3	100%	2.63	2.49	-0.14 ± 0.00126

Average change in mass -0.10 ± 0.0012

Percent error Tooth 1:

1.7% Tooth 2:

1% Tooth 3:

0.9%

Calculations:

Percent error and uncertainties:

$0.01/1.73 \times 100 + 0.01/1.68 \times 100 + 0.1/20 \times 100$

$= 0.6 + 0.6 + 0.5$

$= 1.7\%$

$1.7/100 \times -0.05$

-0.05 ± 0.00085

Conclusion of Data

The aim of my experiment was to depict whether there is an effect of sugarcane juice on teeth. I have done so by putting teeth into increasing concentrations of sugarcane juice. Taking the results into consideration, it can be said that there definitely is a correlation between the concentration of the juice and the time in which the teeth have stayed in the beaker. The difference between the masses was calculated by subtracting the initial mass from the final mass. The initial masses were generally a greater number than the final masses, thereby resulting in their difference being a negative number.

For the first tooth that was in the 20% concentrated beaker, the change in mass was -0.05 grams changing from 1.73 grams to 1.68 grams. The visible appearance of the tooth was still the same so there was not much qualitative data for this tooth; however, the juice was beginning to ferment so there was quite a pungent smell especially coming from the higher concentrations of the juice. The colour of the 20% concentrated juice was the same colour it was to begin with—a light brown cardboard box sort of colour. Tooth 1 to begin with was a cloudy white colour with a few visible cavities. At the end of the week, the tooth looked the same appearance but things had clearly changed.

The second tooth was in 60% juice and 40% water. The change in mass for this tooth was -0.12 which was more than twice of that of Tooth 1 even though the concentration only increased by 40%. This shows the damage that sugarcane juice can do to ones teeth. The appearance of Tooth 2 before adding it into the juice was a cream-ish yellow colour that enhanced the possibility the person to whom the tooth belongs to did not have the best oral hygiene. Before weighing and putting all the teeth into the different concentrations of sugarcane juice, I made sure to softly clean them with some cotton buds and tissue paper to try and remove any excess bacteria. After 7 days, parts of the tooth began to dethatch from the root. The reason for this was because the enamel was being torn apart by the sugar.

The third tooth was in 100% pure sugarcane juice. At the beginning of the week the tooth was solid with a few visible cavities like Tooth 2; however, I was appalled with the appearance by the end of the week. On day 7, Tooth 3 had broken into 2 pieces. Honestly, I was disgusted! The mass change for tooth 3 was -0.14 grams which as one would predict was the highest change in mass. The beaker of liquid for Tooth 3 was a dark brown almost black colour, and by the end of the week, it had a very pungent smell that was radiant in all areas of the lab.

Evaluation and Improvements

Overall, the lab was a success however some of the improvements that could have been made are; I could have weighed everyday for a week, that way it would have made making my graphs easier and I could have seen the gradual progression of the

change in data to see exactly when Tooth 3 had broken in half.

One of the problems faced was, whilst I was setting up the experiment with my supervisor, we were looking for an appropriate scale to use to have the best data for the lab. The usual accurate scale went missing so we had to use another scale that was in the cupboards. When we tried to assemble it, the plug was not working and so it wasn't switching on. We asked another teacher for some help and the problem was solved. In order to have avoided the problem, I could have prepared all of the equipment a day before doing the lab so that I wouldn't have wasted that time.

Referring back to the research question, it can be said for certain that there is a negative effect of sugarcane consumption on teeth. Evidence of this is seen in the results of the experiment conducted. Relating to the oral healthcare of Malawians, sugarcane consumption on a whole has a negative effect however, it is not the main influencer of the poor oral hygiene in the country, other factors such as access to oral hygiene products and awareness and the country's economic status play a big role since Malawi is still a developing country that suffers majorly from third world issues such as poverty. In order for the oral hygiene of Malawians to improve, the country on a whole needs to be able to afford healthcare and be educated enough to know how to take proper care of their health and hygiene needs. These factors can be looked at separately if one wishes to construct an essay abiding to these topics.

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Harishankar Krishnan



World Studies

To what extent can renewable biomass fuels be effectively and sustainably used in Chitetdzo Mbaula stoves to mitigate Malawi's contribution to climate change via deforestation?

Introduction:

The issue identified is the aggravation of climate change through deforestation, with a local case study in Malawi. Deforestation is the anthropogenic clearing of large areas of trees (National Geographic). The significance and importance of this issue is that deforestation is a major contributor to climate change as trees absorb and sequester carbon dioxide, which is the second most abundant greenhouse gas in the atmosphere after water vapor through photosynthesis (IB Geography Course Companion). Without this process, the climate could become highly unpredictable which could lead to devastation of agriculture, living conditions and human settlements all across the globe. Therefore, this choice of topic of researching possible alternates to wood-based fuels is justified in order to minimize the harmful effects of anthropogenic climate change. This essay explores Global Climate from a geography perspective, and from chemistry, Calorimetry and Thermochemistry. The benefits of an interdisciplinary approach was the ability to objectively evaluate the effectiveness of each fuel and the heat energy released from chemistry; while simultaneously exploring the realistic implications of these fuels in rural Malawi. The benefits of an integrative approach can broaden the understanding of environmental sustainability in Malawi; while helping facilitate the potential implementation of these fuels to reduce deforestation.

The materials, sources data, and evidence used were interviews with Richard Carpenter and his thesis, where he conducted a local case study providing background knowledge of fuels and stoves used in Malawi. Information from Afribam, a local bamboo selling organization that are experts in sub-tropical, rural bamboo growth was used. An enthalpy experiment was used later in the essay to determine the most efficient fuel at boiling water.

Background on Malawi's fuel consumption:

Stoves normally used:

The standard stove used by locals around Malawi is the Chitetdzo Mbaula stove. This is a stove made of clay and can additionally have metal supports on the sides to facilitate carrying and moving the stove. It has a chamber with an opening under the support for the pot which allows for the fuel being burned to be placed directly underneath the cooking pot. Several studies have been conducted into improving the design of the stoves used in Malawi, and the Chitetdzo Mbaula stove is known for its thermal insulation capabilities (Carpenter).

Usage of fuel and fuel intensity:

There are two main usages of the fuel in Malawi; cooking nsima, the local staple, and heating of water. Nsima is made by mixing dried maize powder with water while at a high temperature. Other elements of the Malawian diet are not really significant to record, other than small fish, relish and sweet potato. The traditional foods are usually very energy intensive to cook, needing highly intensive flames to be maintained. For example, the cooking of nsima requires a large quantity of hot water to remain at a boiling temperature for five to ten minutes (Carpenter).

Water collected must be boiled in order to purify it from bacteria and other possible contaminants. 20% of Malawians still do not have a secure source of clean water, which is roughly 4 million people (USAID). The rural population hence depends on biomass fuels extracted through unmanaged and unsustainable deforestation, further contributing to climate change through the release of trapped carbon dioxide (Natural Resources Canada).

Alternative fuels used must burn at a high intensity in order to bring water to boil at approximately 100C, thus safely purifying it. Fuels that fail to meet this specification, and cannot bring water to boil, are impractical substitutes for the commonly used indigenous forest-based wood or charcoal (Carpenter).

Deforestation and rainfall affecting agriculture:

In Malawi, the maize crops are planted in a seasonal fashion, during to the rainy season. Based off of that harvest, which is notably the only time locals have enough water to grow crops, is when enough food for the entire year is collected and dried, then to be used or sold whenever the farmer chooses fit.

Deforestation has a major impact on rate and amount of rainfall in an area (Scientific

American). As the trees recycle rainwater present in the soil and transfer it back into the atmosphere through a process known as transpiration (Bitesize). The fewer trees are present, the drier the air becomes and the less water is present in the atmosphere to condense into clouds. This results in less rain, which can negatively impact a country that is heavily reliant on it. Without sufficient measures to minimize unmanaged deforestation, potential food shortages could take place in Malawi (National Geographic).

History of deforestation around Malawi:

From 1990 to 2010, the area of forest cover has significantly decreased, from 41.4% to 34.4%, (United Nations Food and Agriculture Organization). Geographically, the Northern Region has the most forested areas in Malawi, compared with the Central and Southern Regions combined. This is mainly due to the larger populations residing in the Southern and Central regions compared to the Northern region (Ripple Africa). There are two main causes of deforestation, one being cutting trees for timber and firewood, and the second being slash and burn agriculture, aiming to increase the farming area available. The burning of trees to clear land releases vast quantities of carbon dioxide into the atmosphere (Bennet). This mirrors deforestation occurring in Indonesia, which has released 11.3 million tons of carbon dioxide per day (Rochmyaningsih). While focusing on the need for firewood as the primary causation of deforestation in Malawi, the overall effect remains the same: more soil erosion and less nutrient rich soil. In this sense, Malawians are inadvertently contributing to their own hardships. By cutting trees, they are augmenting climate change, which changes seasonal rainfall patterns and causes more extreme weather phenomena to occur, such as flooding or drought; thereby reducing maize yields.

Ripple Africa states, "Wood is the main fuel in Malawi, and 95% of homes still use wood or charcoal for cooking." The government has created laws; however, there is little to no regulation of these laws prohibiting mass deforestation in rural areas. An estimated 90kg of wood is burned every week in a Malawian home (Ripple Africa). Being the cheapest fuel for local Malawians, it is increasingly difficult to convince them to stop using wood. Currently, there is poor forest management and lack of replanting causing uncontrolled deforestation, instead of being potential contributors to Malawi's economy in the form of sustainable logging and trade (Waldrow).

Nexus between Deforestation, Climate change and food production:

This nexus is what proves that the rate of deforestation needs to be reduced immediately, thus justifying the need for a comprehensive study on biomass fuels replacing wood or charcoal. Malawi being a developing nation, with heavy reliance on subsistence farming and seasonal production of maize, will be significantly impacted by climate

change. Climate change resulting from deforestation could then cause political and economic instabilities and social unrest in Malawi and the sub-Saharan region of Africa, mirroring the events prelude to the Syrian civil war (Mathiesen). The nexus highlights the importance of the successful implementation of the sustainable development goals, primarily affordable and clean energy, leading to successful mitigation of climate change.

Aim:

Which renewable, biomass fuel is the most effective at boiling water on a Chitetdzo Mbaula stove?

Background Theory:

Calorimetry is a method to measure the heat released by a combustion reaction in a closed system. As the fuel reacts with the oxygen in the air, it releases heat as a product in an exothermic reaction. This heat is absorbed by water, resulting in a temperature difference that can be measured. Calculating the total heat energy absorbed by the water is done using the formula: $H = mc\Delta T$, where H is the heat absorbed by the water, m is the mass of water, c is the specific heat capacity of water (4.184 J/g C) and ΔT is the difference in temperature. Using this, the approximate heat released by the fuel will be $-H$ because of the conservation of heat law. Therefore, $H_{\text{SUBSTANCE}} = -H_{\text{WATER}}$. Through this process, it is possible to be able to calculate the energy released by a certain mass of fuel, which can help find the most effective fuel at boiling water.

Safety:

As you are dealing with flames, safety goggles must be worn at all times and a caution towards loose clothing must be practiced. Touching the pot without a towel will result in burning of hands. Make sure there is a lot of water and sand near you to douse any flames if needed.

Method:

Using a 250 ml graduated cylinder, 500ml of water was measured and poured into a pot and the initial temperature was recorded using a digital thermometer. Use the same graduated cylinder, pot and digital thermometer to avoid the differences caused by using different equipment. Measure the water as accurately as possible, as different masses of water require different amounts of energy to bring to boil. Then place one handful of dry leaves into the basin of the Chitetdzo Mbaula stove. The leaves are used as tinder to commence the combustion of the fuel; their mass is negligible and will not affect the temperature as they will burn up prior to heating the water. Use the same Chitetdzo Mbaula stove, as different stoves have different rates of air circulation or

different heat conservation capabilities. Weigh 80 - 90 grams of the fuel being tested in a container, using a two decimal point scale. It is important to use the same scale each trial to avoid sensor errors from different scales. Ignite the dry leaves using matches and once the flame is strong, place the fuel on top. Once the fuel is combusting steadily and little tinder is left, place the pot onto the stove. Record the temperature, the dependent variable, till its highest point using a digital thermometer in degrees Celsius, then use a towel to remove the pot from the stove. Empty fuels into a sand pit and pour water from a bucket, using a cup, onto the dumped fuels to douse the flames. Empty the pot and let it cool till it is safe to touch. This way, the effect of residual heat on the pot will not affect the temperature change of the water. Repeat the steps for 3 trials for wood, charcoal, paper briquettes, bamboo and tobacco pellets.

Paper Briquettes						
Trial #:	Mass of Water ($\pm 2\text{ml}$)	Initial Temperature: ($\pm 0.1^\circ\text{C}$)	Final Temperature: ($\pm 0.1^\circ\text{C}$)	Mass of briquette ($\pm 0.01\text{g}$)	ΔT ($\pm 0.2^\circ\text{C}$)	ΔH ($\pm 1\text{kJ}$)
1	499	23.1	64.8	81.94	41.7	87
2	502	23.4	92.0	88.13	68.6	144
3	501	23.5	92.1	88.26		
68.6	144					
Average				86.11	68.6	144

The first trial was the first experiment conducted. Only after comparing with the second trial did I realize that not all the fuel had burned in the first trial, causing the abnormally low temperature. Trial one has been removed from averaging.

Bamboo						
Trial #:	Mass of Water ($\pm 2\text{ml}$)	Initial Temperature: ($\pm 0.1^\circ\text{C}$)	Final Temperature: ($\pm 0.1^\circ\text{C}$)	Mass of bamboo ($\pm 0.01\text{g}$)	ΔT ($\pm 0.2^\circ\text{C}$)	ΔH ($\pm 1\text{kJ}$)
1	503	22.9	86.4	84.55	63.5	134
2	500	23.0	91.7	83.36	68.7	144
3	503	23.2	91.9	87.24		
68.7	145					
Average				85.05	68.7	144

Similar to the paper briquettes, trial one is an outlier due to a lack of combustion from the fuel. The bamboo pieces had been cut so small, that they could fall through air ventilation holes in the bottom of the Chitetdzo Mbaula stove. This caused a lower than measured mass to combust in trial one. Trial one has been removed from averaging.

Tobacco Pellets						
Trial #:	Mass of Water (± 2 ml)	Initial Temperature: ($\pm 0.1^\circ\text{C}$)	Final Temperature: ($\pm 0.1^\circ\text{C}$)	Mass of pellets (± 0.01 g)	ΔT ($\pm 0.2^\circ\text{C}$)	ΔH (± 0.5 kJ)
1	500	22.9	42.9	86.99	20	41.8
2	501	22.9	28.0	83.64	5.1	10.7
3	499	22.9	pellets did not burn.	85.07		
N/A	N/A					
Average				85.23	20	41.8

In trial one, the pellets burned well. However, in trial two, only a few of the pellets burned resulting in a low temperature. Trial two has been removed from averaging.

Firewood						
Trial #:	Mass of Water (± 2 ml)	Initial Temperature: ($\pm 0.1^\circ\text{C}$)	Final Temperature: ($\pm 0.1^\circ\text{C}$)	Mass of wood (± 0.01 g)	ΔT ($\pm 0.2^\circ\text{C}$)	ΔH (± 0.8 kJ)
1	501	22.0	66.4	85.75	44.4	93.1
2	499	21.4	72.4	86.43		
51	106.5					
3	501	22.0	63.7	81.77	41.7	87.4
Average				84.65	45.7	95.7

Charcoal						
Trial #:	Mass of Water (± 2 ml)	Initial Temperature: ($\pm 0.1^\circ\text{C}$)	Final Temperature: ($\pm 0.1^\circ\text{C}$)	Mass of charcoal (± 0.01 g)	ΔT ($\pm 0.2^\circ\text{C}$)	ΔH (± 0.5 kJ)
1	502	24.0	charcoal did not burn	82.26	N/A	N/A
2	501	23.9	32.4	83.36		
8.5	17.8					
3	499	24.1	charcoal did not burn	82.59	N/A	N/A
Average				82.74	8.5	17.8

The small dry leaves did not provide enough initial flame to ignite the charcoal, which is why two trials failed to raise the temperature.

Change in enthalpy per unit mass data table:

$\Delta H/\text{gram}$	Paper Briquettes ($\pm 0.01\text{kJ/g}$)	Bamboo ($\pm 0.01\text{kJ/g}$)	Tobacco Pellets ($\pm 0.04\text{kJ/g}$)	Firewood ($\pm 0.02\text{kJ/g}$)	Charcoal ($\pm 0.09\text{kJ/g}$)
Trial 1	1.06	1.58	0.48	1.09	N/A
Trial 2	1.63	1.72	0.13	1.23	0.21
Trial 3	1.63	1.66	N/A	1.07	N/A
Average	1.67	1.69	0.49	1.13	0.22

Qualitative Data:

Paper Briquettes: There was an intense flame generated. The briquettes needed to be broken up in order to burn well. There was little to no smoke generated and it was efficient and easy to ignite.

Bamboo: The bamboo generated an intense flame, was broken into small pieces and did create some smoke. However, there was no sooting, so heat was not lost due to incomplete combustion. This was also fast to catch fire and was very straightforward to use.

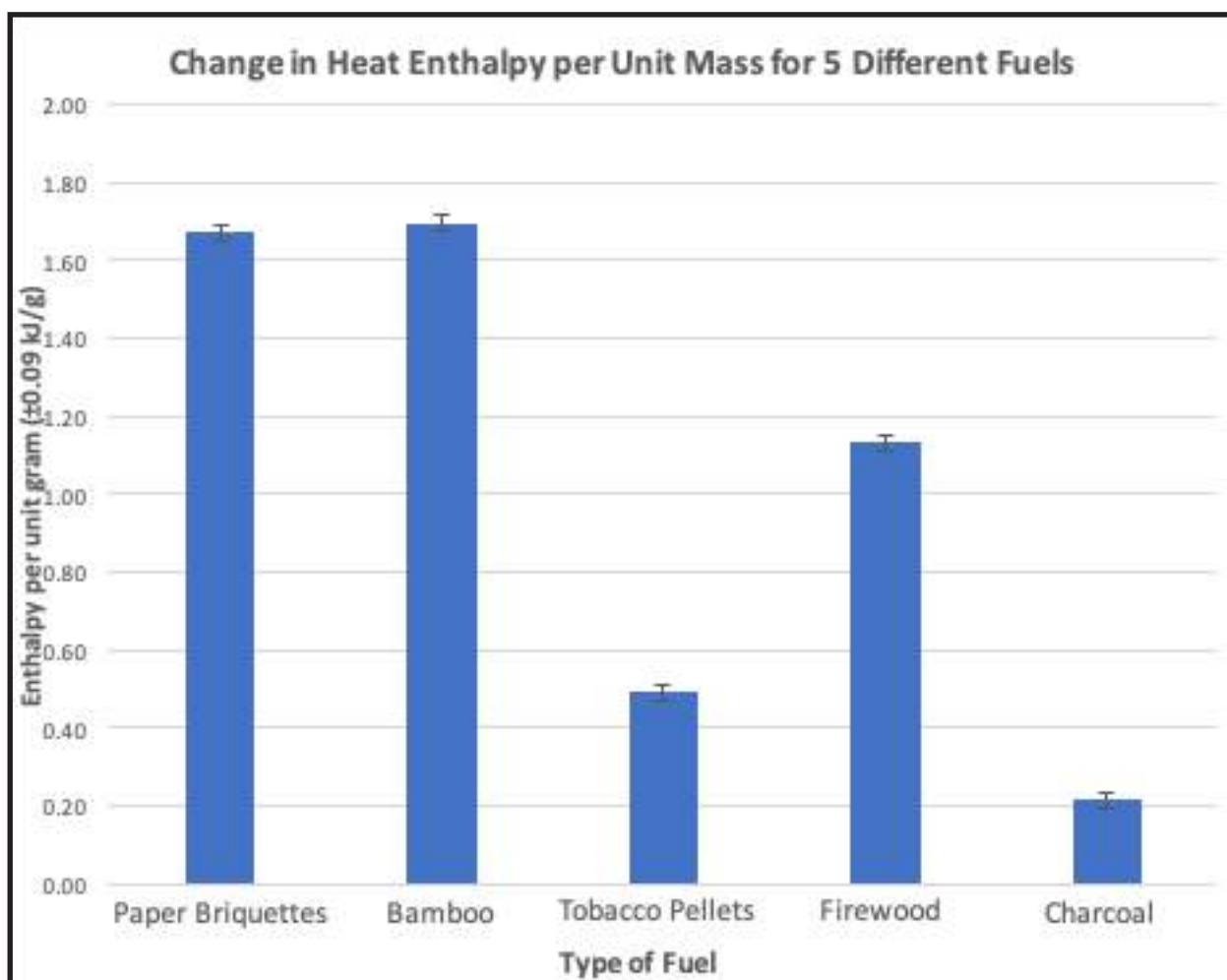
Tobacco Pellets: Acts like charcoal and is very difficult to burn. The pellets were falling through the ventilation holes at the bottom of the stove. There was a very foul smell along with smoke when burning, which causes coughing if inhaled. This fuel requires a lot of assistance through fanning and extra tinder yet an intense flame was not generated.

Firewood: Somewhat intense flame seen but needs a large quantity to be able to burn constantly. The most sooting and the most smoke generated from all fuels not a good sign of heat transfer causing eyes to tear and lots of coughing.

Charcoal: Extremely difficult to ignite charcoal based off tinder alone. Takes a very long time to heat up and glow. Usually an accelerant is used such as paraffin to assist in ignition. No flame intensity, so takes a long time to even make water a warm temperature of 40°C .

Graph:

Figure 1: Graph of Enthalpy Experiment



Conclusion:

In this experiment, the change in heat of water was measured when it was being heated by different fuels on a Chitetdzo Mbaula stove. From Figure 1, the results from this experiment shown in order of increasing heat energy released per unit mass is: charcoal, tobacco pellets, firewood, paper briquettes and bamboo. Figure 1 shows the most reliable fuels that has had the highest average change in temperatures are bamboo and paper briquettes. Their average change in heat per unit mass was calculated to around 1.69 kJ/g and 1.62 kJ/g respectively, while their average change in temperature were both measured at approximately 68.7°C. While firewood burns intensely, it requires a much larger volume of wood to maintain the same temperature, as well as a continuous supply of it. The limited mass restricted the firewood's ability to bring the water to a high temperature. This reduces its potential to be a reliable or sustainable cooking fuel. Tobacco pellets are highly dense, making it hard to ignite. However, the stored energy

inside is high and could burn well and for a long time if enough ignites. The same can be said of charcoal. As a dense fuel, without an accelerant, it cannot release the majority of its stored energy, justifying its lack of a high energy release in the experiment, despite being used all across Malawi.

Example Calculations: Paper Briquettes Trial 3:

$$\Delta H = mc\Delta T$$

$$\Delta H = (501 \times 4.184 \times 68.6) \div 1000$$

$$\Delta H = 143.79822 \dots \text{kJ}$$

$$\text{Uncertainty } \Delta H = (2/501 \times 100) + (0.2/68.6 \times 100)$$

$$= 0.690746 \dots \% \text{ uncertainty}$$

$$(0.690746 \dots) / 100 \times 143.7982 \dots$$

$$= \pm 1 \text{kJ}$$

$$= 144 \text{kJ} \pm 1 \text{kJ}$$

$$\Delta H / \text{mass} = 143.79822 / 88.26$$

$$= 1.62925 \dots \text{kJ/g}$$

$$= 1.63 \text{kJ/g} \pm 0.01 \text{kJ/g}$$

$$\text{Uncertainty } \Delta H / \text{g} = (0.01/88.29 \times 100) + (1/144 \times 100)$$

$$= 0.710627 \dots \% \text{ uncertainty}$$

$$= (0.710627 \dots) / 100 \times 1.629257 \dots$$

$$= \pm 0.011577 \dots \text{kJ/g}$$

$$= \pm 0.01 \text{kJ/g}$$

Evaluation:

The limitations of the chemistry experiment inhibited the best collection of data. Changes in external temperatures was the first problem experienced. While the safety section expresses the need to conduct this experiment outside, it also places it susceptible to the elements and shifts in daytime temperatures. As the day progressed, a secondary thermometer set up indicated that the outside temperatures gradually dropped from approximately 25C in the afternoon to 22C in the evening. This meant that more of the heat generated was moving towards heating the surroundings rather than the water due to the laws of thermodynamics. A proposed solution to this problem is to conduct the experiment from mid-morning till mid-afternoon, where there are few temperature changes. The surrounding temperature will be higher as well, thus more heat energy from the fuel will transfer into heating the water. The sooting observed was a sign of incomplete combustion, which implies that a proportion of the stored chemical energy is not being transferred as heat energy to the water.

Another problem found was that the heating of the water was imbalanced. Certain portions of water had a higher temperature than others, indicating that the flame underneath it was imbalanced. While this does not affect the energy released by the fuel, it does affect the calculations depending where in the pot the temperatures are measured from. This can have huge effects on the values of ΔT and the calculated enthalpy. To minimize these imprecisions, a smaller pot will be beneficial.

Additionally, some fuels like charcoal and tobacco pellets would not burn with the heat from the small leaves. They are fuels that are highly dense for their surface area, making them harder to combust and release energy. As they are usually used simultaneously with an accelerant such as methylated spirits in local villages, I can use equal volumes of accelerant to start each fuel, or I could use a larger tinder base, thus making the charcoal fuels ignite and release their stored chemical energy.

Extension to the experiment:

In order to further this experiment, an examination of cow dung as a possible biomass fuel is an idea. It is a very popular biomass fuel in northern India, where the living conditions are similar to that of rural Malawi. There are also plenty of cows in Malawi, hence it is possible. A cooking test making nsima, to see if each fuel can efficiently cook it, is an important extension to explore. If possible, a carbon capture test would help to further the understanding on each fuel's impact on atmospheric conditions and on climate change.

World Studies Section:

The experimental data that has been collected through this enthalpy experiment, indicates that bamboo and paper briquettes are the most effective fuels in this experiment due to the consistent boiling of water. However, as mentioned in the introduction, a further, geography-based study on the realistic implications of the usage of each fuel is needed to be studied as a secondary criterion to determine the effectiveness of each fuel.

Paper Briquettes:

The paper briquettes are manufactured in a rural area of Lilongwe and are sold by a private animal reserve known as "The Wildlife Center". This fuel is environmentally friendly and promotes a mentality of recycling, which is highly necessary in terms of protecting and repairing the environment. However, a potential disadvantage of this fuel is that it heavily relies on waste paper being brought to an area and can potentially cause a heavy reliance on the city's paper waste. If that waste is in shortage, or difficult to acquire, then locals will merely return to the usage of coal and firewood.

Bamboo:

The bamboo is grown by a private company for the purpose of usage as firewood. The plantation of bamboo is environmentally friendly as it helps prevent soil erosion and is known as one of the fastest growing plants on Earth. It grows well in sub-tropical Africa, so there are not many adaptation issues with growing here. However, some regions of Malawi have had repeated drought due to climate change, and this can significantly impact the growth of bamboo. Irrigation is an option, but if water is in short supply, then locals would logically reason to use firewood from a forest, rather than having to grow something with limited water and use it as a fuel. It becomes impractical to expect a Malawian, or anyone to use a valuable resource, in irrigating a plant for the purpose of fuel for cooking; when they could log and use firewood alternatively.

Tobacco Pellets:

The pellets are made using a pelletizer, compressing tobacco stems that are discarded by the local tobacco industry, after they have been extracted. The pellets are not very effective as a fuel in the first place, due to their dense form, making hard to ignite in a small, dry leaf tinder-based flame. The process of turning tobacco stems into pellets is very energy intensive, and requires heavy machinery, known as a pelletizer (Carpenter). This is obviously not available in rural Malawi, and therefore will become harder to access and potentially more expensive. Another important factor is the usage of tobacco stems as environmentally friendly fertilizer. Using stems for pellets will give rise to farmers resorting to artificial fertilizers, which can harm any animals in the vicinity. Additionally, this is polluting ground water and causing acidification of the soil, (Sustainable Baby Steps) with a direct contribution to climate change through the release of nitrous oxides in a process known as denitrification, which rapidly augments the greenhouse effect due to a Global Warming Potential that is 269 - 298 times more than carbon dioxide (Environmental Protection Agency).

Conclusion:

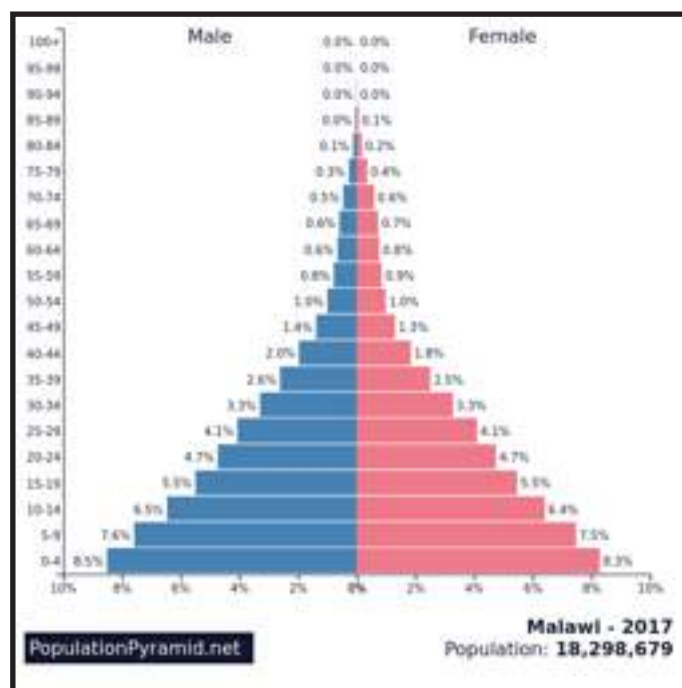
Based off the experiment, the most efficient fuels that can be used are paper briquettes and bamboo. They both have a high enthalpy change per unit mass (1.67 kJ/g and 1.69 kJ/g respectively). They produce low sooting, while also supporting the theme of environmental sustainability. Paper briquettes can be easily made by villagers with low-cost equipment. This also encourages a culture of recycling and sustainability, which can assist in the development of Malawi. However, paper briquettes require a constant supply of waste paper, which is not realistic in rural areas far from major cities. The briquettes can thus be used efficiently in rural villages close to major cities, such as Lilongwe and Blantyre.

Bamboo is well suited to growing in sub-tropical conditions. It can be grown and harvested locally, without a third-person input. Bamboo that can be used for cooking can be purchased as seedlings and be harvested after 4 to 5 years (Afribam). It can be grown in plantations with minimal equipment but will need sufficient water to maintain the growth. This is a limitation as 20% of Malawians still do not have a secure source of clean water, which is roughly 4 million people (USAID). After the growth period, it can be harvested annually, which is an immense difference compared to trees which are grown in cycles of 8-15 years (Waldrow). Some species of bamboo are known to be invasive, which could have detrimental effects on the biodiversity of Malawi. Therefore sympodial (clumping) varieties of bamboo should be used as they are non-invasive (Afribam). Harvesting also can be done with inexpensive materials, such as hacksaws and machetes. Thus, harvesting bamboo will not have much difference in economic terms to cutting trees, and can be an easy transition for Malawians.

The values and benefits of taking an interdisciplinary approach allowed a broader and realistic conclusion to be reached. The empirical approach from chemistry highlighted the most efficient fuels with objective data, while giving an applied understanding on the practicality of the fuels. Through geography, an analysis of the reasons for deforestation reoriented the experiment towards the main objective, the mitigation of anthropogenic climate change. Contextual information such as the usage of the Chitetdzo Mbaula stove, further shaped the experiment, developing the reliability of the results. Moreover, the links between anthropogenic climate change and deforestation were clearly shown.

A limitation of exploring through a geography and chemistry scope was that the economic feasibility of the fuels has not been assessed. With a GNI per capita of \$320 (World Bank), alternatives to wood-based fuels need to be inexpensive. While paper can be donated to villages, this still entails a culture of dependence, which several developing nations are currently fighting. An examination of the change in heat energy per unit cost could give a more economically applicable figure on the best fuel to use.

Figure 2: Population Pyramid of Malawi



Populationpyramid.net

Figure 2 shows the population dynamics highlight that the country has a large youthful population, implying that family sizes are large. This indicates that whichever fuel is needed in cooking must be available in large quantities, as large quantities of food need to be prepared for large families. As the population will continue to grow, an immediate solution is needed to halt further deforestation in Malawi. Bamboo can be an effective fuel in this instance once it has grown as vast amounts of it can be harvested annually. By contrast, paper briquettes cannot support such a large demand unless it is donated on a broad scale. The briquettes can also only be used for cooking, while bamboo is known as being a multipurpose material, as structural material or even for producing paper.

The limitations of my sources are that Afribam is still a project that has not been implemented yet and is still theoretical. Carpenter's thesis does not consider the cultural aspects of Malawians, possibly inhibiting transition to alternative fuels.

Bamboo and paper briquettes can be used collectively to transition rural Malawi, as well as other sub-Saharan countries, towards being environmentally sustainable with renewable biomass fuels. Paper briquettes can be used to slow the rate of deforestation while bamboo plants are being grown in regions closer to cities. Once bamboo has grown enough to be harvested, in close proximity to villages, a reduction in deforestation could be seen, mitigating anthropogenic climate change.

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Tyraan Lopes



Film

How do Brian de Palma and Eisenstein Bolshevik utilise montage to manipulate the confines of space and time to portray meaning in their respective step scenes in 'Untouchables' and 'Battleship Potemkin'?

Introduction

The Editor in conjunction with the Director plays a vital role in accomplishing the structure and pace of a film. The power of editing can guide the emotions of audiences in many ways. Through a specific technique called montage, it has the ability to compress real time into a short amount of film time to create a mental image greater than the individual, static shots with bare information; transferring us from reality into a storytelling process. Arguably, this technique is best represented in Sergei Eisenstein's Odessa Steps sequence from Battleship Potemkin (1925) which conveys a tragic episode in his imaginative version of the Russian Revolution in 1905. The scene's influence is reverberated in other cinematic works, such as Brian de Palma's 'Untouchables' (1987) high suspense union station scene, and is perceived as an evolution of Sergei Eisenstein's 'Battleship', in which too He pays homage. Potemkin Eisenstein is one of the most important pioneers of modern editing theory as he is one of the founders of montage, and the first director to explore propoganda through the use of montage.

The scope of my investigation is narrowed to look at how montage functions to convey meaning in similar or contrasting ways in both scenes, which will be drawn from articles, commentaries, credible websites such as Strictly Film School, informal interviews with certified directors, and the films themselves as primary sources. As Director Fenton, whom I reached out to, states "Once we can tell the purpose of the edit then we can examine how or why it works"(refer to appendix). An analysis and comparison of these resources allows me to critique valid information from different perspectives in order to justify my own argument, and ultimately the RQ.

Montage breaks the conventions of time and space in the real world, which allows directors such as Eisenstein and de Palma to manipulate the idea of perception; providing them freedom and opportunity to use this facet of human psychology. This will be addressed by breaking down space, time, and montage in each sequence, in reference to the montage theory, filmmakers intentions, and subjective opinion. I will analyse the mechanics of montage in Eisenstein's 'Battleship Potemkin', and De Palmas 'Untouchables'. They will both be critiqued in respect to five different components of montage, developed by Eisenstein, followed by a comparison of the effect these techniques and how they are employed in similar and contrasting ways. The reason I'm using this particular theory of montage is because it changes the audiences' perception of both films through the lens of montage; significantly contributing to meaning in both scenes.

Theory of Montage

The word "montage" is a french verb "monter" which means 'to assemble'. Montage is a method of compressing a large amount of real time into a short amount of film time. With that in mind, Eisenstein saw it as "an idea that arises from the collision of independent shots." Montage expresses a story in a uniquely, visual manner accomplished through a series of shots, edited together to induce an idea and feeling within the audience. Eisenstein used his knowledge gained from influences such as Kuleshov and Griffith to formulate a theory, in which he stated the theory of editing as a conflict of visuals and ideas, and then went on to develop five components including: metric montage, rhythmic montage, tonal montage, intellectual montage, and overtone montage.

Metric montage	This measures the length of the shots in relation to one another.
Rhythmic montage	This refers to continuity induced from the visual patterns between the shots, e.g match action and screen direction
Tonal montage	Tonal montage is solely based on the editor's decision making with the objective to install the emotional character of a scene. Emotions change, and so can the tone of the scene.
Intellectual montage	This indicates how ideas can be introduced into highly replete sequences filled with emotions.
Overtone montage	This is the combination of rhythmic, tonal, and metric montage, and how they interplay which each other through ideas, pacing, length of shots, and emotions to create a desired effect. It can be "characterized as an activity of mental fusion or synthesis, through which particular details are united at a higher level of thought."

Sergei Eisenstein And The Theory Of Montage; Filmmakeriq.com

Part One

Sequence and context

The scene analysed first in the film is the massacre of civilians on the Odessa Steps (also known as the Primorsky or Potemkin Stairs). This scene is critically acclaimed because it was revolutionary at the time, which has inspired an in depth analysis. In this scene, the Tsar's Cossacks in their white summer tunics march down a seemingly endless flight of steps in a rhythmic, machine-like fashion, slaughtering a crowd of civilians, including a young boy, as they flee. After the boy falls, his mother picks up his body and yells at the soldiers to stop firing. They do, only to shoot her minutes later. Toward the end of the sequence, the soldiers shoot a mother who is pushing a baby in a baby carriage. As she falls to the ground, dying, she leans against the carriage, nudging it away; it rolls down the steps amidst the fleeing crowd. Eisenstein's objective was to publicise the story of the revolution and uprising of Battleship Potemkin in 1905 to inspire his allies towards Bolshevism. This was achieved in his film in the form of propaganda, which gave him the chance to test his theory of "montage".



Figure 1: The 1925 Silent Film Sequence That's Influenced Every Movie Since

Mode of thought

Eisenstein believed that montage, if executed correctly, functions dialectically. Dialectic is a way of thinking in which the entire human dimension of experience is viewed as being in never-ending conflict, where a certain "force" (thesis) collides with a counterforce (antithesis) in which the resultant force becomes a whole and new phenomena (synthesis). The result is a combination of the thesis and antithesis, but not their mere sum; it is rather something unique and better than both of them. As a result, the synthesis becomes a thesis that forms a new dialectic. (Todd)

In the Odessa Step sequence, Eisenstein's use of intellectual montage induces a psychological effect upon the viewer rather than a physiological one; emphasising that the meaning is produced in the mind and thought process of the viewer, thus dependent on his or her experiences. This is best observed towards the end of the scene whereby the headquarters of the Tsarist generals is demolished by the huge tower guns of the

Potemkin. Eisenstein cuts the sequence thrice to create a three shot montage which captures a sculpture of a lion waking up and roaring; inducing a metaphor to signify the outrage going through the Russian people after witnessing an atrocity on the steps, as well as their mutual rise in anger towards the regime against the government, whom are responsible for the massacre (figure 1). This provides that there was a potential strength in the civilians to rise and “fight” the ultimate battle, although we know that the soldiers won in this particular scene.

Rhythmic montage is apparent throughout the scene. The filmmaker evokes a great amount of tension through the conflict between lengths of the fragments and the activity going on in the frame. We view a shot of the soldier’s boots as they descend down the steps in a stable and fixed manner. This contrasts to the pace in which the editor is cutting the sequence. A sense of chaos is induced, which creates disharmony, as the activity of the Russian people is continuously cut to the progressive and uniform descend of soldiers firing their rifles into the crowd of people. It creates a feeling of unease which depicts the soldiers in a complete bubble of comfort and ease, while an increase of fear and chaos is spread within the people, reinforcing the contradiction that movement in a frame juxtaposed to a frame length can produce. A methodical impression of the scene is noticeable in conjunction with sound too. The soldiers marching in descend and the drums continuously coming in at an off-beat produces a feeling of amiss; reinforcing a powerful piece of propaganda, and evidently the editing replaces the political message. This makes it hard for the viewer to leave the scene without feeling like the Tsarists are vicious and murderous villains. Arguably, the visual representation of disharmony alone does not require context to receive an emotional response as our minds instinctively recognise a conflict created by the story telling process of montage. Similarly, in the context of the silent film era it could be argued that Eisenstein’s main purpose is to prove the extent to which editing can reach to justify its function of storytelling without dialogue.

Intellectual montage in the sequence is perceived dependent on the thesis of the viewer as well as how much the viewer knows about the context of the film. What Eisenstein provides is an antithesis to give us synthesis of this political event. The shot of the soldiers marching down the steps perhaps symbolises a strong and oppressive force. This, juxtaposed with unarmed Russian civilians fleeing, symbolises vulnerability and helplessness of the people, and provides new meaning of the carelessness and brutality of the Tsarist forces. Noticeably, this provides the sequence with depth in the way it evokes meaning, which through juxtaposed shots does not only communicate a single story, but a series of different ideas. The cuts clash with each other to add to the already on-going conflict within the individual shots. The audience is well aware that

there are two opposing forces, so it creates an emotional involvement as Eisenstein frequently directs our attention to the restless crowd. To add, the metric cuts builds pace and visual continuity, this makes the sequence overwhelming for the viewer in most instances. For example, the grieving mother juxtaposed with uncontrollable troops firing instinctively generates a feeling of injustice. Eisenstein's objective to evoke an emotional response has worked, as it enables the viewer to feel sympathetic for the rebellious sailors of the Battleship Potemkin and their severe dislike for their cruel Tyrant. In terms of propaganda, the characterisation is simple, as the viewer can see who the minority are in terms of social class, which is reinforced by the high placement of the soldiers and status quo at the top of the steps overlooking those that we sympathise with, the civilians. In this respect, it could be argued that an audience does not need to know the context of the film for this particular segment of the scene, as it crosscuts between the emotionless soldiers, in contrast to the depth in emotion expressed by the minority.



Figure 2

In terms of time, Eisenstein substitutes out conventional linear time with emotional time to depict the disturbing and violent actions of the troops and defenceless and innocent crowd in front of the audience. We view an image of the lady hesitant to push the carriage down the steps before she is shot, which is represented by four overlapping cuts (figure 2). Metric montage cuts back to her every couple of seconds as she falls lower to the floor in discontinuing effect, because her stance is always more up-standing than her position at the end of the previous shot. The lady's fall to the ground is prolonged, which induces a stretched and repeated effect, forcing the viewer to relive the moment. In the process, she loses control of the baby in the carriage (symbolism of innocence) which signifies a metaphor for loss of power and protection of her own child. Then Eisenstein intercuts rapidly between the baby carriage rolling down the steps, the woman in Pince-nez, the student with glasses and the crowd slashing by the Cossacks at the bottom of the steps. Towards the end of the sequence a student screams as the carriage overturns, and without a clear ending for the carriage and baby, the editing allows the viewer to briefly create their own outcome until the scene quickly cuts to Cossack firing several times from four discontinuous close shots,



Figure 3

which then rapidly cut to a close up shot of the woman in pince-nez whose shattered glasses blood spurts from a slashed and blinded eye; revealing to the audience, the damage done.

In the beginning of the sequence, Eisenstein uses a long shot to establish the space in which the action is about to take place, and to see the soldiers start their pitiless movement down the stairs. He intercuts these long shots with medium shots of the crowd, and composed close-ups of the rifles being fired, as well as the soldiers moving feet descending along the steps, which is counterpointed with medium shots of people running, on the floor in agony, or being shot and trampled on (figure 3). It's the steady movement of the soldiers that cannot be restrained. However, conflict is aroused as the downward movement is reversed and broken when the women carrying the dead child turns and opposes the soldiers firing, as if to show the damage they have caused. This plays as a metaphor that brings a note of humanity to the "inhumanity" of movement, reflected by the soldiers. Within all this activity, time is compressed as a result of repetitive cutting between conflicting shots from multiple angles, which in effect moulds all the movement and activity into one 7 minute scene. This is visible in the scene of crosscut between the child on the floor and his mother watching in anguish. Every time it cuts to the mother, we get a closer sense of her reaction, while in contrast the shot of the boy cuts to a wider frame every time (figure 4). In effect, it freezes the time as the focal point is diverted towards the two characters emotional encounter. As a result of a series of events, we get a more defined and detailed visual of the total space by witnessing different components of the space as we are diverted from cut to cut. One could argue we are bombarded with huge amounts of information that occur in real life into a few short minutes. The viewer experiences one angle, then another, now in slow motion. Another character hiding is exposed. We are suddenly aware of the geography of the stage, its dimensions, the fabric of material our characters are moving in, the concrete wood or marble stairs. This allows us to get a sense of the characters' motives and concerns.

"Eisenstein further intensifies the emotional impact of this individual connection to the collective experience by replicating that universal psychological perception of

time slowing down during moments of exceptional stress and duress" ("Iconic Movie Scene: The Untouchables' Union Station Shoot-Out"). To oppose this argument, one could perceive that the emotional intensity is at its highest even without slowing down individual moments, as the fast pace of composite shots and skilled acting delivers stress in itself. Nevertheless, the pattern of the scene goes from the soldiers marching at the top to the baby in the carriage, which accumulates methodical sympathy from the viewer. The sequence provides intellectual meanings which opens our mind to thinking about the reality of the world, the way it works, and the things that dwell in it. In this case, it derives immorality through these augmented ideas until we come to a conclusion that there is no rationality, but meaningless violence. The pattern of the scene induces the audience to cry out in tragedy. ("The 1925 Silent Film Sequence That's Influenced Every Movie Since")

Part Two

In *Untouchables*, Ness keeps watch as various people and men in suits emerge from the doors beneath the clock- who at this point may or may not be part of Capone's men. At this point the tension is building in a long uncut scene (figure 6, shot 1-4) where we witness POV's through the eyes of Ness. Suddenly, a shift occurs as a figure emerges from the front door whom Ness right-away recognizes as one of Capone's men. Gun fire in slow-motion erupts after Ness pulls out a shotgun, while carelessly and unintentionally letting the baby in the carriage roll down the stairs.

Brian de Palma's Union Station sequence exemplifies a "creator of suspense or shock - a master of composing, manipulating and assembling images for maximum effect" ("Iconic Movie Scene: The Untouchables' Union Station Shoot-Out"). The main theme in this scene is oriented around tension and suspense, which de Palma collectively expands until the scene reaches its climax. Time is the main motif that drives the suspense in this sequence, as aspects of metric montage are depicted through the change in pace of the editing. The time of each edit is around the same duration in the beginning, but the pace of editing increases as the scene progresses.

De Palma integrates these juxtaposed images with slow motion to expand the time and action that takes place in the scene. De Palma immediately introduces slow motion when Ness turns around to see the gangster at the front door (shot 4). In effect, it allows us to assess the situation and finally recognize who Ness has been keeping watch for. Overlapping shots are noticeable in this regard, which draws us straight into the interactive action between the characters, as the shots 5, 7, and 9 are of the gangster while 4, 6, and 8 are of Ness preparing and then shooting the gangster. The use of slow motion means

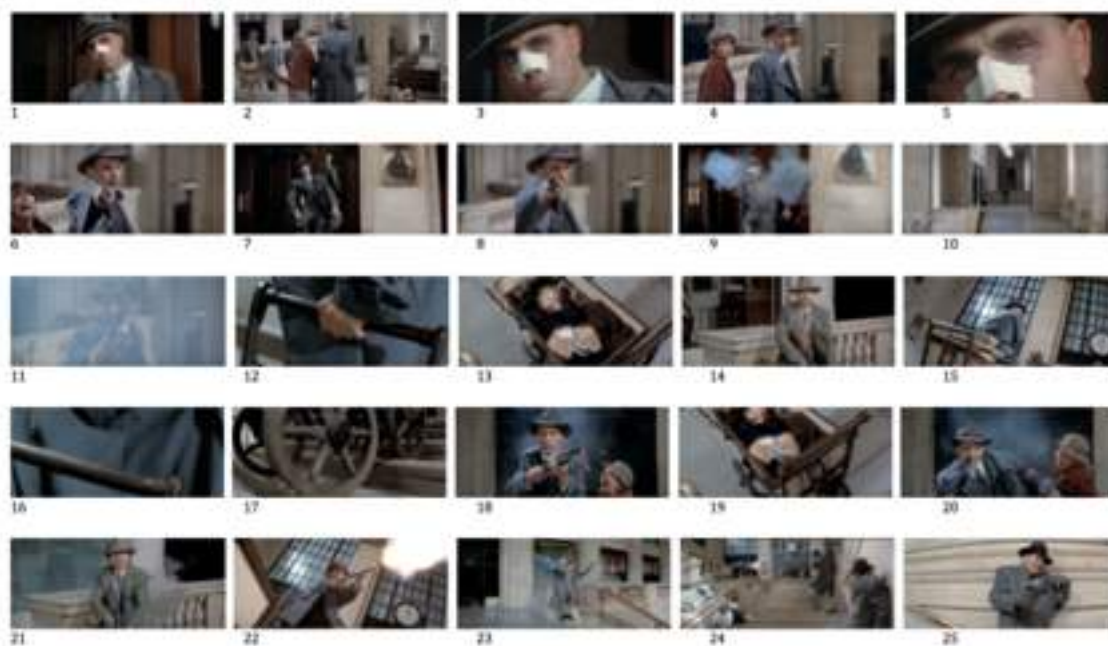


Figure 6-: "Research For Project Film 'Extending Time': Union Station Shoot-Out In 'The Untouchables' | Moving Image 1: Setting The Scene"

we can see both the action and the reaction of Ness and the Gangster and increases the perception of duration in the scene. It can be argued that de Palma could perhaps use tonal montage in these intercuts to further intensify tension; integrating symbolic objects in each frame to reflect a comprehensive and progressive tone. However, a more justified argument sees Alfred Hitchcock as a more influential figure in this respect through the use of subjectivity. This is evident in the beginning of the shoot-out where a series of POV's between Ness and one of Capone's men allowing the audience to see through a more subjective lens; intimately following the experience between the two characters and reflects the perspective of the audience (figure 6: shots 1-9). De Palma continues to use this tool of subjectivity as he cuts between Capone's men and Ness' view of the baby in the carriage. These intercuts viewed through Ness' lens in conjunction with the action allow the audience to sympathise with Ness, as they have recognised the danger he has put himself and the baby in. In essence, by the repetitive usage of this technique de Palma cultivates suspense as the audience watches in such a highly filled sequence whereby Ness observes and is part of a dangerous circumstance. ("6 Filmmaking Techniques Alfred Hitchcock Used To Create Suspense - IFH")

De Palma's use of rhythmic montage sets a pattern of simultaneous events which is cleverly associated around the carriage with the baby in it. This rhythmic method of

editing induces an emotional level of concern for the baby in the carriage and how Ness is going to deal with such an intense situation. As the viewer, we automatically sense the conflict that is evoked by the pattern of gangster(s), and Ness, but because of the involvement of an infant in the middle of a gun fire, our attention is always drawn back to where the carriage is located. The wide shots (23,24) help the viewer maintain an idea of the space and locate the physical relationships of the characters throughout the sequence.

Part Three



"Iconic Movie Scene: The Untouchables' Union Station Shoot-Out (Platt)

Evidently, Brian de Palma pays homage to Eisenstein's Battleship Potemkin and his use of montage. This means that the Union Station and Odessa sequences share similar, but different characteristics in terms of time, space, and montage. The key scene elements include: montage, steps, baby in a carriage, and violence, which all contribute to the suspense, emotion, and conflict to the editing of both scenes.

Similar themes that both sequences induce are chaos, emotion and terror in which the depiction is less in the Union Station scene. While the odessa scene addresses a more political and storytelling medium, Untouchables targets a build in suspense. The Odessa sequence is an implication of social class in which inhumanity is evident in the eyes of the helpless, which can be also said about the Union Station sequence, however at a far lesser level of gruesomeness. In Untouchables, Ness is the only

character who helps the struggling mother carry the carriage up the steps, while a group of commuters dash past without noticing the lady. Complete carelessness is expressed as Capone's men fire towards the carriage with full awareness of infant in the carriage. Time is stretched as the descent of the carriages is prolonged and repeated from different angles enabling the audience to re-live the moment.

In both scenes, suspense is built around the descend of the carriage, which works as a countdown; creating an intellectual effect which forces the audience to seek an end point through chaos occurring in the intercuts of the sequences. The complimentary juxtaposed images in both scenes dramatize the action which is more apparent in the Odessa scene, but still influential in the Union station sequence. The reason for this is because the Odessa scene withholds more pieces of individual shots within a sequence and thus provides a more conflicting and psychological effect when the mind of the viewer fills in the blanks. Conversely, de Palma utilises continuity between the relations of simultaneous shots and uses the action within the individual shots to promote the conflict. Eisenstein's political view looks into pain and anguish revolved around real-life events (propaganda), which leaves the audience with a long lasting effect of questions to ask, as result of intellectual ideas building on top of each other. Whereas de Palma uses the technique of montage to project momentary shock and suspense that is increased in the building of over-lapping and simultaneous images. As a result, we experience every movement in more detail, both actions and reactions. We can deduce that the scene in *untouchables* relies more on metric montage, whereas *battleship* is more reliant on rhythmic montage.

Eisenstein and de Palma manipulate the idea of perception on an intellectual scale, but to a higher extent in *Battleship Potemkin*. Eisenstein's establishing wide-view in the beginning of the scene acts as a thesis, as it forces the audience to assess what is about to happen in relation to the context of the film. The intercutting close-ups of the civilians fleeing provide an anti-thesis, in which we discover the synthesis from, whereby we recognize Tsar's Cossacks as the dominant force. The prolonged sequence at the beginning of the scene that sees Ness look back to the clock as more people enter the building, forces the viewer to develop a thesis that perhaps involves anxiety and time loss. The slow-motion eye-line/POV view intercuts between Ness and the gangster create an antithesis of conflict, while the rhythmic montage further expresses the continuity of the shots, and match action of gun shots being fired each way, juxtaposed with the motion of the carriage; revealing a synthesis that puts the baby in danger.

Conclusion

Ultimately, the juxtaposition of many different shots cut together forces an uneasy and unique response from the audience in both scenes. In terms of the research question, montage in both scenes extensively creates meaning in similar ways. The montage in *Untouchables* provides a sense of exponential growth in suspense which adds a layer of tension every time a carefully lengthened shot is assembled onto another until the sequence reaches its climax. An integration of slow motion and match direction of the carriage (rhythmic montage) along the stairs catapults the viewer into the action of play which allows us to feel every shock and tense action through the interplay of time expansion and montage. Eisenstein utilises a more intellectual approach while integrating rhythmic and metric to reinforce the ultimate ideology; propaganda which is evident in the disharmony of the editing. In addition, he depicts montage as a process of creation that includes the viewers' intellect and emotions, which forces us to follow the creative route travelled by the filmmaker himself. This does not only open our eyes to the finished synthesis, but takes us through the dynamic process of juxtaposition and emergence of conflict. Rather than the action building the suspense, the intellectual idea created by our own minds in conjunction to the gruesome action induces unease and a sense of restlessness that cannot be helped. Thus, both directors' editing abilities enable them to manipulate the idea of perception and time which plays an important role in human psychology. Eisenstein primarily uses intellectual and rhythmic montage to manipulate both space and time to portray his political propaganda, whereas de Palma predominantly utilises metric montage to manipulate time more than space, which plays to our emotion and induces shock and suspense. In effect, the creation of meaning through editing in both scenes, is highly associated with human psychology.

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Esther Mazengera



History

To what extent was the role of women important in aiding peacebuilding and reconciliation post Rwandan genocide 1994 - 2009?

Introduction

Rwanda is a country situated in central eastern Africa. Its population prior to 1994 consisted of ethnic divisions that had been formed as a result of colonial rule and years of civil war between the different ethnic groups. Pre 1994 the population consisted of 85% Hutu, 14% Tutsi and 1% Twa (Belton, ix). On April 6th 1994 Rwandan Hutu president, Juvenal Habyarimana was assassinated. Within hours of his assassination, Kigali Rwanda's capital erupted in violence, Hutu militia began the mass slaughter of the Tutsi minority and moderate Hutu. After a hundred days an estimated 800,000 Tutsi and moderate Hutu were killed. The Hutu militia had annihilated 10% of Rwanda's total population (Oxfam). Unlike genocides of the 20th century, the Rwandan genocide unfolded before the eyes of the international media. Journalists, radio broadcasters, and TV news reporters covered the events live from Rwanda (world without genocide, 2012), shockingly the world watched as the country was torn apart by mass slaughter.

After the genocide the country was economically, socially and politically ravaged and all pre-existing order had been shattered. The task of peacebuilding and reconciliation was an overwhelming task for survivors of the genocide. Following the genocide, women made up 70% of the population (Hamilton, 1) thus forcing them to take on new responsibilities out of sheer necessity. Although all normalcy was stripped of the shattered Rwandan society. Women were a major driving force behind peacebuilding and reconciliation. To tackle some of the challenges facing them, women formed associations and these associations gave women security within their communities, moral support (especially if they were widows or raped during the genocide) and most importantly a chance to rebuild Rwanda at grass roots level. "Rwandan women had become a force from the smallest village council to the highest echelons of national

government" (Hunt), Rwanda's patriarchal society was challenged after the genocide as women had taken on new responsibilities, women headed households emerged post genocide, women were caretakers, many widows adopted orphaned children. Many studies of post genocide Rwanda often overlook the importance of women in reconciliation, however without the involvement of this previously disenfranchised group, Rwanda's social fabric may have tremendously struggled to repair itself. However other factors also played a role in peace building and reconciliation of Rwanda. The International Community and Non-Governmental Organizations (NGO's) like the Clinton Foundation, Oxfam, Foundation Rwanda and UNICEF provided aid to Rwanda in many different forms. The Rwandan government had an obligation to also be at the centre of peacebuilding and reconciliation to ensure the rejuvenation of Rwandan society. By looking at personal accounts, accredited books, research papers, video documentaries and interviews, the investigation will assess the role of women in aiding peacebuilding and reconciliation post Rwandan genocide between the years 1994 - 2009. This time range is most suitable because it enables the assessment of long-term effects of women's involvement in peacebuilding and reconciliation.

Women and widow associations

After the genocide women worked to reclaim their lives via formation of widow associations'. Avega was an association "which gathered its members into cooperatives that played a role in getting rape recognized as an instrument of genocide" (Topping, 2). The association also had aims of challenging social taboos by opening retirement homes, in order to provide for survivors of the genocide approaching old age with no family to look after them. Janette Gahongayire leader of Avega was recorded saying, "After the genocide we said: What are we going to do? Are we going to carry on talking and crying? We have to do something'. And we continue in spirit" (Topping, 3). During the genocide between 250,000 - 500,000 Hutu and Tutsi women were raped (Newbury, 4), although it is impossible to determine the actual number due to the social stigma surrounding rape and determining whether the rape was a result of the genocide, 76% of genocide rape survivors were living with HIV and an estimated 20,000 women were looking for help in regards to the children they conceived as a result of rape (Topping, 2). These children experienced a lot of resentment from their mothers (whom were not allowed to abort them, because abortion in Rwanda was illegal). Devil children or little interhamwe were largely disowned by society (Newbury, 5), non-governmental organizations like Foundation Rwanda provided these children and their families with aid in the form of school fees, books, uniforms and transport (Topping, 4). However the Foundation could not provide for all 'children of rape' due to low funding and it was up to women to find solutions to such problems. As well as financial aid the organisation also provided counselling to families to help heal wounds. (Washington post p3 - 4)The

organisation helped Angel and Jacqueline form a loving mother daughter relationship. Angel was conceived from rape and her mother Jacqueline, from an early age would tell her "You're not my real daughter", Angel was locked in and not permitted to play with other children. This dynamic changed in 2007 when foundation Rwanda provided them with therapy in the form of weekly support groups. Other mothers from the support group inspired Jacqueline to become Christian, she then accepted Angel as "a gift from God" (Washington post p3 - 4). Duhozanje is another women's association that dealt with problems of accommodation post genocide. Homes were in ruins and women whose husbands were in jail or had been killed in the genocide found themselves homeless. Due to Rwanda's highly patriarchal society it was considered taboo for women (especially in rural areas) to wear trousers and build houses without male assistance. To solve this problem Duhozanje had women build houses at night. By 1999 the housing project was complete, Duhozanje had successfully built themselves an office and small houses to accommodate some of its members (Radical Films). Overall these associations helped rebuild and reconcile Rwanda at grassroots level, women were forced to be at the forefront of rebuilding and they successfully formed these associations' as a support system for each other whilst challenging the social structure of a shattered Rwanda by taking on tasks that traditionally were previously taken on by their male counter parts i.e. building houses. On the contrary these associations' successes was partly due to final aid and support provided by NGO's, without support from these NGO's women's associations wouldn't have been as functional as they were.

Women's extended responsibilities

Rwanda's traditional position of women in society was challenged after the genocide. (Shattered lives, p 20). According to a 1995 government report prepared for United Nations: The ideal image of a woman was still generally viewed through her maternal role. The woman must be fertile, hardworking and reserved and she must learn the art of silence and reserve (Shattered lives, p 20). "Customary law prohibited women from inheriting property and land resulting in the inability to provide for themselves after the death of a father or husband." To make matters worse this problem was emphasized by huge population displacement post- genocide. Post genocide Rwanda saw women take on new responsibilities out of sheer necessity. Many children were left parentless after the genocide, Rwandan women provided food and clothes for orphaned children and some even took them in as their own (Hunt, 154) .Inyumba ,a women in her 20's designed a massive adoption program for hundreds of thousands of orphans regardless of their ethnicity, this definitely contributed to the country's healing not only by providing assistance to children but by also disregarding ethnicity in her management process , she later went on to lead the National Unity and Reconciliation Commission 1999 - 2000 (Hunt, 154). Actions like these showed women to be the

caretakers they had an obligation to this role as most (not all) of the perpetrators of genocide were men, whom had either fled the country or were awaiting trial in Rwanda's prisons. As a direct result of the genocide the number of women headed households increased dramatically. In 1996 a demographic government survey showed that 34% of households were headed by women. However the accuracy of this figure is hindered by the reluctance of some women to claim their status due to social stigmas and the figure does not account for the influx of returnees (Kumar, 42) in November and December of the same year, who sought refuge in neighbouring countries. Traditionally girls did not inherit land from their father or other families unless there was no male successor or the male successor was not traceable (Human Rights Watch 82-5). This caused tremendous issues for women (especially in rural areas) post genocide, they would claim land and often distant relatives would take advantage of the situation and inherit the land wrongfully. Additionally it was Hutu women whom where finding it especially difficult to obtain land, many Hutu women often returned to their property after the genocide to find that returnees had occupied their houses . To tackle this problem in 1995 the ministry of family and promotion of women announced that there would be a revision of the discriminatory laws affecting women and children. The government began an extensive legal revision of customary law which did not comply with international standards (Human Rights Watch 82-5). Although, with regards to inheritance laws it seemed as though government legislation was the only way to enforce change but without women fighting for the change it would have not been implemented or even considered.

Women's involvement in imidugudu villages

According to Human rights watch prior to the genocide Rwandan woman's status in Rwandan society was extremely low, and their livelihood was dependent on their male counterparts, their role was centred around, being a wife and mother (Doan, 20). Moreover their access to fair working conditions were limited, even though they bore most of the work, making up 65-70% of all farmers in an agriculture dominated economy (Doan, 7). In December of 1996 the Rwandan government created imidugudu villages, under the National Habitat Policy, there was a call that all displaced Rwandans should relocate to these villages, it affected 94 % of the population (Doan, 5) . The first people to arrive in imidugudu were given settlements, but the majority of people forced to leave their homes to relocate were given very little resources to build houses, this resulted in many living in temporary homes made of grass/ leaves / pieces of plastic. Despite the difficulties women experienced new roles that they carried out with sheer determination, due to the imprisonment of many males, women were to play roles in agriculture and home construction. Women provided their families with food by working on cooperative plots thus showing that the patriarchal structure of Rwandan society

was facing immense change, through their involvement in building projects women broke the Rwandan “myth that if a woman constructs a house, it leaks” (Mutamba). The success of imidugudu was demonstrated in the building of “Nelson Mandela Village in the heavily genocide-scarred region of Ntarama which boosted social services, utilities, a health clinic a school and a store” (Doan 53) which was constructed by a women’s association called the Association for solidarity between Rwandan women.

Women as security promoters

Tensions were still present following the genocide, thus women took on roles as security promoters which was essential to reconciliation and peacebuilding. After 1994 rebels continued to attack across the Rwandan border from neighbouring countries, women stepped up and played a role in convincing their male family members to leave the rebellion and come home, realizing that such a move would mean more security for their families, despite the personal risk involved. Women negotiated directly with the government for peaceful surrender for their family members (Mutamba and Izabiliza 2005, 30). Moreover women recognized that the influence they had over their husbands was vital, they played a part in convincing male family members who were part of the post-genocide rebellion to return home to Rwanda. As demonstrated by a statement made by a local district mayor of Ruhengeri town: women made a tremendous contribution to the restoration of the “security in Ruhengeri, they continued being involved in the vigilance and passing of information to security personnel regarding strangers whom they spotted in their area...” This was not the norm because traditionally it was the men’s job to be the reporters of peace but given the genocide and years of civil war, women gained confidence in regards to their role within society as peacemakers’ (Doan, 57). Furthermore the formation of groups for ex-women combatants showed women to be security promoters. Ndabaga brought together former female fighters from rebel groups. A member of the organisation commented that; “We had a duty to show our sisters and other Rwandese that we are capable of contributing to unity and reconciliation” (Mutamba 2005, 30).

Reconciliation through communal business

An interesting way in which women contributed to peacebuilding and reconciliation was through involvement in communal business initiated by USAID and the Rwandan government. Following the genocide, organizations saw a link between economic development and peace-building (Mutamba, 26). A successful example of such income generating activities would be the “Cows of Peace” project which was created in 2001 in Byumba province, it aimed to “support vulnerable groups to acquire improved breeds of cows in order to increase income and livelihoods” (Mutamba, 28). The project was inclusive of genocide widows and other disenfranchised groups of women

.The program brought income to an association of 31 members (most of them women). Success of this program can be further evidenced by an account of the impact it had on one participant and her community “everybody feels responsible for the security of the cow. This is a forum for sharing and building trust and solidarity and by far contributes to reconciliation and peace building” (Mutamba, 28). According to Matumba and Izabiliza this program enhanced the roles of women as they became managers thus raising their societal status. Alternatively it is idealistic to assume that stigmas surrounding the role of women changed with one small communal project , unsurprisingly the project was met with sceptic ,traditionally managing cows was seen as a “demanding” job that could only be done by men to counter this belief, a local veterinary assistant in Byumba claimed that he noticed “women proved to manage cows better than men” due to the fact that there was notice that cows managed by women looked healthier and are more productive than those managed by men Mutamba,28).

Reconciliation through Basket weaving

Another way in which women aided reconciliation in Rwanda was through weaving “Baskets of Hope”. Gahaya Links was a company cofounded by Janet Nkubana in 2004, the company started operations with only 27 women (Ellis). Conversely in 2007 the company had expanded into different branches, namely one in Byimana province which had 1000 members (Seymour). Originally Nkubana aimed to organize women to make baskets to suit the market in hopes of restoring their dignity (Ellis). Gahaya links partnered with women associations such as Avega. Providentially it saw success in its early years when Avega sold the first 1200 “peace baskets” in the United States (Seymour). The appeal was that weaving groups consisted of both Hutu and Tutsi and according to Willa Shalit (Artist) it was an “incredible embodiment of reconciliation” , Shalit wanted to help create a sustainable business backed by a multinational corporation , she used her family connections to sell the baskets to macys , an American multinational company . According to The New York Times Macy’s ordered 30,000 baskets which sold for around \$35 to \$120 each, in the first year sales grew from \$150,000 to \$1.5million (Seymour) although the women only made \$2 to \$3 per day, the act of weaving brought them “out of the back room” according to Irene Mugaybuzu president of the weaving group in Byimana (Seymour). Through the art of weaving Hutu and Tutsi women could move beyond hatred although not explicitly talking about genocidal events but acknowledging them and reconciling through means of teamwork and laughter. Uwimana, a weaver claimed that there was need to move on despite the anger and resentment that was at times among the women (Price CBS). Lastly via weaving women demonstrated “that goodwill can also be good business”(ibid) which essentially uplifted them from their economic disadvantages and empowered them.

Women’s increased political positions

As a result of the genocide, Rwanda's patriarchal society began an immense transformation. One way that patriarchal society was challenged was by the rapid increase of women in political positions within the government. In 2000 Rwanda ranked 37th in the world for women's representation in an elected lower house of parliament (Hunt, 152). In 2008 remarkably the first female elected speaker of Chamber of Deputies Rose Mukantabama, explained how it was a requirement for political parties to elect both female and male candidates (Doan, 79). As previously mentioned one of the biggest issues facing women post genocide was the issue of inheritance of land. To tackle this issue women in government (under the Ministry of Gender) created legislation to give women in Rwanda inheritance rights although the legislation was created its establishment proved difficult as it encountered delays - according to field researchers Newbury and Baldwin this was due to the continuing strength of patriarchal constraints however their research was conducted in 1999 merely five years after the genocide and the country was still shattered on all levels therefore it would have been difficult to access the cause of delays within the overwhelmed government. To conclude although there was an increase in women in political positions following the genocide, Rwanda still remained one of the poorest countries in the world and gender inequality still persisted in Rwanda, traditional attitudes that marginalized women began to create conflict in communities, a large number of widows / female headed households led to practice to polygamy. (Oxfam, 84-5).

Role of Clinton and Kagame

Following the genocide many of Rwanda's medical personnel had been killed or had fled the country. This was a huge problem as there was need for trained doctors and nurses to treat survivors of genocide. Former president of the United States, Bill Clinton through his organisation known as the Clinton Foundation in collaboration with Partners in Hope, in 2007 sent a team of doctors to southern Kayonza. Kayonza was then one of the poorest areas in Rwanda, with leadership from Paul Farmer (who led similar medical efforts in Haiti) the team trained paid community health workers to identify diseases such as AIDS and TB (Clinton, 6). Following an evaluation of efforts made by the team during the first 18 months, the results were outstanding so much so that the Rwandan government agreed to adopt the model for the whole country and even put full resources behind the project (Clinton, 6). However a big part of the Clinton foundation's work was largely due to the leadership of Diana Noble. Noble was a very gifted business woman who crafted a business plan which enabled the team to scale the health system for the whole country (Clinton, 6). Although Clinton worked to implement a viable healthcare system in Rwanda its sustainability is uncertain. Moreover establishing peace in Rwanda was not solely about rebuilding the physical infrastructure that was destroyed during the civil war and 100 days of genocide but also required the "reconstruction of the

social and moral tissue of the nation” (Hamilton, 7) and this could only be achieved by Rwandan people without intervention from the international community. Popular figureheads namely Rwanda’s President Paul Kagame were extremely critical on over reliance on foreign intervention to reconcile and rebuild Rwanda. However Kagame’s leadership was highly controversial, he was accused of authoritarian behaviour which included internal dissent and support of regional meddling (Hunt, 151). Regardless without Kagame’s intervention with progressive gender policies and support of women whom Kagame regards as “warriors” (Kagame, 2009) women would have not been appointed in key cabinet positions.

Role of international community

Organizations like Oxfam set up programs in Rwanda that aimed to “contribute to building a society in which security was assured for all of Rwanda’s people” (Oxfam, 84). One of the areas Oxfam chose to work in was Gitarama province, which was severely affected by the genocide: an estimated hundred thousand were slaughtered ruthlessly in Gitarama. Hostility, conflict, and mistrust between survivors and families of prisoners was extremely common. The program tackled gender equality therefore men and women both participated in Njanama meetings, similar to the Gacaca courts implemented by the government these meetings aimed at conflict resolution at a community level. However women often outnumbered men at these meetings, showing an eagerness to reconcile and peace build. According to Oxfam’s evaluation of the program’s impact was “almost immediate among the participants and in the communities”. For example, in an exercise called the Tree of Life, which created a safe non-threatening environment whereby communities were able to reflect on their lives. Non-literate women were especially open, because they felt free to talk without men. In Gitarama training course women said, “We have hearts full of suffering and sadness. We could never tell anyone. But in this training we have learned to trust each other and can finally speak”. Oxfam also claims that the training often changed long-held traditional attitudes to gender roles (Oxfam, 89). The issue with the international community’s involvement in peacebuilding and reconciliation lies within the understanding of what “reconciliation” means to Rwandans. When Rwandans spoke of “reconciliation” they spoke of liberating themselves from “old mentalities” that plagued their minds and ultimately fuelled the genocide. “Old mentalities” range from colonialism, dictatorship, ethnicity and feudalism (Gourevitch, 251). When international community spoke of reconciliation they often gave off an impression that survivors of the genocide should directly forgive perpetrators who at times committed atrocious crimes against their own families. Most (not all) genocide survivors believed in a need for justice before reconciliation. The approach that Oxfam and various other NGO’s took was problematic, although immediately showed success. Programs set up in communities often ignored

that many perpetrators of genocide denied the existence of genocide and their participation in it (Hamilton, 8), this was a huge obstacle to reconciliation as forgiveness only occurred if the author of the crime was wholeheartedly willing to admit that there was crime (Hamilton, 8).

Conclusion

After examining the factors that aided peacebuilding and reconciliation in Rwanda. It is fair to conclude that women were a key factor in reconciliation as they took on new roles, became caretakers for orphaned children and formed associations for psychological healing, but women could not have succeeded in peacebuilding without assistance from the Rwandan government which had an obligation to reconstruct a nation socially and economically, as well as to heal people and prevent a genocide from occurring again. The government with help from the international community worked to rebuild many areas of Rwanda society. In summary although women were not at the forefront of reconciliation and peacebuilding they were drivers and instigators of social change, arguably because women suffered the most as a result of genocide, they were displaced, denied land and marginalised but they managed to overcome some of these challenges through various means such as the creation of associations and the adoption of new roles i.e. household leaders & security promoters which essentially transformed Rwanda's patriarchal society, roles that had been traditionally male oriented were in the hands of women it can be argued that this change signified Rwanda's urgency to reconcile and peace build and without it perhaps the process would have been slower.

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Maxime Mugisha



Economics

To what extent has the introduction of the FISP (Farming Input Subsidy Program) impacted Malawi's economy in its agricultural rural poor areas in Lilongwe?

INTRODUCTION

The intervention of the FISP (farm input subsidy program) by Malawi's government has had an important impact on the economy, as the production rates started to go up once it was introduced in 2005. However, observing what the outcomes have been subsequently from 2014 until today and how its impacts on the small farm holders in some rural poor areas of Lilongwe have influenced the way the nation observes it was very intriguing. So basically, my topic focuses on the Malawian food crisis, as the FISP is trying to get rid of it, but on the aspects of it that might influence the economy.

This essay seeks to reach many points in a way of investigation on how has the FISP specifically influenced and impacted Malawi's agricultural poor, and so I will try to do so by surveying farmers who are living in the rural poor areas of Lilongwe. However, I will extend my research as well into some aspects that might be relevant, such as child labour, if farmers require their children to work on the fields. The research needs to gather data from the public, as well as using World Bank, so it will be interesting to compare small farm holders which have received the FISP and if some household didn't, and how differently bad or well have their cultivation has been doing, if it influenced their production upwards or downwards.

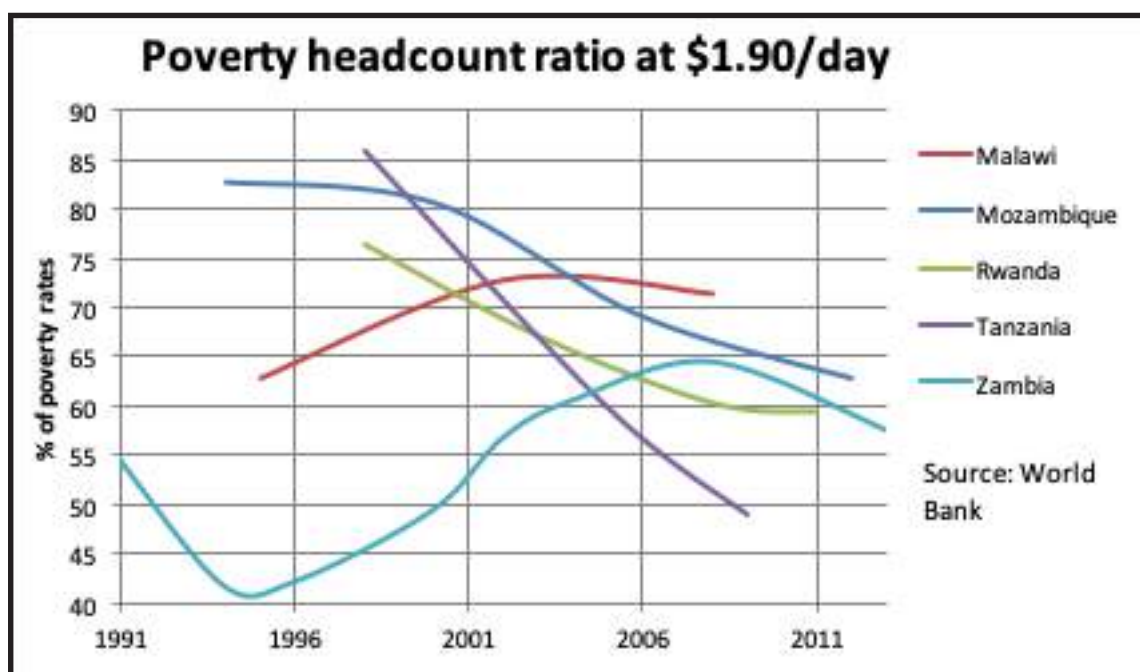
In order to conduct my investigation, I have used my own resources, based on what I have got from the surveys I carried out. The essay will also simultaneously explore other factors that are worsening the food crisis, therefore, slowing down the development of the country, and it will propose possible other ways in which we can help the country improve.

This research is worthy of investigation because I do not think that it has been done before, and I wanted to use some of my knowledge that I have gained a specific subject area that I had chosen, which was in Economics HL, in order to be able to draw original conclusions.

INVESTIGATION

Malawi is a small south-eastern African country in which I have been living in since October 2014, and it is located between Tanzania, Zambia and Mozambique. According to the "Nations Encyclopedia", Malawi's agriculture is central to the country's economy and national life, occupying 86 % of its workforce, and making up 38 % of its GDP and 90 % of its exports achieving food self-sufficiency on a national basis is a high priority for the government of Malawi. This is where FISP comes in. (Dans Shoe Repair)

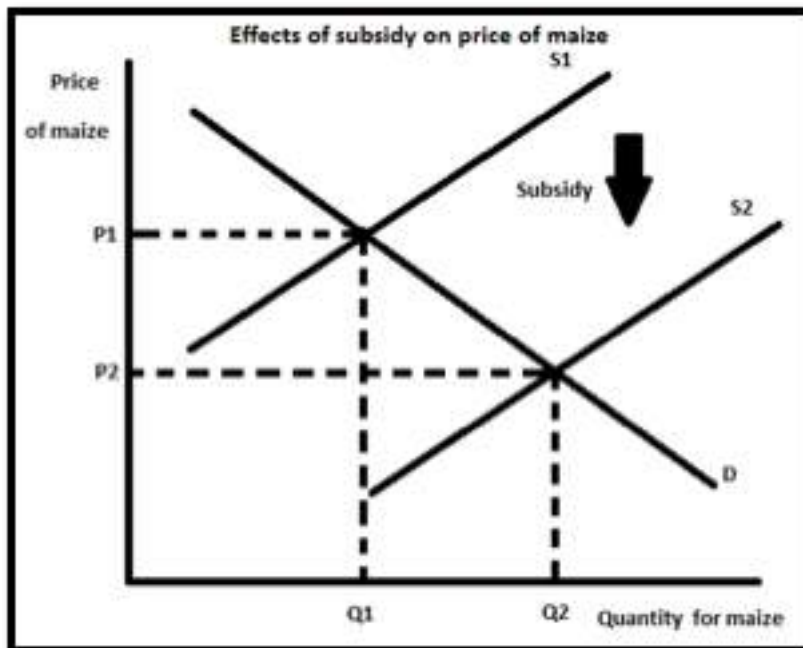
Diagram 1:



As we can observe on diagram 1, Malawi has higher poverty rates than its neighbouring countries. The goal of the Farm Input Subsidy Program (FISP) is to enhance food self-sufficiency by increasing smallholder farmers' access to and use of improved agricultural inputs, thereby boosting the incomes of resource-poor farmers, and will help in employment levels to rise. A subsidy is usually in the form of a cash payment or a tax reduction. The subsidy is typically given to remove some type of burden, and it is often considered to be in the overall interest of the public, given to promote a social good or an economic policy. Or it could be an amount of money paid by the

government to firms for a variety of reasons: to prevent an industry from failing, to support producers' incomes, or as form of protection against imports (due to the lower prices and costs that arise). But in this case, it is a selective distribution of coupons in order to facilitate the accessibility to buy new tools and materials or to facilitate the accessibility of the market.

Diagram 2:



As Diagram 2 shows, the subsidy would help them more, in this scenario, by giving out coupons which would pull down the prices for crops of maize. Instead of paying at P1 they only have to pay at P2. However, there are several problems with the subsidy system, the first is the cost to government, the second is that funds

could be distributed unfairly by corrupt officials and thirdly, one of the farmers biggest problems is transporting their crops to the market place ; the subsidy does not assist in this area. It will have only an either positive or negative impact on only a handful of people who have been chosen to receive coupons, and furthermore, sharing those ones, which is only reducing the effectiveness of the process.

SURVEY

In order to respond to surveyed questions, the interview was conducted towards farmers and villagers in agricultural producing rural poor areas of Lilongwe about their productions and the FISP. So the first step was to get in contact with someone who has good connections with some villages around Lilongwe and who could put me in contact with a good translator. Through a contact in the E.U. delegation, I was put in touch with a programme manager who works for the Inter Aide organization in Malawi; Manuel Milz. Being here for some time, Milz has really good connections with the villagers where Inter Aide has contributed assistance. Being able to speak

Chichewa, he also brought his 13 year old stepson Mwanjiwa Milz who has been very kind and helpful to me as an interpreter. We got approvals from some chiefs to be able to interview farmers in their villages. We went to villages called Mongo, Mlinga, Mninga and Kasinzira, and my survey/questionnaire is in the appendix.

There are the 12 questions I have asked in all the villages we've gone through in a day. I was able to get results from 13 individuals in those areas. Also, I had to make some changes in the questions because some didn't really apply with the farmers, for example, most of them didn't have spray availability, so I changed it unto 'fertilizer' use.

Image 1:



In this picture, I'm carrying my questionnaires onto some villagers with the help I have received from my interpreter Mwanjiwa Milz.

(Photographer: Manuel Milz)

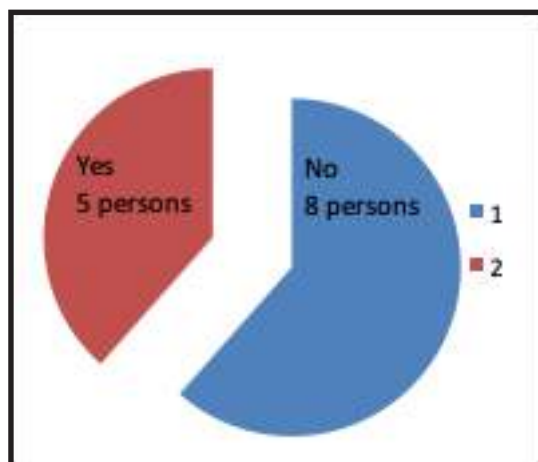
Image 2:



*Photographer:
Maxime Mugisha*

In this picture there are maize crops being produced at the bottom of a hill. The farmers are indicating their own lands where they produce. These are some pictures taken from my own device (phone camera, Acer Liquid Z6), as for evidence of my primary sources investigation on field. It was a captivating experiment. People received me nicely and answered my prepared questions. I made a small change to my ninth question, as majority of the people living in those areas do not spray at all, they use solid fertilizers. Some farmers feel scared about speaking openly because of their suppliers' image; therefore their names are not included on the questionnaire. Accurate information was required, including family size, so anonymity was important.

Some of the problems farmers are facing:



- 8 persons said they were mainly producing maize
- 5 persons said that they produce some groundnuts, soya, beans and cassava, but they aren't too focused on those.
- No real changes over the last ten years, in terms of processes
- NGO called LUANAR supported people selectively but this was not very helpful, focused mainly on women
- People share the coupons provided by the

FISP in order to buy fertiliser, so it might not be as useful

- There is little use of compost, which could be more useful to the issues

FISP will not facilitate the access to agricultural tools and materials very successfully on a long-term, as not everybody will benefit from the program because of selective distributions.

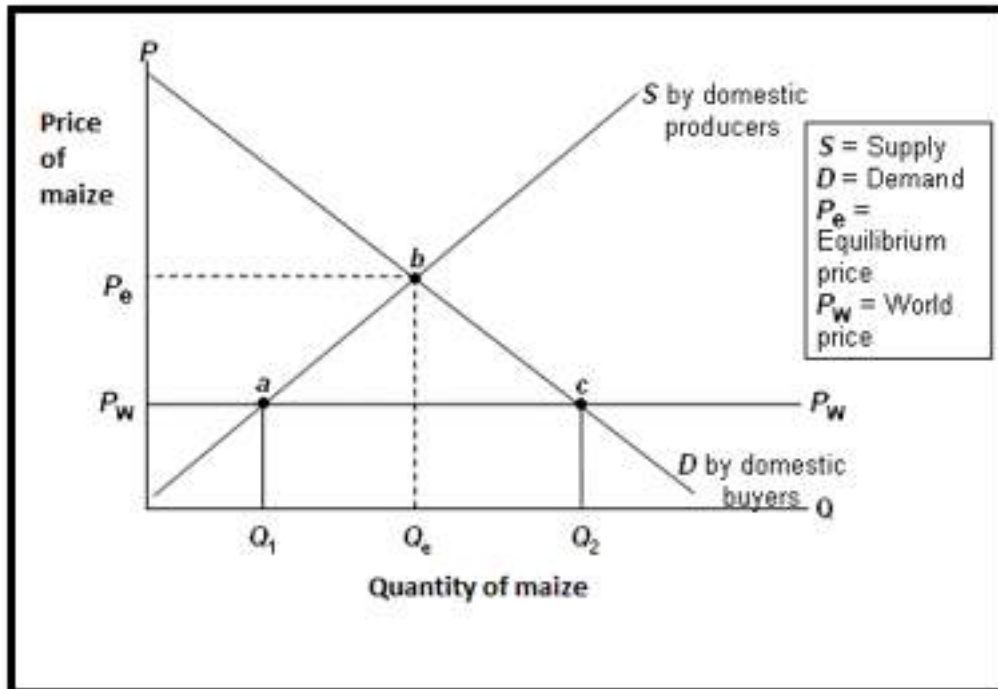
Although FISP has had some effects, the farmers still have a lot of issues regarding money, their finance is troubled, and they lack food every year, they never have much surplus and if they have some of their crops left, they won't throw it to the market; they will keep it in order to eat. They don't even have a good access to market. This causes the government to make more imports than exports in the food market, which could lead to depreciation in the Malawian kwacha. There seemed not to be such a drastic satisfaction from the farmers I have interviewed. Majority of them told me that there had not been a lot of positive changes in their lives since 5 years, back in 2013-

2014. Only 4 of them have seen positive changes in their food productions. But overall from the knowledge I gained from my own interviews and questionnaires, FISP doesn't appear to be a good solution to solve the problems.

SECONDARY SOURCES

The primary sources did not provide a clear picture, so secondary sources were consulted. A critical review of FISP, conducted by the research gate mentioned FISP's main objectives are increasing maize production, promoting household food security, and enhancing rural incomes. Farm level studies indicate modest increases in maize production and productivity during the years of the FISP, since its introduction back in 2005, whilst national production estimates suggested dramatic increases. (Ludunka) Consistent with the farm level results of modest maize production increases, there has been some changes on the food prices, they have been increased, and the country continued to import food during most of the subsidy program years.

Diagram 3:



Based off of diagram 3 above, if Malawians are moving from the equilibrium price to the world price, they have to drop the prices and they will only be producing at Q_1 , and that's why they are forced to make more imports, in order to provide the maize at Q_2 .

It represents the free trade in maize for Malawi, where it is both produced domestically and imported. Now, according to the Economics Course Companion: Second Edition, on p.272, if there was no foreign trade, and then domestic farmers would produce Q_e at P_e for maize. Here for instance, due to the issues in the productivity and intervention of FISP, we can assume that the country has to make imports. The thing is that because farmers do not have enough money to pay those, the subsidy program helps them by giving some coupons which shall help to reduce the amount of money they need to pay for the crop. A major problem is truly the mind-set of people, as they are too much focused on producing maize, so their production diversity is limited. Also, it isn't really fair as the government is doing a selective choice by deciding which particular farm holders they are going to provide coupons for, which includes a bit of favouritism for the selection. This isn't favourable for domestic producers since they already don't have enough money to pay the tool, crops and materials required for their fields. Furthermore, it stipulates that there is evidence that better-off households have gained substantially more than poorer households when they participated in the program, and that's due to the sharing households which have to divide in order to make most of the people happy with their outputs. This information linked well to my primary source results, as the villages I surveyed were all saying that those coupons provided by the FISP did help at the beginning, in terms of productivity, but now are not making the situation any better. According to this source, together these findings cast some doubt on the FISP's ability to reduce food insecurity and the poverty rate. The reliability of the program is diminished; people don't trust it as much as before and any hopes or expectations from it seem like they have disappeared. Also, from the discussions I have had with Manuel Milz, I have come with information that it seems government uses favouritism towards farmers who follow their campaigns/parties (which is a bite unfair and could be considered as corruption) while selecting the farm holders to which they're going to provide with the help of FISP.

Apart from the money aspect, another factor that plays a big role in the production is the weather. That, we cannot control, it is becoming harder and harder to produce as the soils are badly affected by drought during the dry season and inconsistent rainfall during the whole year, it is starting to be catastrophic. Looking now, with the facts that FISP isn't even useful when it is supposed to be the solution for the poorer farms in Malawi, it almost looks like a scam as individuals do not seem to be truly satisfied with the results.

In another recent article I have found that FISP might be 'abolished'. The parliamentary Committee on Agriculture has proposed that the Farm Input Subsidy Programme (FISP) should be abolished. Joseph Chidanti Malunga, the chairperson of the committee,

said:

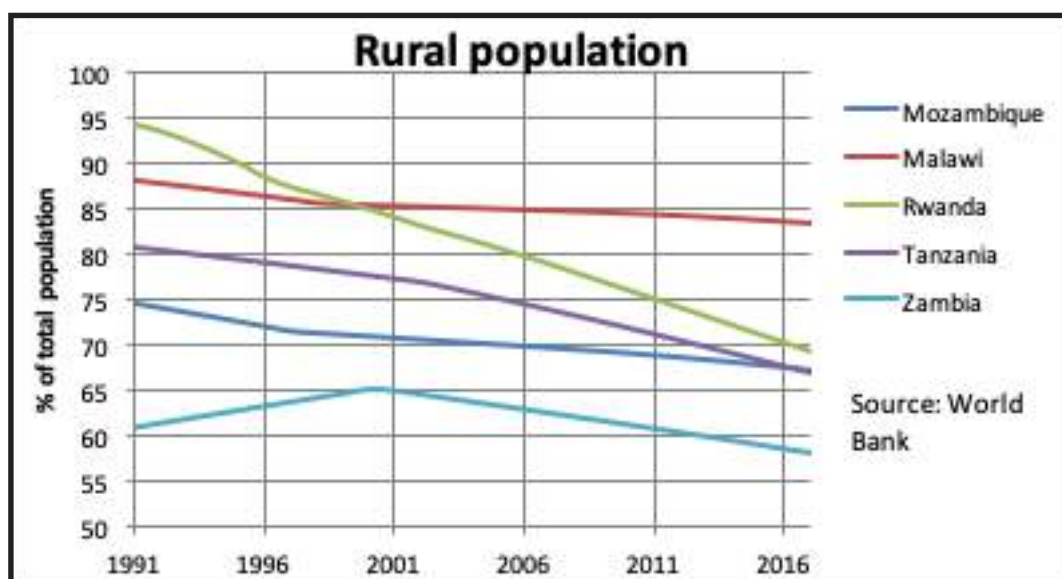
“...funds meant for FISP would benefit Malawians better if they were diverted to other more useful projects. The programme was introduced in 2005 to allow small scale farmers access fertilizer and seeds at a lower price but in recent years, people have been questioning the significance of providing cheap fertiliser to poor farmers when the rainfall pattern has become unpredictable. Since 2005, Malawi has spent over K300 billion on the program. In the 2017/18 program, government subsidised the price of Urea and NPK fertilisers as well legume, maize and sorghum seeds for selected farmers”. (Nzangaya)

Malawi has about 16 million people, 53% of who live under the national poverty line, and 90% of who live on less than \$2 per day. The United Nations Children’s Fund (UNICEF) estimated that there are 46,000 severely malnourished children. There is a clear problem.

In addition to this, my research has gone over some points regarding the limits of FISP. As it is not enough already, there are two main issues in Malawi which we can link to the limitation.

1. It is overpopulated: Compared to its neighbouring countries, Malawi has a higher percentage of population in rural areas, as shown below on diagram 4.

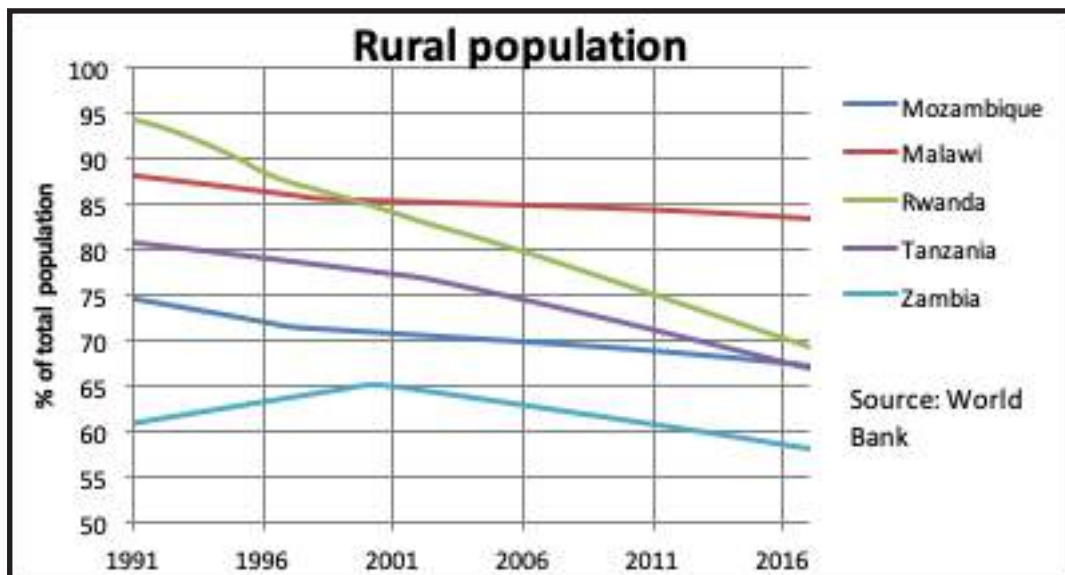
Diagram 4:



2. Literacy rates are low: Without education, there will be other issues which Malawi will be facing. On diagram 5, except for Mozambique, Malawi has a lower percentage rate

of literacy compared to the other countries, and it seems to go downwards.

Diagram 5:



My research looks at the overpopulation and the literacy rates. People on the fields working to produce food haven't all gone to school, and they tend to marry at a young age.

- There isn't easy accessibility for schools in most of the rural poor areas, so people will only have to worry about their homes and their fields.
- In Malawi, just like in many other LEDC's, if people don't have accessibility to education, they will tend to focus more on domestic requirements (e.g. initiating their children to the work practices). In order to help them for the food production, Malawian farmers will have lots of kids who won't go to school and will stay with them to work on the fields. That is just a kind of vicious cycle, because those kids who have been raised in that mind-set will carry that reasoning on as they didn't get the chance to go school and get well educated.

In the survey, for primary sources, the interviewee is asked to precise if they are married or not, has children or not, and if possible to specify how many. The majority actually responded no less than 5 kids, which is unreasonable, and therefore I would ask my interpreter to ask them if they maintained their children on the farms in order to work, and they all said yes. It was relevant to the investigation. Also I should have changed the 1st question to 2014.

There are four main categories of economic impact of child labour:

- The effects of child labour at the micro family level, particularly on family poverty both in the short and in the long run.
- The effects of child labour on long-run growth and social development through a number of different transmission mechanisms.
- The international economic effects of child labour particularly on foreign direct investment.
- The effects of child labour on adult labour market.

All of the above have negative implications.

If you could put yourselves in their shoes, it is truly hard to do what they are all supposed to do when they aren't even selected for the program, or even when they do, the outcome isn't as great as what would be expected from all the inputs they've bought for productivity. Debts are coming back. In one other article, it says that "foreign debts are creeping back to unsustainable levels, putting the country at risk of plunging deeper into poverty as more pro-poor resources go to debt servicing." This is quite bad, so what are the solutions, stopping FISP? All of the problems aren't from the FISP itself of course, but what to do?

As for the malnutrition and all of the food complications, one of the methods that must be applied is the production of other products. This is not a secret; Malawians rely too much on maize. They cook it into Nsima, but that only isn't enough for a proper nutrition. Variety is needed in order to have a healthy life-style, and that's why they should not only focus on maize, but other types of food. Sustainable agriculture is another possible solution to the problem. But what is sustainability? It is the use and management of resources that allows full natural replacement of the resources exploited and full recovery of the ecosystems affected by their extraction and use.

POSSIBLE SOLUTIONS

Sustainable agriculture is the production of food, fibre, or other plant or animal products using farming techniques that protect the environment, public health, human communities, and animal welfare. This form of agriculture enables the facility of producing healthier food without compromising the future generations' ability to do the same.

Benefits from it are:

- Protection of public health: This is a very basic but still very important one. As the sustainable doesn't use pesticide or toxins, it will produce healthy foods.
- Sustaining Vibrant Communities: remain economically viable, providing farmers, farmworkers, food processors, and others employed in the food system with a liveable wage and safe, fair working conditions.
- Upholding Animal Welfare: Animal rights are also to be taken care of with humanity. We should not disturb them, as they also contribute to the ecosystems we live in (e.g. the bees).

In agriculture, sustainability is a complicated but considered aim envied by many, but there are many possible outcomes that might have constraints based on some views, which include the economic view, the social view and the environmental view.

Economic: according to this view, a sustainable farm should be a profitable business that contributes to a robust economy, if the focus only goes on the profits from the start her, we will be struggling, so we therefore need to reach the sustainable first before having high hopes onto the economic success.

Social: it should deal fairly with its workers and have a mutually beneficial relationship with the surrounding community, that isn't an easy target to make as many groups are separated. If some farmers haven't joined a group, we cannot and shouldn't force them to. It is a collaborative aspect that should be initiated individually.

Environmental sustainability in agriculture means good stewardship of the natural systems and resources that farms rely on. Among other things, this involves:

- Building and maintaining healthy soils
- Managing water wisely
- Minimizing air, water, and climate pollution
- Promoting biodiversity

But of course, those are all very hard to achieve, because it would be a sudden change. There's a field of research devoted to achieving these goals: agro ecology, the science of managing farms as ecosystems. By working with nature rather than against it, farms managed using agro ecological principles can avoid damaging impacts without sacrificing productivity or profitability.

Sustainable agriculture practices:

- Rotating crops and embracing diversity (Scientists)
- Planting cover crops (Scientists)
- Reducing or eliminating tillage (Scientists)
- Applying integrated pest management (IPM) (Scientists)
- Integrating livestock and crops (Scientists)
- Adopting agroforestry practices (Scientists)
- Managing whole systems and landscapes (Scientists)

Maybe, we should educate and inform farmers and initiate them to adapt these practices, it wouldn't cost as much as what FISP has in the past.

A key theme connecting many of these practices is diversification. "Keep it simple" is good advice in many situations, but when it comes to agriculture, the most sustainable and productive systems are more diverse and complex—like nature itself. Maybe they might even try permaculture perhaps.

CONCLUSION

To what extent has FISP (Farming Input Subsidy Program) impacted Malawi's economy in its poor, rural, agricultural areas around Lilongwe? Initially it did a fairly good job, due to the considerable increase in production it has had at the beginning of the introduction of it. FISP isn't the main problem facing the food security; but it wasn't the right solution to undertake for solving the money issues and production rates. Based on my investigation, the extent of FISP's impact onto the overall economy of Malawi isn't great, although technically, it may have been a good solution suitable for the short term; it wasn't in the long term. Furthermore, in both my primary and secondary research, it was revealed that they were selecting the persons to which they would distribute their coupons and support for their production requirements.

As for poverty in the rural poor areas, they could have approached it in different ways. School accessibility is a crucial fundamental that needs to be overcome, and that, with the food security, should be on top of their worries, regarding the future, as it is the people of tomorrow who will rule. Since some villages are very far from very few schools which have fees, it is a normal behaviour that parents won't send their kids to learn at school, they'd rather keep them at their family homes and give them jobs to do. In order to respond to their family's needs, some of them might even have to go and work for some other farmers with more facilities.

If the government is importing more food and the prices are increasing, then what even is point of having the FISP? It is a good initiative to make a system where it will facilitate the farmers to pursue new seeds, fertilizers and/or any type of instruments required for them for the production of food. But, if the prices are increasing, and the farmer only has one crop being produced, he's against an external competition that's got the financial advantage for producing the same crop and exporting it to Malawi, how is that going to benefit the farmer? No, the Malawian government should first of all concentrate first on the areas that need improvement, because it is a shame that NGO's have to do the work of the government. The international trade for example, shouldn't be occurring because the imports that are being made are taking place over Malawian supply abilities, and so it is interfering with the development Malawi's agricultural poor, which slows down the economic growth. Tariffs is another solution, if there are higher prices, producers will be forced to pay more in order to fill that gap.

In conclusion, I think the extension of FISP's impacts was not the one that were expected, as they haven't analysed correctly the situation for a long term basis, and carried on in the wrong way from the beginning. From a personal view, I'd say the program will only provide some help to farmers or households that were selected at random, then those who benefit from it will use that boost but in a very short period of time, and then it will reduce their purchases by not much. On a long period, it isn't very effective to raise the production rates. There is a problem where individuals are only asking for money and others providing it instead of asking for new ways on how to find other alternatives to make their food productions more effective. I personally think that it is the only way for farmers to get out of these difficulties. Experts should be coming and informing or teaching the people more about sustainable agriculture practices.

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Kiridan Munro



Physics

How does shade effect the power output of a photovoltaic module?

Introduction

Over the past few years, the consumption of photovoltaic modules has vastly increased. Photovoltaics is the field of technology using the transmutation of light to create electricity at an atomic level. It uses materials that contain photoelectric properties which allow them to absorb photons of light and release electrons. These electrons are then conducted through an electric current which gives us electricity.

There are many factors that determine the power output of solar modules such as shading, temperature, orientation, size, type and conversion efficiency of solar modules. This essay will be addressing "how does shading affect the power output of a photovoltaic module?". This essay will explore in this topic through the ways in which light intensity is affected and how light intensity affects the overall power output of a photovoltaic module. This will address the issue of the inaccessibility of none shaded areas for locating photovoltaic modules. Therefore, the effects of different types of shading must be analyzed to determine which location will be most efficient in producing power. This is a relevant area of research due to its implications on how solar sites are decided as well as how the knowledge expressed in this essay can be applied to Malawi's current electricity shortage. As well as answering the question that "Due to Malawi's sporadic rainy seasons will it have a dramatic effect on the power output of photovoltaic modules within that area?". Additionally, this will also respond to the common assumption that the slight shading of a solar module will only cause a slight decline in power output.

Photovoltaic module shading is a complex topic due to its many areas; however, it can be looked at through two main ways. The solar module is completely shaded over, for example by a nearby building thereby affecting the overall beam radiation intensity on the module. Or, there may be partial shading, for example, a leaf falling on the module. This is shading a specific number of photovoltaic cells and will have a different effect on the power output of the module.

Light

To grasp the intensity of light, light must be defined. Light is a transverse, electromagnetic wave. A transverse wave is if the displacement is perpendicular to the direction of energy transfer. An electromagnetic wave is when the electric field is oscillating perpendicular to the magnetic field and are both propagating in the same direction.

All waves carry energy, the rate that the energy is carried in is expressed through power (P) which is measured in watts (W). When this power is exerted onto an area (A) the intensity can be obtained through the following equation:

$$I=P/A \quad (1)$$

Using equation 1 the overall intensity of the sun on the earth can be calculated. The sun radiates roughly 3.86×10^{26} W at any moment. The distance between the earth and the sun is roughly 149.6 million kilometres (Egelstaff, Julian). Since the sun radiates power in all direction $a=4\pi r^2$. Hence the intensity that the sun radiates on the earth is:

$$I=(3.86 \times 10^{26})/(4\pi \times (1.496 \times 10^{11})^2) \approx 1370 \text{ Wm}^{-2} \quad (2)$$

However, this is just a general form of calculating the intensity of a light. This is not taking into consideration the shading that the atmosphere or nearby buildings cause.

Shading

A major factor of light shading is caused by clouds. All cloud formations are unique; thus, it is impossible to have an accurate expression on how one cloud will affect the intensity of the light. Nonetheless, some brief generalization can be constructed. Clouds can be looked at as a medium formed by water vapour as well as other particles that may have been in the water as it was evaporating such as, dirt, salt or ice. (Dunbar, Brian). Additionally, the concentration of these particles will differ amongst the cloud and will be affected by the pressure at the different altitudes, temperature and size of the cloud. Due to the vast factors, it is more accurate to do data collection of light intensity within the year during cloudy days than to try and express it through an equation.

On the other hand, a building or tree shading is simpler to express. It is dependent on the angle of the sun and the height of the building or tree. With the height of the obstruction (H) and the altitude angle (β), the following equation can be used to express the length of the shadow (L) it will create.

$$\tan\beta=H/L \tag{3}$$

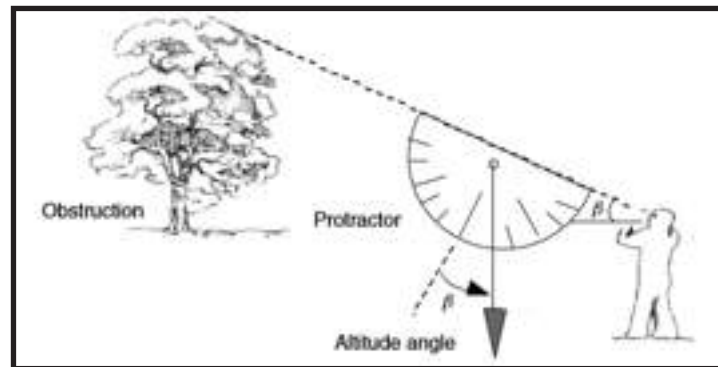


Diagram 1 (Masters, Gilbert M.)

Due to acquiring the length of the shadow it would thereby be clear to put the photovoltaic module out of reach. However, if the photovoltaic module is fixed then the length of the shadow can be used to establish the portion of the photovoltaic module that will be covered.

Direct Insolation

Direct insolation is a reasonable estimation of the intensity of light that hits a PV module. It is made up of the direct beam radiation, diffused beam radiation and reflected beam radiation. For calculations, the photovoltaic module will be referred to as a collector. The direct beam radiation is the simplest of the three as it only includes the beams of light that directly hit a PV module. It is the direct light rays that hit the collector.

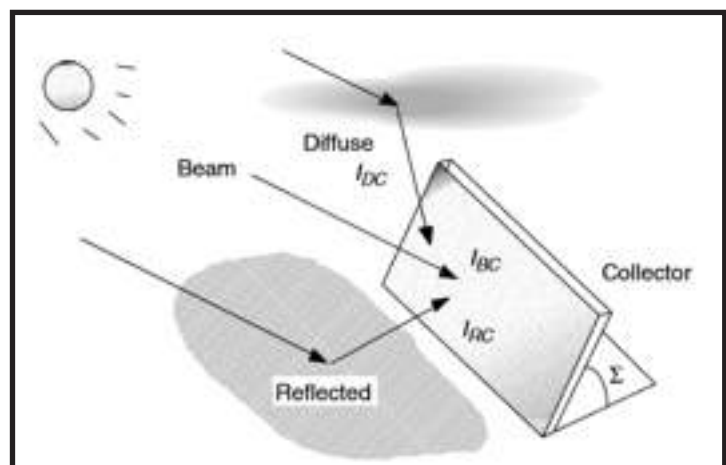


Diagram 2 (Masters, Gilbert M.)

While diffused and reflected beam radiation only provide a small fraction of energy that reflects or refract onto the PV module (Masters, Gilbert M.). Diffused beam radiation are the light rays that come into contact with a particle which causes the ray to differ

in a direction so that it hits the collector. Reflected beam radiation are light rays that reflect off of the surface to hit the collector. Additionally, reflected and diffused beam radiation can both occur when the light ray is travelling to the collector. For example, a light ray may reflect off the surface and then hit a particle in the air causing the light to diffuse and hit the collector.

Direct Beam Radiation

The intensity of the direct beam radiation will be referred to as I_B . This intensity is lessened or of the same value as I_B depending on the angle at which it strikes the collector. Thereby giving a different intensity of I_{BC} (H., Ali M.).

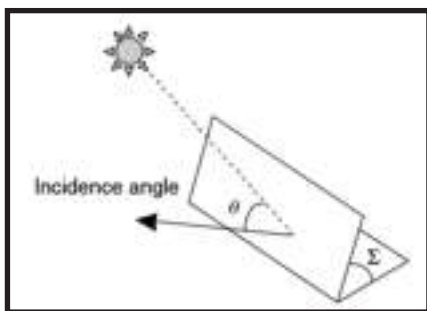


Diagram 3 (Masters, Gilbert M.)

In this diagram θ is the angle normal to the surface of the collector and the solar ray. This can thereby give a simplistic correlation between I_B and I_{BC} as:

$$I_{BC} = I_B \cos \theta \quad (4)$$

However, factors such as the altitude of the sun (β), the angle at which the collector is tipped at (Σ), the angle of the collector relative to the due south (Φ_s) and angle of the sun (Φ_c) all make up $\cos\theta$. These angles can be seen in diagram 4.

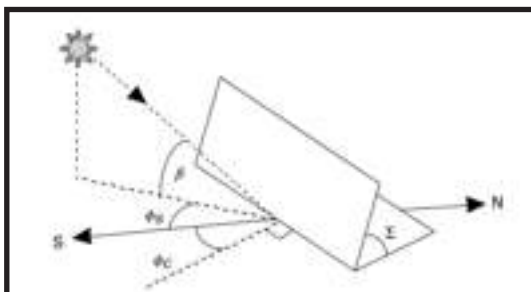


Diagram 4 (Masters, Gilbert M.)

The equation that expresses the relationship is given by:

$$\cos\theta = \cos\beta (\Phi_s - \Phi_c) \sin\Sigma + \sin\beta \cos\Sigma \quad (5)$$

If the collector is perfectly horizontal on the surface then its intensity (I_{BH}) would be expressed as:

$$I_{BH} = I_B \cos(90^\circ - \beta) = I_B \sin\beta \quad (6)$$

Diffuse Radiation

Diffused radiation is the most difficult of the radiations to establish an accurate estimation due to the various components that contribute to it. This is also the aspect that most applies to clouds as it is looking at how radiation coming from the sun can be dispersed by particles within our atmosphere. These particles are concentrated in aspects such as clouds. There are two main ways that a beam of radiation can strike the collector with diffusion: it reflects off a particle in the atmosphere and strikes the collector or it reflects off the ground and hits an atmospheric particle and strikes the collector (Masters, Gilbert M.).

The intensity of the beam radiation when the collector is placed flat on the ground (I_{DH}) is proportional to I_B . The following equation is given:

$$I_{DH} = C I_B \quad (7)$$

In this case, C is the sky diffuse factor. To find the sky diffuse factor, data is taken and then correlated to the day of the year expressing an approximation. Therefore, sky diffusion factors would need to be calculated from Lilongwe to provide an accurate equation. For example, data from Atlanta has been used to create the following expression of sky diffuse factor:

$$C = 0.095 \sin[360/365 (n-100)] \quad (8)$$

In this expression, n represents the day. If the collector isn't flat on the ground then the effect of the angle must be included. If the collector is placed perpendicular to the group it found only face half of the sun and thereby only receive half of the solar radiation. Therefore, the intensity striking the collector through diffusion can be expressed as:

$$I_{DC} = I_{DH} ((1 + \cos\Sigma)/2) = C I_B ((1 + \cos\Sigma)/2) \quad (9)$$

In this expression, Σ represents the angle at which the collector is tilted.

Reflected Radiation

Reflection makes up the least in terms of intensity. One of the factors to consider is the reflectance of the surface near the collector (ρ). Additionally, it would include

the intensity of radiation if it directly hit the ground (I_{BH}) or the intensity after going through diffusion then hitting the ground (I_{DH}). Finally, the angle of the collector with the assumption that if it is placed perpendicular to the ground it only receives half the intensity (Masters, Gilbert M.). Therefore, the intensity of radiation due to reflection is expressed as:

$$I_{RC} = \rho(I_{BH} + I_{DH})((1 - \cos\Sigma)/2) \quad (10)$$

Then substituting the expressions that have already been established for I_{BH} and I_{DH} the equation can be adapted to:

$$I_{RC} = \rho I_B (\sin\beta + C)((1 - \cos\Sigma)/2) \quad (11)$$

Direct, Diffused and Reflected Radiation

All three ways of the collector receiving radiation intensity express the over-intensity it receives as shown (Masters, Gilbert M.):

$$I_C = I_{BC} + I_{DC} + I_{RC} \quad (12)$$

These three expressions all revolve around I_B the intensity the sun emits which can be absorbed by clouds. Therefore, I_B must be extracted to view the effect that it will have. The effect is expressed as:

$$I_C = I_B (\cos\beta (\Phi_s - \Phi_c) \sin\Sigma + \sin\beta \cos\Sigma + \rho(\sin\beta + C)((1 - \cos\Sigma)/2) + C((1 + \cos\Sigma)/2)) \quad (13)$$

Through the equation, the sky diffusion factor can clearly be seen to have an effect on the intensity of light on the PV module. As well as the different angles and the degree of reflectance caused by the near surface. Since all these aspects that determine light intensity are constantly changing; only generalization can be applied to calculate the light intensity over a period of time.

Effect of Light Intensity on PV Module

To determine the effect of light intensity on a photovoltaic module it is dependent on the type of photovoltaic module used. These modules are made up of different cells with different efficiencies in the transfer of light energy into electricity which are caused by the difference in materials, arrangement, size, and purity of the materials.

For simplicity, a generalization will be made stating that each cell of the module will experience the same beam radiation intensity. The main aspects that will vary are the

cell shunt resistance, cell series resistance and the concentration of light (Honsberg, Christiana, and Stuart Bowden). Cell shunt resistance is used to measure alternating or direct electric current which is done by measuring the voltage drop across a resistor. Shunts have a maximum current rating. The resistance is given by the drop-in voltage at the maximum current rating. However, a shunt is used primarily to protect against too high a voltage or by passing a defective device. In the case of PV modules shunts appear within the PV module due to anomalies in the production of the photovoltaic cells. The effect on the current can be expressed in the following:

$$I = I_L - I_0 \exp[qV/nkT] - V/R_{SH} \quad (14)$$

Within this equation, I is the cell output current, V is the voltage across the cell terminals, T is the temperature, I_L is the light generated current, R_{SH} is the cell shunt resistance. The constant q is the electronic charge which is 1.602×10^{-19} coulombs. The k constant is also known as Boltzmann's constant which is $1.3806388 \times 10^{-23}$ joule/K. n is the ideality factor. The ideality factor states how close the diode is to following the ideal diode equation. Since it is V divided by R_{SH} then the smaller the shunt resistance the greater it will decrease the intensity of the photovoltaic cell (Honsberg, Christiana, and Stuart Bowden). While cell series resistance is the resistance of the overall circuit. Over time resistance will occur in a system that affects its overall performance. In this case its ability to transform light energy into electricity (Tummala, Abhishiktha).

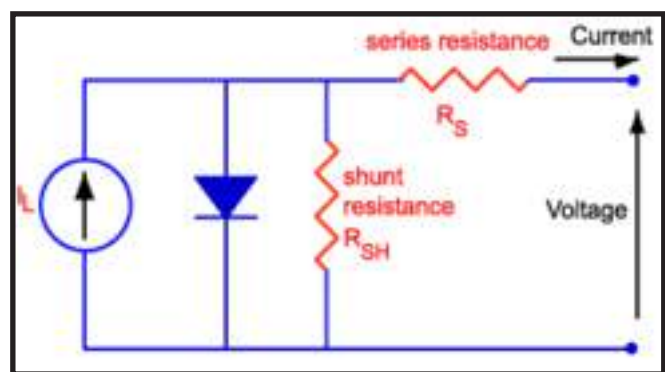


Diagram 5 (Honsberg, Christiana, and Stuart Bowden)

Overall, the effect that shunts resistance and series resistance will be expressed as the following:

$$I = I_L - I_0 \exp[(q(V + IR_s))/nkT] - (V + IR_s)/R_{SH} \quad (15)$$

V expresses the voltage, I represents the current and R_s expresses the series resistance of the cell. To provide an overview of the effects of light intensity the performance of mono-Crystalline Silicon solar cells under low light will be looked at. This equation expresses how the change in cell shunt resistance, cell series resistance, and light intensity interact with each other to provide the voltage output and current output,

which if multiplied, will give us the overall po output of the system:

$$V'_{oc}=V_{oc}+nkT/q \ln(X) \quad (16)$$

Due to the logarithmic expression, any changes in the intensity of the beam radiation will have a strong effect on the power output (Honsberg, Christiana, and Stuart Bowden). In diagram 6 it expresses the power to voltage characteristics when there are various solar radiations.

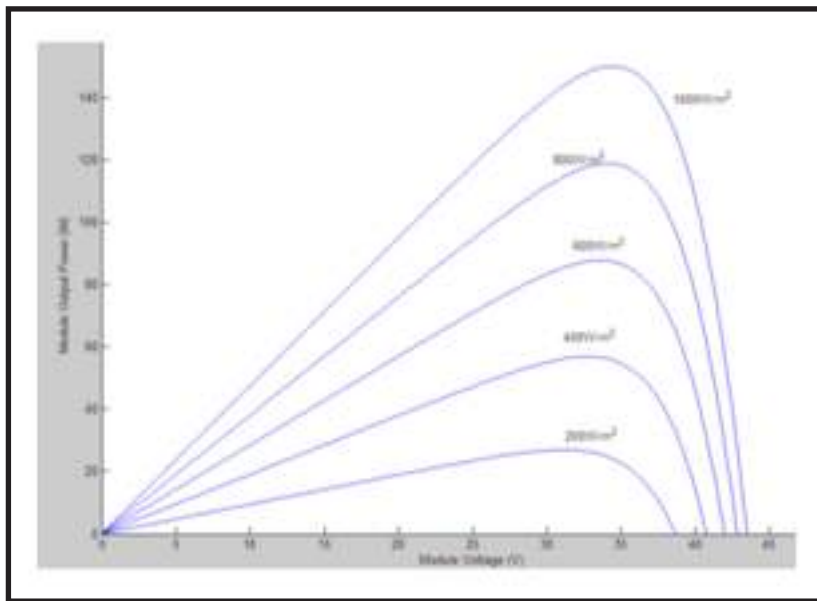


Diagram 6 (Bikaneria, Jitendra, et al)

When a Portion of a PV Module is Shaded

Partial shading is when one or more of the PV cells are shaded. Examples of this would be when a cloud has covered a portion of the PV module, dirt or leaves landed on the PV module or the orientation of the sun caused a nearby building to cast a shadow.

PV Module

All cells within a PV module are wired in series to increase the voltage it creates. If a PV module is not shaded and all cells are equal in all factors the following equation for current will apply (Masters, Gilbert M.):

$$I=I_{SC}-I_0 (e^{(38.9V_d)}-1)-V_d/R_p \quad (17)$$

I_{SC} each cells short-circuit current, I_0 reverse saturation current, V_d junction voltage of each cell, R_p parallel resistance:

$$V_{\text{module}}=n(V_d-IR_s) \quad (18)$$

n is the number of cells in the module, R_s is the series resistance:

$$P(\text{watts})=V_{\text{module}} I \quad (19)$$

Shading Effect on Power

Now when a cell is shaded since the cells are in series it will affect the voltage. Therefore, the shaded output voltage of the module (V_{SH}) with cells shaded (n_s) gives the expression (Masters, Gilbert M.):

$$V_{SH}=V_{(n-n_s)}-I(R_P+R_S) \quad (20)$$

If all the n cells not shaded carrying the current I, giving the output voltage as V then the cells shaded $V_{(n-n_s)}$ will give the voltage:

$$V_{(n-n_s)}=((n-n_s)/n)V \quad (21)$$

Now applying this equation to the V_{SH} the following it achieved:

$$V_{SH}=((n-n_s)/n)V-I(R_P+R_S) \quad (22)$$

V_{SH} is the amount of voltage lost since it only affects the voltage, the current will still be I. Therefore, the power loss would be expressed as:

$$P_{(\text{module loss})}=(((n-n_s)/n)V-I(R_P+R_S))I \quad (23)$$

To find the new power, the power without shade minus power loss due to shade or find the change in voltage then times by current. All of the power lost in the shaded cell is converted to heat, therefore, if a cell is continuously shaded it will cause a build up in heat which could damage the weather protective laminates surrounding the cell or nearby cells. Thereby making the photovoltaic module vulnerable to weather. Hence, if the cell is shaded it acts as a resistor.

Overall, if a small portion of cells are shaded it will have a massive decline in voltage thereby in power. The showing diagram with 36 cells (Masters, Gilbert M.). As seen if only one cell is shaded out of 36 the power delivered in this case to a battery would be decreased by two-thirds.

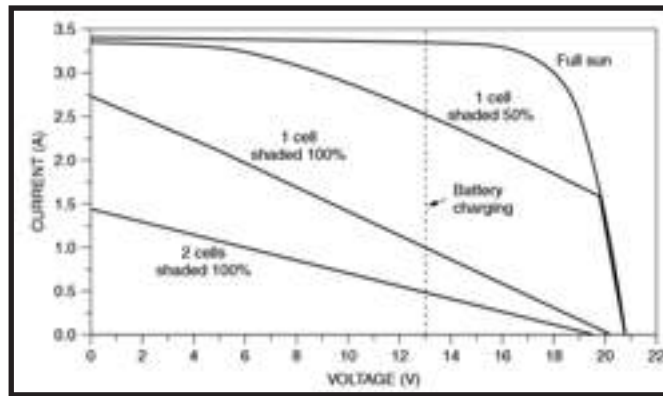


Diagram 7 (Masters, Gilbert M.)

Bypass Diodes

Due to the severe shifts that shading causes of voltage and power. Additionally, it can potentially damage it can cause if a cell is shaded. To mitigate the effect that shading has on voltage bypass diodes are placed across each cell. The bypass has no effect if all the cells are in the sun; however, if there is a drop-in voltage the bypass diode will activate, diverting the current through the diode rather than the cell (Masters, Gilbert M.). This way, instead of the shaded cell having a domino effect on the efficiency of the other cells, the diode causes the one cell to act as though it wasn't there. Therefore, the only resistance is the one caused by the diode. The overall effects are expressed through the diagram below where the full sun is when there is no diode and no shading:

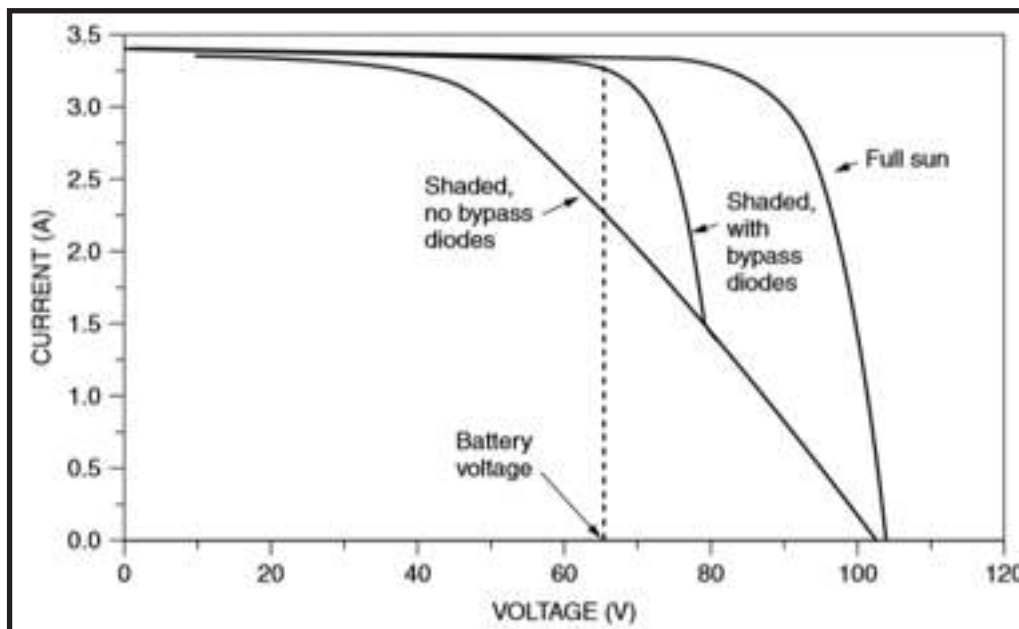


Diagram 8 (Masters, Gilbert M.)

Take the following set up as an example of how the diodes function:

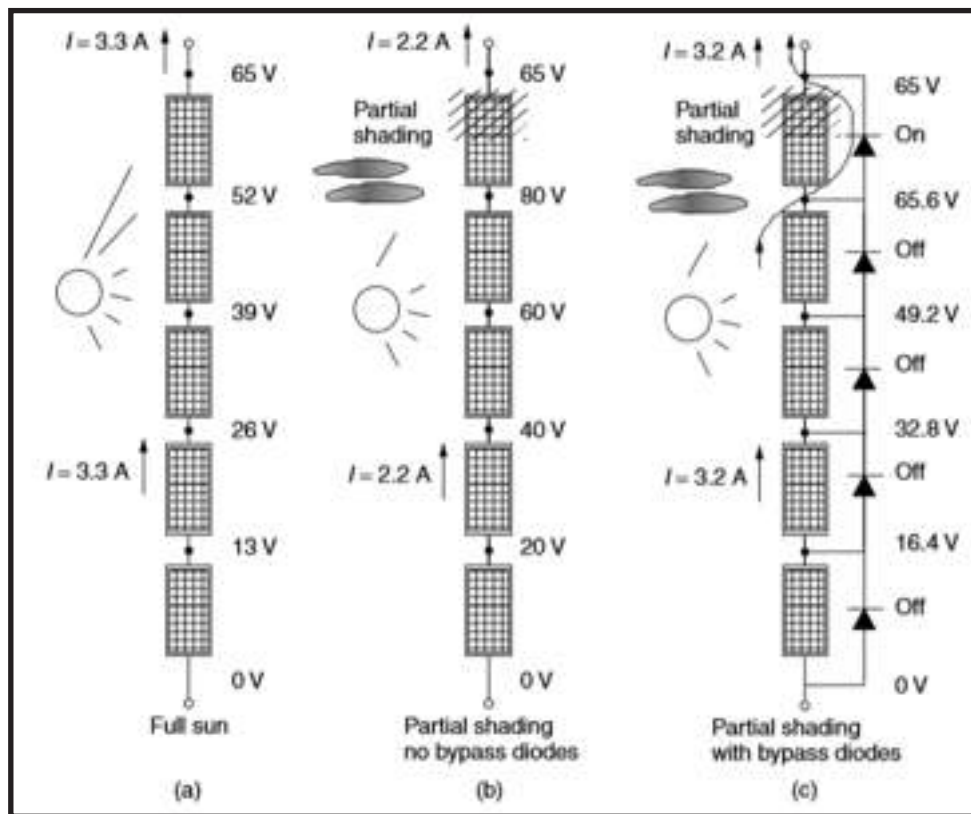


Diagram 9 (Masters, Gilbert M.)

In (a) the module is functioning with the full intensity of the sun giving a current of 3.3 amps and a voltage of 65 volts giving a power of 214.5 watts. While in (b) the last cell is partially shaded reducing the current to 2.2 amps; however, in (c) there are bypass diodes allowing the effect of shading to mitigate and only decreasing the current by 0.1 amps.

Lab

To further reinforce the effect of shading of PV modules the following experiment has been conducted:

Aim: To identify how shading will affect the power output of a photovoltaic module

Background Theory: The power output of a photovoltaic module is dependent upon the number of cells in the module that are covered. Commercial PV modules, like the one used in this experiment, contain bypass diodes; hence, covering a fraction of the PV module will express a strong effect on the power output.

Hypothesis: As stated in the background theory, the power production revolves around the number of cells that are shaded. Additionally, as more cells are shaded more diodes will be activated and hence there will be more diode induced resistance. Therefore, the more the solar module is shaded the greater the effect it will have on the power produced.

Variables:

Independent Variable: The fraction of the photovoltaic cell that will be covered by the cardboard with the following increments: 0, 1/6, 1/4, 1/3, 1/2, 2/3, 3/4, 5/6

Dependent Variable: The power output (watts) of the cell

Controlled Variable: The same photovoltaic module will be used as using another type would change conversion of light intensity into voltage and current which would vastly change the dependent variables. Additionally, the same light source should be used as changing it will change the light intensity. Additionally, the light source should be kept at 20 cm from the photovoltaic module for the same reason. Any change in the light intensity would affect the current and voltage produced as it could increase or decrease the number of photons being converted into electricity.

Labelled Diagram

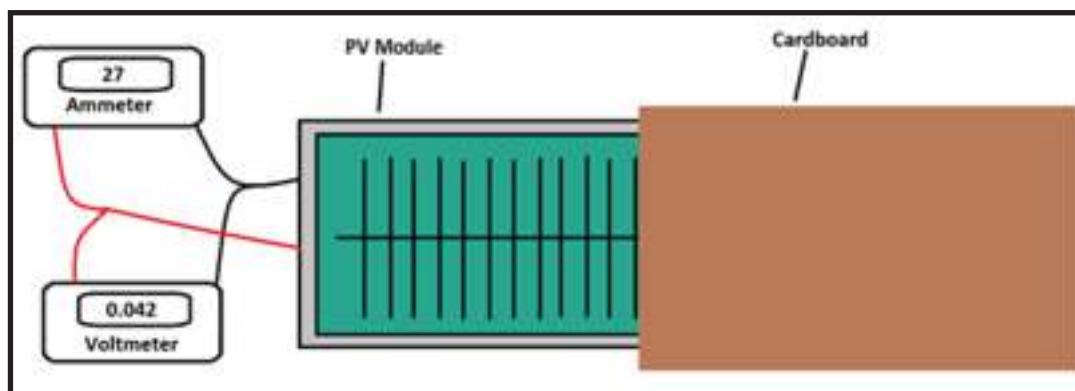


Diagram 11 (K, M)

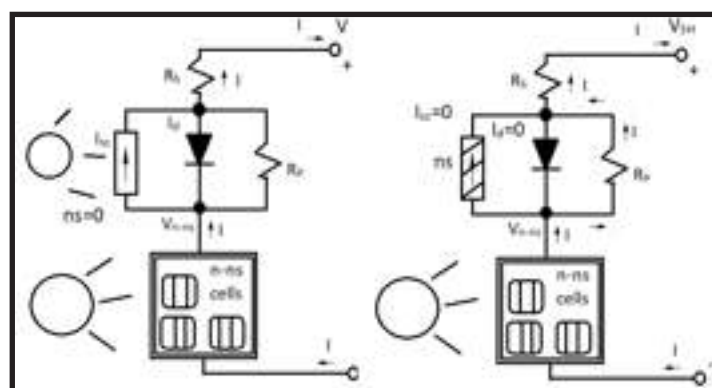
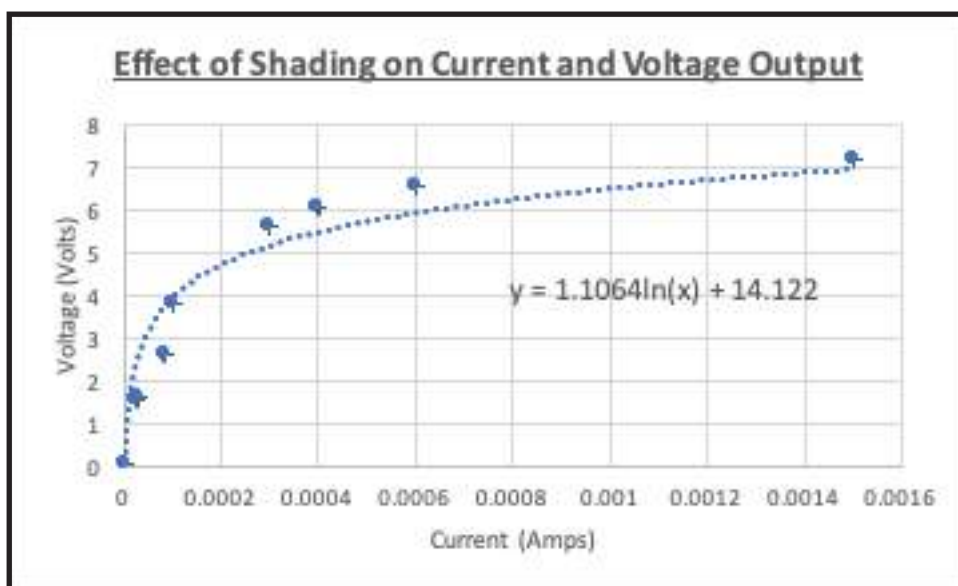


Diagram 12 (Masters, Gilbert M.)

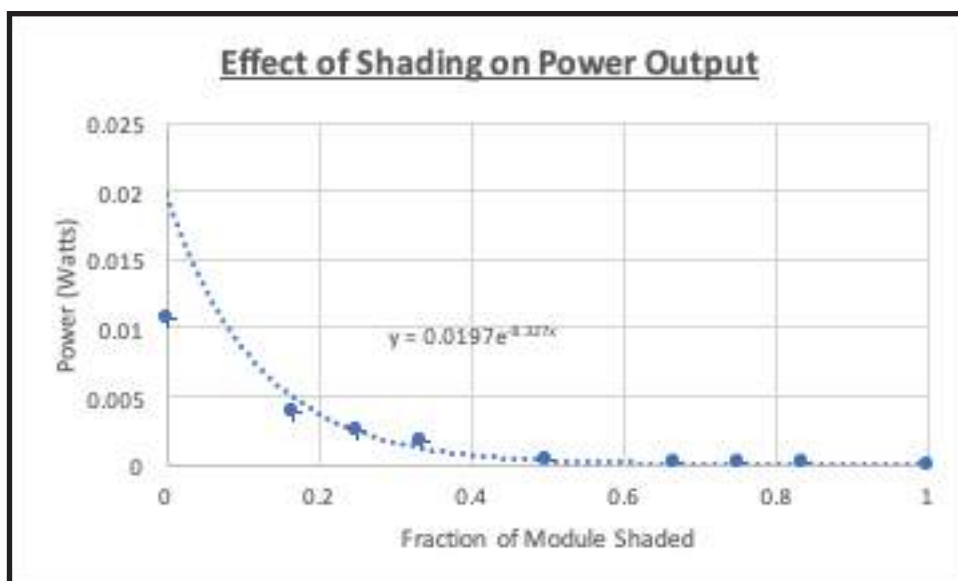
Results Table:

	Fraction Covered								
	All Cover	5/6	3/4	2/3	1/2	1/3	1/4	1/6	No Cover
Current (micro-amps ±1µA)	1	26	27	82	100	300	400	600	1500
Voltage (volts ±0.004V)	0.042	1.548	1.582	2.614	3.775	5.580	6.058	6.524	7.135
Power (watts ±0.000001W)	0.000001	0.000040	0.000043	0.000214	0.000378	0.001674	0.002423	0.003914	0.010702

Graph 1: (Error bars are too small to see)



Graph 2: (Error bars are too small to see)



Analysis

From graph 1, there is a clear logarithmic correlation. This is evident through the trend line equation expressed $y=1.1064 \ln(x)+14.122$. Additionally, this disproves the common misconception that covering half a photovoltaic module will decrease its power output by half. This is proven in the diagram as power decreases even more than half when half the photovoltaic module is covered. Looking at the general shape of the curve there is a slight outlier when the photovoltaic module is covered by 3/4 as its current is slightly higher than expected. Additionally, However, this could be due to a shift in the light source or the photovoltaic module. As well, a possibility of a manufacturing error in the creation of the photovoltaic cell.

From graph 2, the correlation of shading to power has a similar gap when the photovoltaic module is 3/4 covered. Similar to the other graph, there is a logarithmic correlation from power to the fraction of the photovoltaic module shaded. This is proven by the equation $y=0.0197e^{(-8.327x)}$. Therefore, there is a dramatic decrease in power output when a small portion of the photovoltaic module is shaded. However, as a higher percentage of the photovoltaic module is shaded there is a less significant effect on the power output.

In graph 1, there are some clear outliers and issues with accuracy as the error bars do not intersect the trend line. In graph 2, there are fewer error bars that do not intersect the trendline; however, they are still present. Although, if there is no light (the fraction shaded is 1) theoretically the power output should be zero; this is not the case. When the whole photovoltaic module is shaded there is $5 \times 10^{(-6)} \text{ W}$; hence there is an error in the results collected.

Evaluation

The uncertainty for current was derived through the smallest measuring unit of the ammeter ($\pm 1 \mu\text{A}$). The same applies to the voltage obtained through the voltmeter ($\pm 0.004\text{V}$). Hence since the two values are times together the uncertainty of the power is $\pm 0.000001\text{W}$.

An issue that would occur is that the consistency of the intensity of the light from outward sources. The inconsistency in the amount of beam radiation reaching the solar module would thereby affect the voltage and current that is given. The possible solution would be to conduct the experiment in a controlled environment such as a dark room where light sources such as a lamp would be consistent throughout the experiment.

The other issue is the light source or the solar module moving as this would affect the amount of beam radiation coming into contact with the photovoltaic module.

Therefore, the light source and solar module should be taped in place. Additionally, the area should be marked where the light source and solar module is so that it is evident when either shift from their original position.

Dust particles that appear between the light source and solar module could also affect the experiment. The particles would diffuse or reflection beam radiation changing the amount striking the module. To prevent such particles from getting in between the experiment should be performed within a vacuum.

Another issue would be that unideal ammeters and voltmeters are used. This would affect the experiment by not expressing accurate voltage or ampere. Thus, decreasing the accuracy of the overall experiment. The solution would be to use a digital ammeter with a low level of uncertainty as well as very low resistance. For the voltmeter, it also should be digital, have a high accuracy and an extremely high amount of resistance. These two changes will allow for the collection of data with greater accuracy.

Conclusion

As seen throughout this essay, there are multiple ways in which photovoltaic module are affected through shading. Additionally, if the intensity of the beam radiation on the photovoltaic is equal on all cells it will not have as drastic an effect in comparison to partial shading of cells. From clouding shading to tree shading, to building shading all will have an effect on power output. However, cases in which debris such as leaves, dirt and bird poo fall on the PV module they will cause a severe decrease in the power output as well as causing local hot spots possibly damaging the protective laminate of the cell. Additionally, if sections of the PV module are continuously shaded it would also cause damage to the protective laminate of the cell. Therefore, shading such as wires, building or trees that are continuously shading the same cells will have long-term damage to the overall module.

This thereby calls into question the common perception that partial shading doesn't have a severe effect on power output. Therefore, ensuring that a PV module experiences the least shading possible will guarantee a stronger power output. Thus, areas within Africa such as Malawi where there are few trees, tall buildings, and few wires make technology such as solar power to most efficient to apply. Although, there may be slight declines in power output during rainy seasons. None the less rainy season within this area is quite low and sporadic so it will not have a severe effect. Rather, the debris caused by rainy seasons should be continuously cleared off PV modules to ensure the maximum possible power output.

Overall, the question of “how does shading effect the power output of a photovoltaic module?” was answered. Nonetheless, aspects such as angle of the photovoltaic module in correlation to the sun and the temperature of the photovoltaic module also have effects on the power output. Additionally, the angle of the photovoltaic module is related to the effect of shading caused. Since there are multiple other factors that impact the power output further study must be conducted in these areas. Even so, it is clear that photovoltaic module shading should be avoided as much as possible to all for an efficient production of power output.

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Fathima Aamina Nawaz



Biology

What is the effect of Urea fertilizer on the Relative water content of Maize leaves, under water stress, compared to the effect of NPK 23.21.0 fertilizer on its Relative leaf water content under water stress?

INTRODUCTION

Agriculture, plays a vital role in Malawi. By 2016, it contributed to approximately 27% of Malawi's GDP, employing about 85% of the population . Maize, is crucial as the nation's staple, with an average of 45.8% of agricultural land being used up for it from 2007-2011.

Some of the most important macronutrients for plants are nitrate ions, needed for the synthesis of proteins, nucleic acids and chlorophyll ; phosphates which are components in DNA, RNA, ATP and of phospholipids in cell membranes ; and potassium ions, which regulate the opening and closing of stomata (pores on the bottom surface of the leaf), and is key in ATP production . Therefore, many chemical fertilizers contain these, with the ratios of NPK (Nitrogen, Phosphorous, Potassium) shown . According to Agricultural Economists Darko et al. , as well as one of Malawi's top 10 agro-industries, Rab Processors , NPK 23.21.0 and Urea are the most common fertilizers used for Malawian Maize production.

Unfortunately, drought is a common issue faced by farmers as evidenced by previous food crises. In 2016, severe drought caused Maize production to drop by 12%, leading to 2.8 million Malawian's facing food insecurity . This highlights the significance of the research question as it tries to determine if a large aspect of agriculture: chemical fertilizers, particularly Urea and NPK 23.21.0, positively or negatively affects Maize in water stress, which could potentially contribute to knowledge on how to improve production of Maize in Malawi.

Having seen the importance of maize production in Malawi, through amazing traditions such as the Khulubvi shrine in Nsanje where the Mang'anja tribe worship and give offerings to the spirit of the legendary rain-maker, Mbona , I realize how much rain is valued, thus how valued good crop production is to Malawians.

Biological background

Maize takes up water and minerals through the roots: substances that are absorbed by the epidermis, diffuse across the cortex of the root to the central stele which contains the xylem, they are then moved up through the xylem because of the pull from transpiration . Most minerals enter the root through active transport: H^+ ions are expelled from proton pumps in root cells into the soil . The hydrogen ions displace the positively charged mineral ions from the soil, allowing them to diffuse into the plant along a gradient . Because of this constant use of minerals in the soil, particularly in agriculture where maize is grown and re-grown, the system becomes unbalanced with minerals taken out at a faster rate than the rate of replacement by normal decay . A method used to return this balance is fertilizer usage.

The process in which maize takes up Urea from the soil begins with its reaction with water, through the process of hydrolysis, ammonium carbonate is formed, and this is helped by the catalyst enzyme Urease synthesized by the plant . As ammonium carbonate is unstable it decomposes into NH_3 , carbon dioxide and water . The NH_3 is converted to NH_4^+ (ammonium) when it combines with the hydrogen ions released by the plant. These positively charged mineral ions attach to the negatively charged soil particles and remain until displaced by protons released by the plant for active transport.

Organic phosphate must be mineralized into inorganic phosphate for plant uptake. In NPK 23.21.0, the phosphates are inorganic , thus it is simply diffused across the soil to the roots, where it is taken up by the plant through active transport, being co-transported with protons , similar to Nitrogen.

Reliability of Research:

Relative Water Content (RWC) gives readings of current water status in plants. Another common method to determine water status is Water Potential, however this does not take into account the effects of osmotic adjustment . RWC considers the plants drought response mechanisms , thus it is an effective measurement for this experiment.

The secondary sources include articles from University professors e.g. De Cock P.C,

and IB text-books thus the information must have been thoroughly revised and not highly effected by personal bias due to the shared knowledge of peer review involved in academically related sources. However, a limitation is that recorded statistics such as the 2016 GDP contribution by Agriculture does not take into account that statistics change, thus the validity of the statistics is perhaps reduced by 2019.

Hypothesis:

The RWC of the leaves will increase as the amount of fertilizers increase, however the RWC for plants treated with NPK 23.21.0 will be greater than for plants treated with Urea.

Nitrogen forms the bases in DNA, that code for amino acids, the 'building blocks' of proteins . Thus Nitrogen is crucial for the synthesis of proteins such as the hormone Absisic acid, which is released to close stomata in response to drought . Therefore, nitrogen is crucial as if insufficient the plant will not be able to produce essential proteins. When under water stress after nitrogen application the plant can use drought response mechanisms such as the release of Abscisic acid. However, it is hypothesized that plants treated with NPK 23.21.0 will have a greater relative water content than plants treated with Urea, because it provides phosphorus as well. Phosphorus aids root development and will increase the plants uptake of water .

PROCEDURE

Variables:

Independent Variable

What: Volume of Urea and NPK 23.21.0 fertilizer.

Method of measurement: The chosen volumes for both types of fertilizers are 0cm³, 2cm³, 4cm³, 6cm³, 8 cm³, 10 cm³, 12cm³, 14cm³, 16 cm³. These volumes will be measured using a syringe that gives a $\pm 0.5\text{cm}^3$ uncertainty.

Dependent Variable

What: RWC of the maize plants.

Method of measurement: Using the formula $\text{RWC}(\%) = \frac{(\text{TFW} - \text{DW})}{(\text{TW} - \text{DW})} \times 100$. (see p11)

Controlled Variables

What: The same mineral quantities must be present in the soil for all 150 containers.

Why: Because the fertilizer's purpose is to increase mineral content in soil, part of the experiment is indirectly measuring the effect of mineral quantity on RWC.

How: The soil was collected from the same area for all 150 plants.

What: Amount of water each plant gets before water stress.

Why: If one plant gets more water than the other, the soil will contain more moisture, making it likely for that plant to have a higher RWC.

How: Each plant watered with: Mornings- 70ml Evenings- 25ml

What: Number of days all plants are in water stress.

Why: The RWC will be smaller for a plant that has been in water stress for longer.

How: All plants kept in water stress for 10 days.

What: Amount of sunlight each plant gets.

Why: - Light intensity increases the rate of photosynthesis, increasing water and phosphate intake; -The increase in heat from the sun increases the rate of transpiration by opening stomata .

How: All plants were taken outside and kept under a transparent shed (shed ensured that pests did not contaminate plants). The plants were taken inside at night as precaution against animals in the area.

What: Concentration of fertilizer solution after dilution.

Why: If concentration varies, plants won't receive an equal amount of nutrients.

How: Fertilizers will be mixed in a 1:1 ratio with distilled water and the same solution will be used for all of the plants. This allows the precise quantification of the fertilizers (harder to weigh granules).

Equipment:

Sterile nail	Sterile scalpel	Aluminium foil
Plastic container	Syringe	Labelling sheets
Permanent marker	Paper boat	Measuring cylinder
$\pm 0.001\text{g}$ digital scale	Goggles	
Maize seeds	Heat proof gloves	
Urea fertilizer	Incubator	Disposable gloves
Distilled water	Test-tubes	800micrometer sieve
NPK 23.21.0 fertilizer	Tongs	Sterile $\pm 0.25\text{cm}$ metal

ruler

Equipment Setup:



144 labelled test-tubes with leaf samples

±0.001g digital scale to measure leaf weight



Incubator in which leaf samples were placed to find dry weight.

Method:

1. Using a clean nail, 4 equal holes were inserted onto 150 clean plastic containers. Using a permanent marker, a line was drawn 3cm below the top of the container.
2. 9kg of soil was collected from the same area and sieved in an 800micrometer sieve, to remove large rocks or foreign objects.
3. The containers were filled with soil until the marked line. A metal sterile ruler was used to create a hole in centre of the soil, approximately 3cm deep. 2 seeds were placed and covered with soil. This was repeated for all 150 containers. Once covered they were watered with 50ml of water.

4. All containers were watered with 70ml of water in the morning and 25ml of water in evenings for 31 days. The plants were placed in the same area, under the same amount of sunlight.

5. On the 31st day 8 sets of 9 plants were chosen, each set containing plants that are similar in size. Labelled plants of 1st set from 1 to 9 and repeated with the remaining 7 sets (trials).

6. Repeat with another 8 sets of 9 plants.

7. On the 32nd day the fertilizers were diluted in a 1:1 ratio in water and added to plants through a syringe following these quantities for each set(trial):

Plant 1= 0cm³

Plant 2= 2 cm³

Plant 3= 4 cm³

Plant 4= 6 cm³

Plant 5= 8 cm³

Plant 6= 10 cm³

Plant 7= 12 cm³

Plant 8= 14 cm³

Plant 9= 16 cm³

Plants were immediately watered with 50ml of water.

8. Plants were watered for 2 more days with 70ml of water in the mornings and 25ml in the evenings.

9. On the 35th day of experimentation, water stress began. The plants were not watered for 10 days.

Measuring Relative Water Content :

1.6cm of the largest leaf blade was cut starting from the leaf tip and immediately* place in the paper boat to weigh (TFW).

2. The sample was then placed in a test-tube filled with 5 ml of water, sealed and set aside for 24hours. Then the leaves were dabbed on a paper towel to remove excess water and weighed(TW).

3. Placed in an incubator at 70celcius for 40 hours and weighed (DW).

*It was necessary to work fast in order to avoid water evaporating from plant.

Equation:

TFW= Total fresh weight

DW= Dry weight

TW= Turgor Weight

$RWC(\%) = (TFW - DW) / (TW - DW) \times 100$

Understanding of Equation:

The RWC of leaves determines the percentage of water in the leaf by comparing the leaf's current water content to its water content at full turgidity. This is why TFW is divided by TW. DW is subtracted in order to measure the amount of water only.

Process of writing method:

When first planning method it was thought to measure fertilizers in milligrams, placing solid fertilizer in the soil. However, it was learnt that this could cause fertilizer burn.

Initially planned to place one seed on each cup, however after conducting research with domestic worker, Memory Dzimkambani, who has experience farming, she conveyed that it would be best to place more seeds than plants needed as some seeds might not germinate.

Safety Precautions:

Wear gloves when collecting soil.

Wear heat proof gloves when collecting test-tubes from incubator.

Wear goggles throughout experimentation, to avoid substances entering eyes.

Environmental Precautions:

Collection of soil was conducted away from crops and carefully so as to not damage roots of any nearby plants.

Method extension:

After completion of experimentation, in order to test if the waxy cuticle was damaged, 5 drops of water were added to the leaves and observed.

Uncertainties:

The uncertainty for the volume of fertilizers used was $\pm 0.5\text{ml}$ because an analogous instrument was used therefore the uncertainty is half the smallest division of 1ml .

The uncertainty for the weights of leaves will be $\pm 0.001\text{g}$ because a digital scale (the uncertainty of electronic instruments is the smallest division) was used as the uncertainty is the smallest division of 0.001g .

RESULTS

Quantitative Data:

Sample Calculations for Relative Water Content:

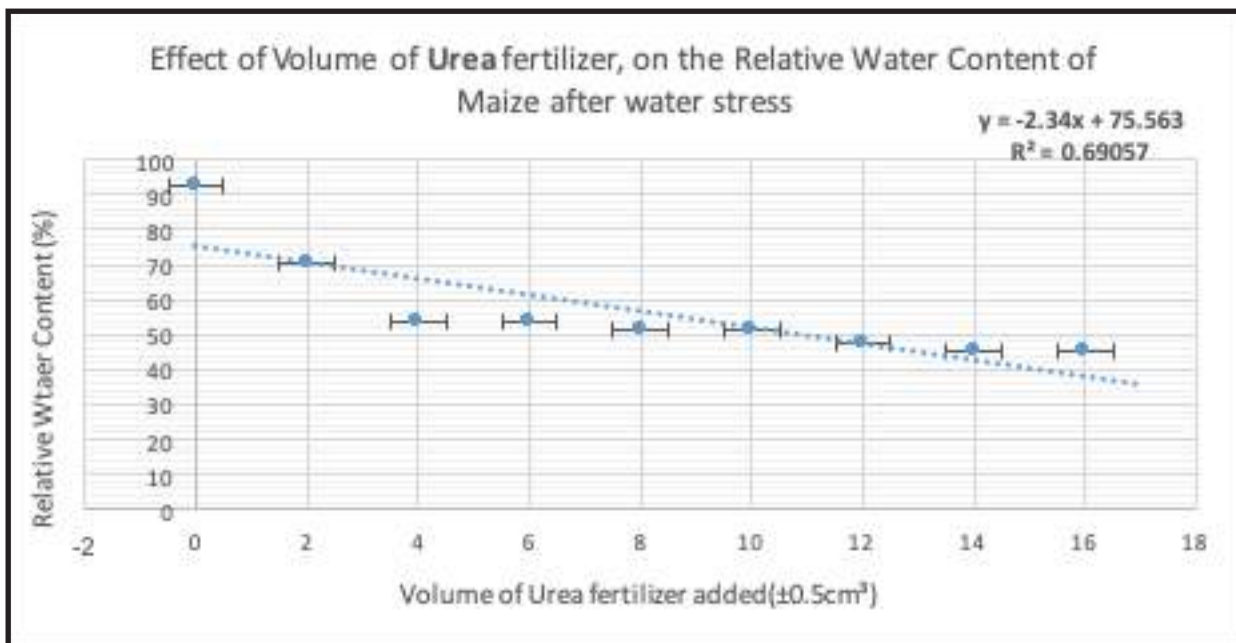
NPK 23.21.0 Variable 1, Trial 1:

$$RWC(\%) = (TFW - DW) / (TW - DW) \times 100$$

$$RWC = ((0.117 - 0.017) / ((0.145 - 0.017))) \times 100 = 78.125\%$$

Relative Water Content of Urea (%)	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Mean
0	78.125	97.479	97.541	91.525	95.455	95.882	89.431	94.958	92.550
2	41.228	57.664	89.209	52.381	70.677	91.209	82.051	81.443	70.733
4	48.101	37.931	44.186	34.615	44.776	62.810	75.000	81.818	53.655
6	38.095	39.623	29.885	77.165	42.857	39.286	85.833	77.419	53.770
8	50.000	66.917	25.743	55.195	41.237	81.944	41.401	50.000	51.555
10	52.500	70.513	25.424	43.969	42.574	55.172	66.176	54.667	51.374
12	38.043	21.739	45.122	45.794	43.590	60.577	69.811	55.769	47.556
14	42.574	42.308	28.571	53.846	45.070	56.944	30.357	63.333	45.376
16	29.688	69.231	25.287	66.250	44.286	29.577	67.857	27.941	45.015

Relative Water Content of K3.21.0 (%)	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	
0	95.977	82.086	76.983	78.965	85.987	98.565	96.789	82.345	87.212
2	67.391	33.333	65.000	75.362	74.615	70.652	35.106	84.516	63.247
4	65.000	64.894	66.387	65.049	56.566	48.315	38.372	44.348	56.116
6	62.069	63.415	55.000	61.386	45.588	51.613	48.571	48.361	54.500
8	35.714	33.333	81.905	80.645	72.067	41.053	51.020	28.736	53.059
10	20.635	76.768	42.609	30.986	37.681	50.602	96.330	64.348	52.495
12	57.000	58.824	49.412	58.462	38.596	43.564	46.316	51.042	50.402
14	55.118	80.734	40.000	38.776	35.938	40.000	35.955	50.000	47.065
16	57.143	46.667	43.038	43.114	32.609	63.303	46.835	38.272	46.372

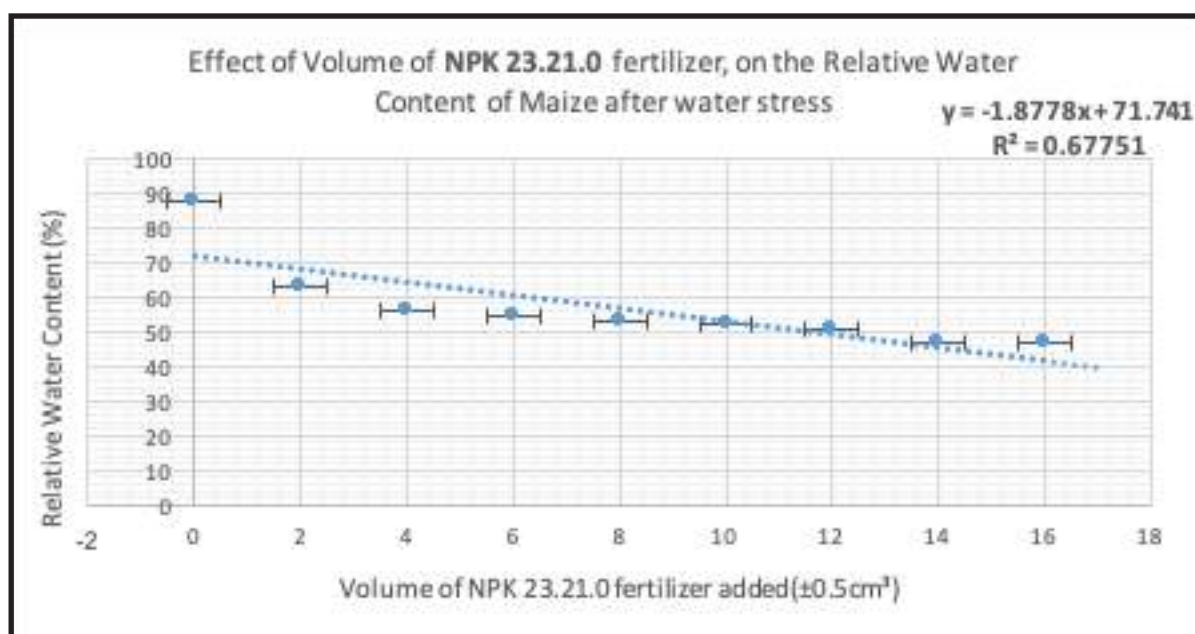


Graphs: (Note: Errors bar for RWC too small to see.)

The graph shows a negative correlation between the volume of Urea fertilizer and leaf RWC, with the trend-line decreasing from left to right.

The R2 value is 0.6906, which is relatively close to one. The main cause for the decrease in R2 is the outlier at 0cm³ and 4cm³ of fertilizer.

The RWC of the outlier at 4cm³ is 53.655% which is 0.115% less than the next point, going against the negative relationship. This could be because of the plant in trial 4 of



the variable, which only has a RWC of 34.615%, was very large, thus it has a higher rate of transpiration, reducing the RWC.

The R2 value is at 0.6775, the major outliers causing this being the points at 0cm³, 2cm³ and 4cm³ of fertilizer.

The outliers at points at 2 and 4cm³ of fertilizer. These could be because of trials that used large plants resulting in lower RWC's (trial 2 for 2cm³, and trial 7 for 4cm³).

The main outlier prevalent in both the graphs is the point at 0cm³. The RWC's are very high producing a large drop from the control to 2cm³. The high RWC in the controls highlights the great decrease in RWC after addition of fertilizer.

These graphs are the statistical representations of the images below:



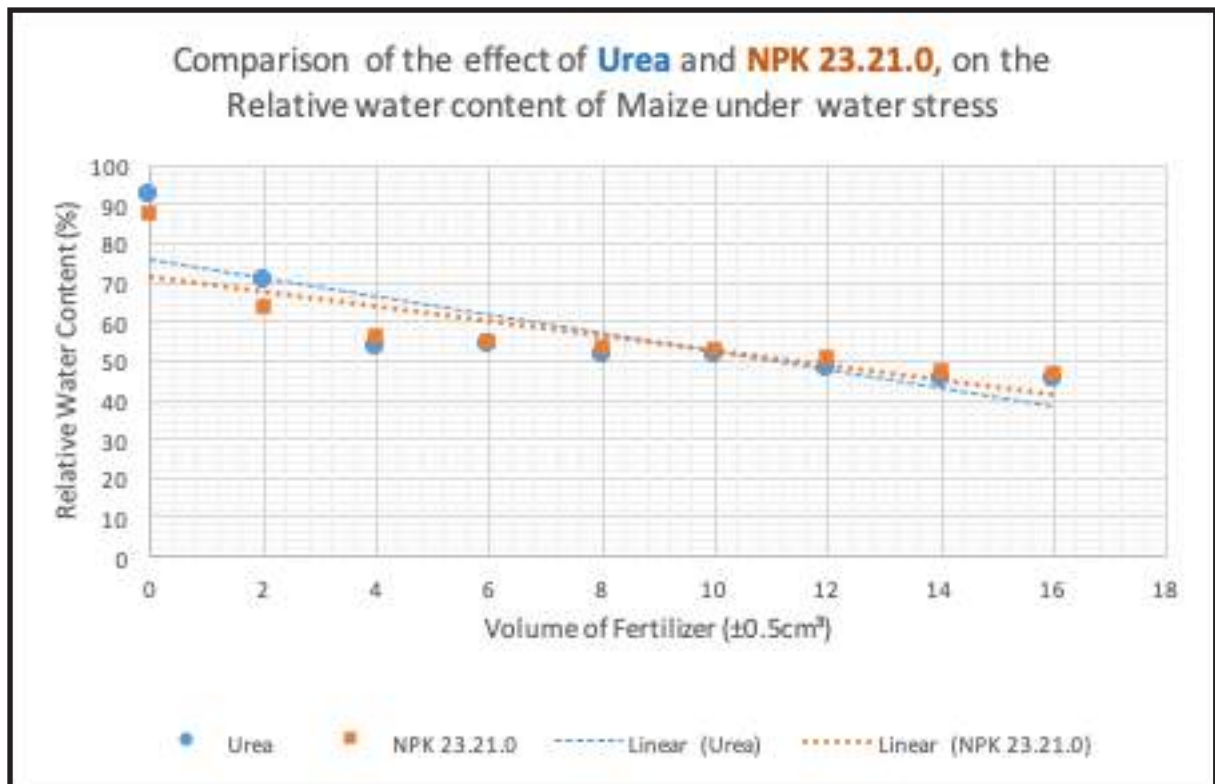
Plants Treated with NPK 23.21.0:

The leaves are more flaccid and brown, as NPK23.21.0 increases.



Plants Treated with Urea.

The leaves are more flaccid and yellow, as Urea increases.



In the comparison of the plants treated with NPK 23.21.0 and Urea, there isn't a large difference, thus it is hard to determine if the difference is significant through the graph above. To determine if the difference is significant the t-test will be used.

t-test

The t-test is a numerical representation of the difference between two data sets, allowing the determination of whether or not the difference between RWC of Maize treated with NPK 23.21.0 and Urea are statistically significant or simply due to chance .

$$t = \frac{((X_1) - (X_2))}{\sqrt{(((N_1-1) s_1^2 + (N_2-1) s_2^2) / (N_1 + N_2 - 2)) + (1/N_1 + 1/N_2)}}$$

(X₁) =the mean of Urea

(X₂) =the mean of NPK 23.21.0

N₁=sample size of Urea

N₂=sample size of NPK 23.21.0

Volume of Fertilizer ($\pm 0.5\text{cm}^3$)	Degrees of Freedom	Sample Size	Standard Deviation of Urea	Standard Deviation of NPK 23.21.0	t-value	Probability that chance alone could produce the difference
0	7	8	6.056	2.461	0.326	>50%
2	7	8	17.254	4.154	0.163	>50%
4	7	8	16.362	4.045	-0.056	>50%
6	7	8	20.856	4.567	-0.013	>50%
8	7	8	16.021	4.003	-0.035	>50%
10	7	8	13.312	3.649	-0.032	>50%
12	7	8	13.757	3.709	-0.077	>50%
14	7	8	11.475	3.387	-0.055	>50%
16	7	8	18.417	4.292	-0.028	>50%

The high values for the standard deviation highlight that the range of the data is very large. This could be because, although the method states to choose plants similar in size, it is improbable to have 8 equally sized plants. Although all leaf samples were cut the same length, the whole leaf size before measurement affects the RWC because plants with larger leaves will have a greater surface area for the loss of water, thus transpiration increases, reducing the RWC of those leaves.

The t-tests suggest that for all volumes of fertilizer, the differences of the effects of Urea and NPK 23.21.0 are insignificant with the probability of the difference being due to chance higher than 50%. This implies that the differences were due to random errors e.g. observer misinterpreting the leaf sample size because of the readability of a ruler. Random errors can be reduced by repeatability; thus it could be beneficial to increase the trials.

Qualitative Data:

Tips of some leaves began yellowing on day 25. This could suggest that the containers were too small for the plant as all the nutrients in the soil were used by the plant, reducing its fertility.

Starting Day 4 of water stress, the leaves of Maize treated with Urea were fully yellow whereas plants treated with NPK 23.21.0 were not completely yellow, with patches of green visible (see fig. 2).

Plants treated with Urea were visibly more flaccid compared to those treated with NPK 23.21.0. After the completion of measuring RWC, water was poured onto leaf samples.

Unlike control plants, leaves of plants treated with fertilizers absorbed water suggesting the disruption of the waxy cuticles on the leaves. The waxy cuticle is a layer on the leaf that stops water from leaving the plant. Thus this disruption of the cuticle could have caused excess water loss.

Plant treated with NPK 23.21.0.



Plant treated with Urea.



Figure 2

DISCUSSION:

Both graphs depict a negative correlation between the volume of fertilizer and the RWC of the leaves, suggesting that NPK 23.21.0 and NPK 46.0.0 reduce the RWC of plants in drought. This differs from the hypothesis, which stated that fertilizers would increase the RWC.

A common reason for why fertilizers reduce the RWC is because of excessive growth within a short duration. Phosphorus and Nitrogen, increases cell division, which increases plant size and apical meristematic tissue. Apical meristematic tissue contains undifferentiated cells (similar to stem cells in animals) and occur in the root tips and shoot. These cells can give rise to more leaves. Increased leaves would increase the amount of water lost by the plant through the stomata, causing a reduction in RWC. However, the plants did not show any visible indications of increased growth. This suggests that there was a greater impact on the plant than increased cell division.

Both fertilizers provide nitrogen through Urea: the process of Urea conversion into ammonium involves the proton expulsion by the plant for NH_3 to turn into ammonium

. Multiple protons cause soil pH to decrease, creating acidic soil. Acidic soil makes aluminium soluble, thus it can be taken up by the plant . Excess aluminium disrupts root cell division and as water moves through the plasma membrane into the root hair cells, the plants ability to take up water from soil is reduced if roots are damaged . This would affect large scale crop growth because if cell division is obstructed by aluminium the roots will not elongate reducing water and nutrient uptake, causing crops do die. However, 2-5ppm is the concentration considered to be toxic to roots and as this is usually achieved when pH is lower than 4.8 , aluminium toxicity due to Urea fertilizers would be very rare, unless used for a long period of time.

Another reason for RWC reduction could be because when mineral ions are taken up by the plant there is a high solute concentration inside the roots than outside, the cells become hypertonic, thus the rate of osmosis increases, with water going into the cell . Extreme intake of water within a short period of time, reduces the water content in the soil of the container and as water is lost by transpiration into the surroundings, there will not be enough water in the soil for the plant to take in. Although, the Qualitative data states that the leaves of plants treated with Urea were visibly more flaccid and yellow in colour than plants treated with NPK 23.21.0. This could be because of fertilizer burn, in which excessive nitrogen salts in the soil causes the diffusion of water across the membrane into the soil . Thus, rather than the plants uptake of water increasing within a short period of time, the plant loses water through the roots due to osmosis. However; the fertilizers were diluted in water in order to avoid fertilizer burn. If fertilizer burn occurred, then this could suggest a methodological flaw or the impact of water stress. Even though the fertilizers were diluted, the containers were small, thus the ratio of salts to soil was imbalanced, causing a high concentration of fertilizers around the roots, signifying a methodological flaw. However, the plants were watered for 2 more days after fertilizer application thus excess salts could have been flushed out of the soil. So, perhaps when put under water stress, the reduction of water in the soil, in turn increased solute concentration , meaning fertilizer burn was aided by water stress.

The second part of the hypothesis stated that NPK 23.21.0 would increase RWC more than Urea. However, the t-test suggests that there isn't a significant difference between the RWC of plants treated with NPK 23.21.0 and Urea. This could be because the flaccidity and yellowing of leaves are also the symptoms of chlorosis, a condition in which leaf tissue yellows due to the lack of chlorophyll . Initially, it was thought that the Nitrogen from fertilizers would reduce the possibility of chlorosis, because 4 Nitrogen atoms surround the magnesium atom in the chlorin ring (see fig. 3), making Nitrogen crucial for chlorophyll production . However, iron chlorosis which is the yellowing of leaves due to an Iron deficiency, can be aggravated by drought and excess phosphorus

. Lack of water in soil slows down the mass flow of micronutrients such as iron into plants and excess phosphorus reduces the plants uptake of micronutrients . Reduction in chlorophyll, reduces the rate of photosynthesis, which decreases the glucose available for various functions including root development . Thus, plants treated with Urea would have greater possibilities of suffering fertilizer burn, while plants treated with NPK 23.21.0 have a greater possibility of suffering Chlorosis, suggesting why they both caused similar reductions in RWC.

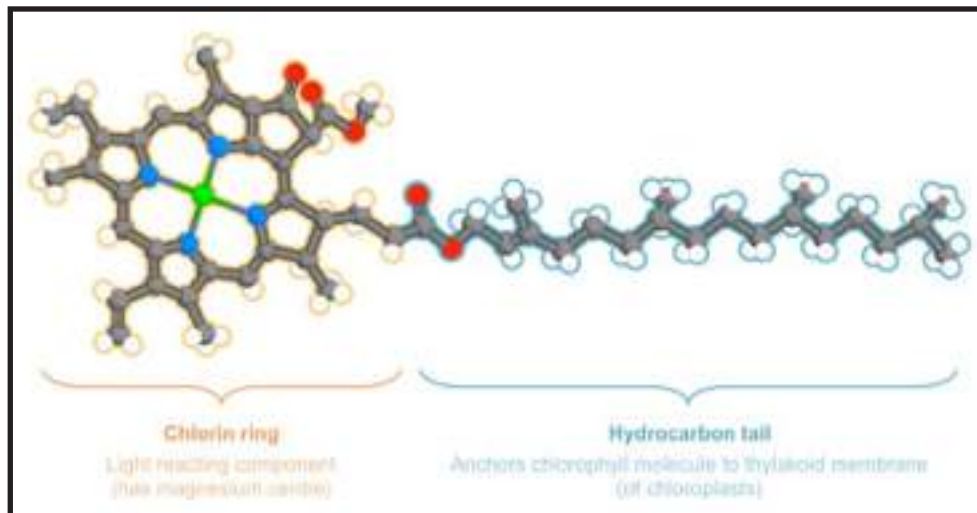


Figure 3: (Bioninja)

Another possibility for why there was not a great difference between plants treated with NPK23.21.0 and Urea, could be because after a certain amount of Nitrogen impacting the plant the remaining does not further damage the plant until flushed out of the soil. However, this is an unresolved issue requiring further investigation (see extensions p.25).

Evaluation:

Possible random errors (errors that can be reduced by repetition/increase in trials):

- 1) Misinterpreting leaf sample size due to readability of ruler.
- 2) Slight wind in surroundings effecting measurements through small opening in scale (lab door was open).

Systematic errors- errors due a methodological flaw:

Possible Systematic Error	Effect on results:	Solution
The tips of some plants yellowed on Day 25, suggesting a lack of nutrients provided by soil before fertilizer application.	Difficult to determine if low RWC was caused by fertilizers and drought or if these simply aggravated prior damage due to lack of nutrients.	Use larger containers (15cm in diameter and 17cm in height), to increase amount of soil and nutrients.
The different plant sizes caused a large range in data.	Caused outliers (larger plants having much lower RWC than if the trend was followed).	Different forms of measurement to determine effect of fertilizers in drought such as plant root size before and after experimentation, which would give implications of how water status will be effected. This would also help test the theory that aluminium toxicity could occur.

Extensions:

1) The graphs show large reductions in RWC from 0cm³ to 6cm³, however after 8cm³ the reductions are minimal. Additionally, the t-test suggests that there is not a great difference between the effects of NPK23.21.0 and Urea, even though they have different compositions. Thus an extension to the experiment would be to determine if after a certain amount of Nitrogen (common to both fertilizers) has impacted the plant, the remaining is flushed out, which is why Urea did not have a greater effect than NPK23.21.0. The question being what is the effect of Nitrogen on the plants in drought, and determining if a logarithmic graph is formed.

2) Measure the effect of fertilizers on yield, determining to what extent fertilizers are beneficial to quantity of crop production.

Conclusion

There are different possibilities for the similar negative correlations between the fertilizers and RWC, including fertilizer burn and chlorosis, which are then aggravated by drought. Therefore, according to the results, in agriculture, fertilizer must be carefully used so as not to exceed plant requirements and mass fertilizer application before drought can cause fertilizer burn. However, due to methodological errors, further experimentation must be conducted before coming to a conclusion as to whether fertilizers are beneficial or not for a country that frequently suffers drought, Malawi.

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Feline Rozestraten



Economics

Are the current strategies used in developing women's rights effective in creating change in Lilongwe? A Case study between the UN FPA/ UNESCO, Theatre for a Change and Girl up.

Introduction

This essay is about women rights in Malawi. Men and women have roles - their roles are different, but their rights are equal (Harri Holkeri) . Malawi is an agricultural society. There are 13 million people who live within the rural areas and rely on subsistence agriculture. Malawi faces big problems with female rights. Women are judged in different ways than men: for example, women struggle with educational opportunities, employment and hav-ing traditional and cultural obligations. In general, women are more likely to be abused and raped. Even though Malawi's government would like to implement rights for women, the local chief in the villages have more power and would like to keep their traditional ways. This essay will focus on my research question which is: "Are the current strategies used in developing women's rights effective in creating change in Malawi? A Case study between the UNFPA / UNESCO, Theatre for a Change and Girl up".

I've chosen to do an Extended Essay in Economics. The reason I picked economics is because it related to the theory of economic development. The reason my topic is worthy of investigation is due to the fact that women rights are a part of economics development. They are a part of the GDP. Gender equality broadens the economic development in a country as there will be more women in labor, and it leads to a higher school enrolment. Economic development could be boosted by equality of Man and Women's rights which will have a good impact on the Production Possibility Curve.

The three organisations mentioned above are all involved in women rights and they specialise in empowering women. I chose to focus on Lilongwe as it is the capital city of my residence as well as a city facing underdevelopment of women's rights. However, Lilongwe is step by steps starting to improve women's rights, especially with help from organisations.

Firstly, I will present the organisations which are interviewed and whom I have studied. Secondly, the history of women rights in Malawi will be highlighted. Thirdly, I will be writing about the consequences of being a woman and explaining their struggles that relate to issues like rape, sexual abuse by husbands or men in their villages.

UN FPA / UNESCO

The UN is a multilateral organisation which receives funds from everywhere over the world. "8 years ago the UN established a new sector which is UN women Malawi, unfortunately it is a rather small project with not enough funding to achieve an excessive change" (Jean Munro, 2018). On the other hand, the United Nations Population Fund (UNFPA) worked with the project "GEWE" which stands for "gender equality and women empowerment". This project was funded by European Union and UNFPA. The project went on for 3 years, and in these years, they needed to be able to make an effective change. This project was mainly focusing on groups that consisted of people who were attacked by gender based violence, people living with HIV/AIDS and girls that have had to drop out of schools as they did not have enough money to afford the education or for pregnancy reasons (GEWE, 2015). The project had to have 3 outcomes that needed to be effective. One of these outcomes was that the equality between men and women had to be improved through the economic development but also the social and legal empowerment of women. GEWE was performed in the Southern regions of Malawi in 13 different districts as the poverty scale in that region was excessive.

The issues found in the Southern side were: illiteracy of women and many people infected with HIV/AIDS. Due to the fact that the villages were in remote areas and therefore difficult to reach it also had this impact on the economic development as well as on the medical care. The goal that was to have the Government commit themselves to decrease gender inequalities between men and women, not only to make the world a better place, but also to give the children a better upbringing where they are equal. The outcome of this project was that mass amounts of women were given more opportunities within the village to take on action: After GEWE 6 females became the head-chiefs, and the empowerment of women increased as they are now able to have similar functions in their society as men.

Theatre for a change

Theatre for a change is a non profit organisation that uses theatre to show innovative ap-proaches to changing the behaviours and policies that stand in the way of the empower-ment of women and girls. They use drama in order to portray a message to women in the villages. The organisation tries to implement how women should deal with their relation-ships in sex work by showing them how to react around voice, body, and space behav-iour used in relationships (Beatrice Chiphwanya, 2018). The organisation tries to get women to forget about their sex work, and start a new career. Their strategy to doing this is by inviting women that are involved in sex work to act in a play. These plays contain work done

Girl Up

Girl Up is a global leadership development initiative, positioning girls to be leaders in the movement for gender equality (GirLup, 2018). Girl up is an organisation that reflects on the girls living in villages. It is a Co-organization of the UN that is led by students from all over the world. They show how girls can improve their futures by approaching a different perspective of life. This is because Malawian girls are not used to the world that is happening outside of the village. They are used to living in a village and cooking Nsima (tra-ditional Malawian dish). At the local schools, girls don't get the education as they should be getting. Their education is simple, but for them it is difficult. Girl up wants to help these girls achieve a positive career. The girls in the villages don't have access to study mate-rials for jobs like being a lawyer or Management degrees. The average job for a village girl would be being a housemaid of a well-paid family, to work as a nurse or teacher, but these girls would never study law. Girl-up shows girls of a younger age how they can make money on their own in order to get an income so they can pay for their own educa-tion.

History of women's rights in Malawi

In Malawi, it used to be normal to get married at a younger age due to a family wanting children that can earn money for them. The men in Malawi had a strong impact on the females as they treat them solely as their house wives who were maybe not skilled to do anything else then being house wives as in some circumstances they did not have mon-ey to pay for education. The women had two jobs, one that was taking care of the chil-dren and the other one was cooking dinner for the husband who goes to work.

An example is of a girl named Nolia (Empowering Women in Malawi, 2011). She was a woman who was married to her husband who passed away. After the funeral, her broth-er in law proposed that she must marry him, but she refused. Consequently, the husband took away her clothes and traded them for beer and he made life extremely

difficult for her. In 1987, the Government of Malawi said they would take some measures to stop the discrimination that has happened from the men to the women. However due to corruption this project was never implemented. In 1995, Malawi adapted a law that would guarantee a women equal rights to men. In 2017, a survey was conducted where women were asked what they knew about women's rights. Unfortunately, the result of this survey was a very negative one as the majority had no clue which rights they were granted by this law. The poor knowledge of women also shows their lack of education regarding wom-en's and human rights.

This is where Theatre for a change comes in effectively as they educate the women that they should be more independent, especially when it comes to sex work. They want women to be independent and start their own companies so that they do not have to deal with situations where they are dependent on a man that can take advantage on them. Girl up teaches this to younger girls but in a more friendlier way. They bring up real life situa-tions where they include career options that girls could do so they don't have to become dependent.

Why are some women struggling in Malawi?

Women are seen as an object in Malawi by many communities in Malawi. The men in Malawi marry women who are expected to only do duties equivalent to cooking and cleaning . In addition, they need to be fertile to get children. This tradition is also kept in place by the older women who never got education about the rights and men do not want to change this tradition as it is very convenient to them. Men have all the freedom and women must stay at home to serve the men. Therefore, the future of women is at stake. They do not have the money to afford their education due to poverty and therefore will not be able to get a job. To give an example of these types of situations "The Committee is particularly concerned about the contradictions between the Marriage Act, which estab-lishes 21 as the minimum age for marriage, and the normal way of life, which allows child marriages to happen.

The Committee is further concerned about the contradictions between the Constitution and the Citizenship and Immigration Acts, which provide that upon marrying a foreign man, the Malawian woman loses her right to a Malawian citizenship, and that married women are not allowed to migrate unless they are under the custody of a husband" (UN Committee on the Elimination of Discrimination against Women: Concluding Comments, Malawi, 2006). This statement already shows how the average Malawian woman loses the little rights she had just by immigrating to another country. This will not enable her to come back to her home country. Obviously, all women living in these circumstances want to achieve a better future but they do not get the opportunities.

Chief Kachindamoto (Malawian chief from a Malawian village) implemented a child marriage policy where girls are not allowed to get married younger than the age of 18. By implementing this policy, she has achieved that 2549 child marriages were stopped and cancelled (Chief Kachin-damoto, 2018).

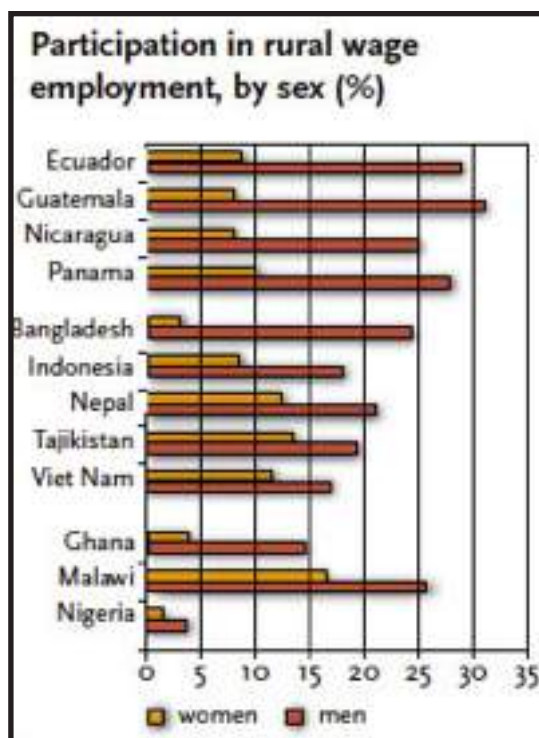
Looking at the organisations, the UN, Theatre for a change, and Girl-up it is understandable that initiatives have been taken by these organisations to change the perspectives and opportunities of uneducated girls and women in a positive way as well as empowering them, because the rights of women in Malawi are far under a generally accepted level. An average price for a village girl to get education in a secondary school would be approximately around \$8 per term. Although this is such a low amount, they often are not able to afford this.

Malawi is a country that is a LDC (least developed country) and therefore not as developed as other African countries. It is considered to be one of the poorest countries in the world. It does have a large group of donors and non-governmental organisations (NGO's) but those who are involving themselves in changing women's rights aren't always able to make a change. If education would be more effective it could add a substantial benefit to the economy of Malawi and their development as well as achieving equality of rights for men and women. For Malawi, it is important to develop as they do want to bring their economy up. The only problem is that not enough organisations take care of the problems happening. Since there are so many challenges in Malawi, like hunger, no clean water, poor electricity, bad infrastructure and poor health facilities, the change of women's rights does not seem to be high on the agenda.

The main focus seems to be to stop the domestic violence that is happening against women. Women are not always as safe in their houses as they should be, especially those women that don't have a husband. Unfortunately, there are many cases of sexual harassment and rape that is sometimes even committed by the husband himself. Malawian girls from the age of 4 are involved in scenarios of sexual harassment as they get attacked by rape. Women are therefore often living in unsafe and frightening conditions outside their comfort zone.

Women in Malawi are often involved in sex work. In Malawi police will arrest women for their job as a sex worker. If the women want to get out of jail the police men often suggest the idea of sleeping with them as a bribe (Beatrice Chiphwanya, 2018). This can be seen as rape and therefore enforces the law.

In the diagram shown below it shows that less women, living in rural areas have been employed compared to men. The percentage for working men would approximately be around 26% based in Malawi as shown in the statistics diagram below while women are only on 16%. This definitely proves that men are quicker accepted for jobs than women. This diagram shows the poor economic choices that have to be made as women do not have money for education.



(FAO,2011)

What stops organisations from funding projects?

Malawi is well known for its corruption. Corruption occurs in a LDC country where decision makers in government often want bribes for their own welfare to do work that they should normally do for their normal salary. However, the wages of these civil servants are so low that they are often tempted to make money on the side when they have access to (Government) funds or funds from projects initiated by the donor community. Corruption is a very big problem in Malawi as it happens daily. NGO's and Organisations that fund Malawi in specific areas try to stop as they do not know where their money is spent. Instead of donating money, they will try to come up with alternative solutions by for instance donating goods instead of giving money to avoid the risk of corruption.

One of the strategies of the UNFPA is putting their money into a project where they know there is no corruption happening. This gives reliability to where their money is going but also that the money is used for wise spending. An effective strategy for Girl up is that they barely need money to support. Girl up is more about empowering girls

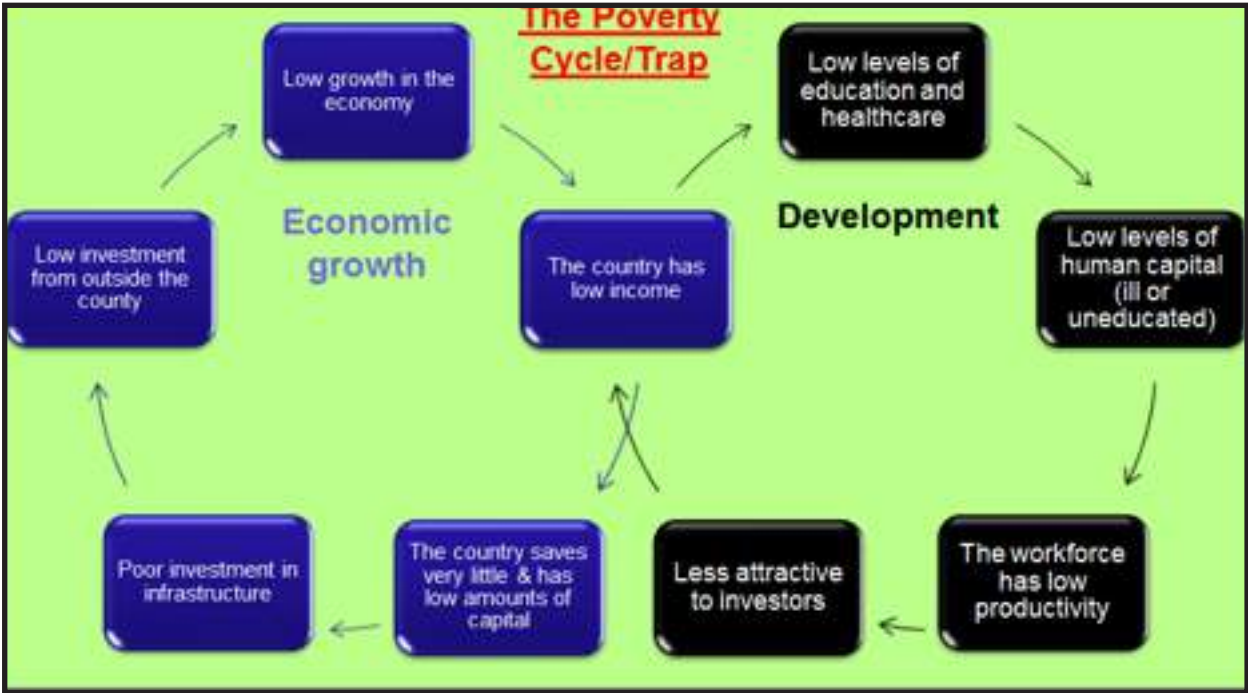
through talking which doesn't require money and therefore they don't have to deal with corruption.

Development/Poverty cycle

If Malawi would decide that they want to improve their women's rights, their GDP will develop due to literacy rates increasing. The literacy rates would grow as more girls would be able to get an education of higher value, and they would be able to get employed for better jobs. The property cycle is when families become impoverished as they spent their money on bare essentials that they need to live with in order to survive.

This relates to back Malawi as it is an economically poor country. Their natural capital decreases often as poverty will destroy their environment. This is due to the need of certain products causing deforestation. Malawi will need a new capital in order to develop and for that they will need to start saving their resources and natural capital. An average cleaner/gardener working for an expat earns approximately \$50 a month. When a country is extremely close to the poverty trap it proves how undeveloped they are.

The poverty trap cycle in the image below shows in what state a country is when they are in the middle of poverty. Malawi does have the issue of things happening to be low standards. By low standards I mean they do not have sufficient amounts of money to create a better living standard.

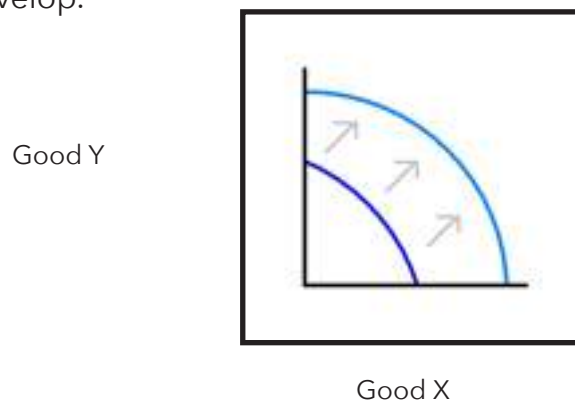


(coolgeography.co.uk , 2017)

The country has a low income, they have low investment as they don't have money to invest, but the most important part is that they have a low level of education/health as well as low economic growth.

Production Possibilities

In Economics women rights is one of the development factors. Economic development is very important for a country as it reflects upon its economy as well as economic growth. Economic growth can be defined as a positive change in the level of goods and services produced by a country over a certain period of time (Economics Discussion, 2018). One of the several factors influencing economic growth is education. Education is important to have in order to develop a countries rates. If the education rate grows the general economic growth will grow by immense amounts. In economics growth we can look at the production possibilities of the women that are educated, how they grow and how they develop.



Looking at the production possibility curve, it shows how women could have a lot more possibilities by shifting to the right. If Good Y was imagined as the amount of sex work done by the women, and Good X as the education rate that Malawi is at now, there is a huge difference. Malawi is currently at possibility the inside line of development. Due to theatre for a change's progress in educating sex work, Malawi is slowly moving towards the outside line as they have achieved to sent a girl to college that used to be involved in sex work (Beatrice Chipwanyanya, 2018).

Theatre for a change and UNFPA have a big impact on improving the sex work. The reason they have good strategies to improve this is due to the fact that they do ground work. This ground work is based in village areas so it will be more effective to the sex workers as they will get face to face education.

To what extent are the 3 organisations effective in creating change?

The un has been effective in what they have done so far with the GEWE project. GEWE made an a small impact on the southern region of Malawi. However there is a negative impact of GEWE as the project was only 3 years long. 3 years for a project is usually not long enough to create an effective change. A project will need to have a longer time as it will create a much bigger impact. If they would have extended it by 2 years they might have been able to empower thousands of women more.

Theatre for a change is effective as they do a lot of ground work and they work with the women so the women will get a better perspective of what is supposed to happen when they have to deal with complicated life situations.

Girl-up uses strategies which help girls create ideas to improve their future and sometime can arrange the funding for projects the girls come up with, where they can earn money with. For girl up, it is important to make dreams come true of girls that can't make those dreams happen. Even if it is just setting them in the right direction to make this dream happen, it is of importance that Girls all get the same opportunities to make dreams come true. Girl up is effective as they use strategies that maintain a stable connection between the girls in the village, and the club as well as the groundwork that happens during the maintaining of the stable connection. However the Girl-up organisation in Malawi is still setting up so they have to maintain a stable plan to achieve the plans that run for the fu-ture of helping the village girls. I therefore think Girl-up is not the most effective.

Theatre for change on the other hand uses another strategy compared to the other organisations. Theatre for a change wants women to have the best lifestyle possible, without any sexual harassment from their husbands or other men. The need for women to have a better life without harassment will help bringing their self confidence up, in order for women to feel more comfortable with being in a relationship. Theatre for a change al-so teaches women how to manage incorrect behaviour of men to establish a better rela-tionship where the rights of women are more clear and valued. Women are therefore en-couraged to come to these sessions as they will gain experiences that they will need throughout their entire life. Theatre for a change therefore evaluates their own organisa-tion on a continuous basis to analyse where they can improve to get their message even clearer to their audience.Theatre for a change uses the strategy of using Body, Voice and Story to take an innovative approach to educate their students/ community. This is an effective approach as their students will perceive it as a very personal understanding.

Conclusion

In conclusion, all organisations do their job in a different way. In our global society we need to give women the same opportunities as men. If women want to be engineers they should be able to. If looking at poor countries and their status to equality, it does not only affect the women personally, but it can also deflate their economic development. The reason is it can deflate because women might not be able to get the experience of being qualified for jobs that are not within their range, and they will often be given to men. If there is low income, there will be low education, low education will then evolve into low human capital, and there will also be no money for investment. This will all decrease economic growth. The three organisations I have mentioned are trying their best to stop this from happening. They all have their different ways of showing it, and they have different methods of teaching empowerment to women, but they do want to try and change the equality of women. Relating this back to my essay question "Are the current strategies used in developing women's rights effective in creating change in Malawi? A Case study between the UNFPA/UNESCO, Theatre for a Change and Girl up. I have come to the conclusion that the UNFPA is definitely more effective. In general, if the UN would leave Malawi there won't be enough funds to support the economy, and Malawi's economic development will decrease by immense amounts. The UN funds more projects that relate to women empowerment instead of doing the ground work themselves, but they do have situations where they go out and experience it themselves. This makes UNFPA / UNESCO effective as they have a very big impact on the economic development. Girl up was least effective due to the fact that they are just setting up in Bishop Mackenzie and therefore it is complicated to already make a big progress, and to have efficient strategies.

However, Theatre for a change is effective, but there is no judgement to do whether they are effective in record holding. By interviewing Beatrice Chiphwanya there was information about successful cases that they have had including helping sex workers to a job, and sending girls to school. But on the other hand there was no record of their effectiveness and it was therefore very hard to judge whether their current strategies are effective in creating a change.

Questions that arose during the writing process of my essay were whether I would need more organisations to make it broader? As well as this; Are all my points valid? Now I also had some strengths and limitations in my research as I didn't write down the exact interviews, as I just took notes. This made it harder for me to get information out of those sources.

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Natasha Sama



Economics

Does writing about grief derive closure? Explored through the works; 'On My First Son' by Ben Jonson, 'Poem at Thirty-Nine' by Alice Walker and 'How Could You Leave Us?' by Nathan Feuerstein

Introduction

This essay will investigate the universality of human experiences with grief as presented through three texts written in different places and eras. This goal will be attained by analyzing some well-known literary works such as: Ben Jonson's poem 'On My First Son,' written in the late 1560s, a heart-rending dedication to the death of his firstborn at the age of seven. Also included is Alice Walker's 'Poem at Thirty- Nine' (written in 1983) indicating her age when she wrote the poem. She expresses her thankfulness for all that her father had done to raise and support her. The final piece is from the less well-known and more modern writer Nathan Feuerstein's (NF is his stage name); 'How Could You Leave Us?' a contemporary rap song produced in 2016 and is an ode to the death of his inattentive mother who died of a drug overdose and the affects her death have had on him. The first two texts were chosen in order to provide diversity through pure literature in contrast to a contemporary rap song to indicate 'The Universality of Grief in a Range of Texts'.

The analysis of these poems will be organized using 'The Five Stages of Grief', a psychological model created by Elizabeth Kubler Ross in 1969. The model was developed and created to be a self-help guide during the grieving process. 'The Five Stages of Grief' was created as part of a structure that indicates the stages one passes through in order to overcome and learn to live with loss. They are tools to help frame and identify the various emotions that occur through the time of grief according to each individual. Some may seemingly skip stages but still pass remotely through each stage. The stages of grief work in signifying mannerisms one goes through when grieving a loved one as well as the effects it has on the person's emotional and psychological state. These stages are denial, anger, bargaining, depression, and acceptance. However, all

chosen texts clearly present regret as a distinct stage although it is not included in the original model.

By assessing the backgrounds of the writers and analyzing their use of language, it was possible to identify these stages within the works. It is interesting to note that the stages have been presented within the texts in different forms even if written by writers from different backgrounds and eras who use differing literary forms. These writers are similar in the way that they have lost a loved one and have written in the hope of releasing the emotion and sadness that was caused. The aim of this essay is to analyze how poetry can bring or facilitate closure and work as a method of healing for a grieving heart, much like music and art therapy, and how writing about grief can drastically affect a person's emotional state and how they see the world through this outpouring of grief.

Denial

The first stage in the cycle of grief is denial, which is made obvious in one of these text as Jonson and walker have already passed through this stage. It carries the traits of confusion, shock and fear. It causes one to refuse to accept the death of their loved one. Bereaved people might think that there has been a mistake, that the doctors are wrong or that they are being confused with another patient. Denial is refusal to accept the inevitable and occasionally leads to mental distress as one refuses to accept reality. In 'On My First Son' Jonson does not show signs of denial as a result of having come to terms with his loss. There is evidence that he expresses his heartbreak but does not use a tone of refusal in accepting the event that has taken place. This is shown through the metaphor "Rest in soft peace" (L9) where he has accepted that his son is dead and wishes for him to be at peace.

Correspondingly, Alice Walker in 'Poem at Thirty-Nine' also seems to have passed the stage of denial and instead relives the happier memories of her father. Walker reminisces fondly about her father managing money, cooking and sharing food, and is in full realization of her father's death. Therefore, it can be assumed that his death is not new. The pain expressed is not raw and shocking. She is able to recall her father and remember the good experiences that she had with him. This is further shown through her assertion that "He would have grown / to admire the woman I've become:" (L41-43). Although sadness is evident, there is pride in who she is because of her father, as seen in the text "Now I look and cook just like him: / my brain light; / Tossing this and that / into the pot; / Seasoning none of my life / the same way twice; happy to feed / whoever strays my way" (L34-40). The imagery portrayed in the lines express how she is thankful to her father and relives memories of him with happiness; evidence of an

outcome of, no doubt, having gone through denial at an earlier stage.

Alternatively, in 'How Could You Leave Us?' Feuerstein has passed the stage of shock, but still holds on to the presence of his mother in "I know you gone but I can still feel you." (L20) He holds on to a faithful belief that his mother is watching over him and that although she is not there in human form, her spirit is still beside him. He refuses to acknowledge that his mother is truly gone which allows him to keep the sense of hope that she is watching over him. This does not stop his anger towards his mother, and the hurt that has come from her leaving him. The use of colloquial language in the song expresses informality and the direct speech to his mother provides evidence of her presence. The rhetorical question in the song expresses how Feuerstein still has an emotional connection to his mother although she was not there for him. He refuses to see the logic in why she left him when all he ever wanted was her love, and is in denial over the fact that she would take her own life by choosing drugs over her family.

Anger

The writers portray anger in their necessary outpouring of emotion, the second stage of grief. Anger is viewed in sections of their texts as it is a common emotion that individuals feel as a replacement for being distressed, and thus steering away from feeling the emotions of despondency. Anger may include the use, as well as the display, of frustration, irritation or anxiety. The writers have demonstrated this in the texts, whether executed intentionally or subconsciously, and is also seen in the techniques used as well as vocabulary choice. Jonson expresses his anger in 'On My First Son' towards himself through the apostrophic exclamation "O, could I lose all father now!"(L6) He is still in the second stage of grief and displays anger at his own misfortune. The rhetorical cry illustrates the poet's reaction upon seemingly losing everything, further expressed by the use of the exclamation mark highlighting the importance and pain he feels, causing him to feel alone. He seems to feel that he has failed as a father and wants to escape the pain of having to grieve over the death of his seven year old son.

Contrastingly, Alice Walker reflects on the hurt she must have caused her father in line 25 "/...my truths must have grieved him/". Although there is a sense of remorse from Walker's perspective, the main emotion is a reflection of anger, or rather frustration, from causing disappointment. This phrase indicates that she caused her father anger and wants to change that as she regrets it, especially because she has no way in which she can truly ask for his forgiveness. Walker sees her father's anger towards her as pity on herself. That whilst he was alive she should have cherished the moments spent with him instead of causing him grief. This is foreshadowed at the beginning of the poem when she stated: "I wish he had not been/So tired/when I was born". (L2-5)

However, in the case of 'How Could You Leave Us?' there is a recurrent pattern of anger as the overriding emotion throughout the song. Unlike the two other writers, Feuerstein blames his mother for her own death and for abandoning him and his siblings at a young age. 'How Could You Leave Us?' explains the events of his mother's death and how she died of an overdose, not a natural death like the other two writers' losses. His anger is largely directed towards his mother because he feels she had a choice to live and chose against it. "I ain't gon' say that I forgive you cause it hasn't happened/" (L38) focuses on the grudge he has against his mother bringing attention to how she did not change her ways and stay alive for him. Feuerstein lapses into his past and the mistakes his mother made by not caring enough which had an immense effect on his behavior while growing up. The use of rhetorical vernacular in "You shoulda been there when I graduated/ Told me you love me and congratulations/ Instead you left us at the window waiting/ Where you at mom? /We're too young to understand where you at huh?/" (L29-32) transmits the most important part of the song; the core emotion and connotations from which the song springs as Feuerstein conveys saddening frustration at not being able to grow up with a mother. This tone refers directly to the writer's late mother in an aggressive manner, followed by rhetorical questions providing a sense of self-doubt and reflecting his need for closure of the unanswered questions. He reflects on the ways in which his mother disappointed him and what their relationship could have been like if she had been attentive. The personification in "They took you from us once/ guess they came back to finish you/" (L50) refers to the pills that his mother overdosed on, also intimating a time where she attempted the same but did not succeed. The tone used is bitter and hollow as if reliving hate and anger towards the substance that took his mother from him; an anger not only directed at his mother, her actions that lead her to her death, but also to the substances that caused her addiction and death.

Bargaining

Additionally, in their desire for closure the writers use the process of bargaining, the third stage of grief, which can be expanded into many subsets. In grief, bargaining is used to cause affirmation to oneself and includes struggling to find meaning, reaching out to others, and telling one's story; all attributes shared in grief poems because the structure used by the writers is almost in the form of storytelling. 'How Could You Leave Us?' is structured through the events that played out in the writer's life. He was affected by his mother's absence, whether she was living or not. Feuerstein expresses his confusion and innermost distress about his feelings of continuing to have an absent mother in "I thought that maybe I feel better as time passes/" (L39) which illustrates his need to feel less empty after his mother's death. He uses a tone of disbelief in his words explaining that the feeling of grief has not changed and still causes him sorrow. He bargains with his emotions, contradicting them and hoping to find a better way of

coping, but is left with the reality of having to scramble for closure.

Similarly, Walker uses the structure of a story to reference her past with her father and all the things she loves about him, as well as employing the same structure towards the end of the poem where she restates those qualities in herself and how she has come to love her qualities because they remind her of her father. "I think of him. / He taught me how." (L7-8) embracing all that she had learned from her father. These skills include cooking, writing, and chopping wood as well as financial discipline. Referring to these qualities, she is making peace within herself and bargaining with the idea that although he may be gone, those parts of him will live on within herself. She expresses this through the Volta in her poem in lines 33 - 34, where she makes the change between the days when her father was alive and present day.

Contrasting with Feuerstein and Walker, Jonson uses a sub-section of bargaining in which he is struggling to find meaning. Although he has come to terms with his son's death, he finds it hard to cope without his son and feels regret. 'On My First Son' holds the raw emotion of a grieving father. "For why will man lament the state he should envy? / To have so soon 'scap'd world's and flesh's rage/ and if no other misery/ yet age?"(L6-8) Here he is restating the position he is put in after his son's death; he is left confused about why life is so cruel which is emphasized by the question mark to indicate a confused tone. He still does not comprehend why we have to deal with death, or why it takes the ones we love. He uses his son's young age to express the disbelief that his son is gone. The writer feels a sense of incredulity and shock, an inability to bargain and sees only the fact that his son was undeserving of death.

Depression

The halfway stage of grief's journey is depression, leaving the writers overwhelmed, helpless and hostile. Depression may often cause the griever to say or do things that they do not mean because of the increasing sadness that, at times, can be mistaken as anger. This is seen primarily in 'How Could You Leave Us?' where Feuerstein is a prime example of masking depression through anger and trying to connect with his mother through his lyrics which begin with a rhetorical question; "How could you leave us so unexpected?" (L1). The tone implies abandonment issues and a sense of pleading. "We needed you, I needed you" (L2.) The scars that he portrays in his lyrics burrows deep within him and make him feel worthless because of his mother's neglectful behavior. This in turn, caused him to suffer depression as evidenced in the metaphor "They say pain is a prison/ let me out of my cell" (L10.) Although paradoxical, the metaphor outlines the recurrence of sadness and pain within, of being in a place of confinement and restriction, causing helplessness as though he cannot reach out to

his mother any longer. "I got this picture in my room and it kills me/ But I don't need a picture of my mom, I need the real thing/" (L25-26) reintroduces the concept of pain being the driving force, and the developed abandonment issues. He tries to hold on to the memory of his mother in vain, feels overwhelmed and helpless, knows he cannot do anything, left only with a picture as a reminder. Recommended to many people dealing with grief, Feuerstein uses music as his anchor which helps him to latch onto sanity as states clearly in "Crying my eyes out in the studio is difficult/ Music is the only place that I can go to speak to you/" (L51-52.) He uses music and lyrics to escape reality and to try to connect with his mother. The song left him open to much hurt and allowed him to face the emotions he had kept hidden inside for a long time, ultimately leading to closure.

The same type of vulnerability is shown by Jonson in "Farewell, thou child of my right hand/ and joy; /" (L1) in the poem's introduction. The use of right hand could be referring to "right hand man", someone who is by your side in case of need just as a son would be to his father. The poet also uses the word "joy", recalling the pleasures and happiness his son brought to him, a sense of bliss then destroyed by the "Seven years tho' wert lent to me/ and I thee pay/ Exacted by thy fate/ on the just day." in the third and fourth lines. He highlights the age of his son and cannot yet accept that his son was taken from him too early.

Walker portrays sadness and depression in a different way. She channels all her father had done for her into happiness and remembers him in times of practicing those skills. "Writing deposit slips and checks/ I think of him. /" (L6-7) there is a lean towards acceptance and she shows slight depression, but certainly not to the extent of the other two texts. The repetition of food references throughout the poem indicates the fondness she has for her father and how she remembers him, and how this visual and tactile imagery through the act of cooking plays a pivotal role in her memories of her father.

Regret

Following on from depressions as evident by each of the writers in the cycle of grief is regret; bereaved people often regret events and blame themselves when a loved one has died, asking themselves what they could have done differently and how they could have done more to have prevented their loss. This form of self-deprecation can often lead to regret even though death is inevitable and cannot be escaped. A prime example of regret in the poems is when Walker stated, "I wish he had not been/ so tired/ when I was born. / Writing deposit slips and checks/" (L2-5). She regrets not having enough time with her father and that he was so preoccupied by work or so tired by it.

Contrastingly, Jonson's 'On My First Son' shows regret although seen in a different form. "My sin was too much hope of thee, lov'd boy." (L2) Regret is seen as Jonson portrays how the hope he held for his son caused him even more hurt when his son died. He regrets not having more time with his son and wishes that he could have another chance to be there as his father or, another extreme, where he wishes he had not been a father in the first place so he could avoid the pain and grief the early death brought him.

Alongside depression and anger Feuerstein's song includes many examples of regret. Towards the end of the song he speaks directly to the audience. At this stage he is in hysterics and on the verge of tears, and in continuing to address his mother he regrets not calling her, not making an effort to be with her, not spending time with her, and regrets his childhood. He is angered by her behavior, by her putting aside her obligations as a mother as shown in much of the song. As much as "Now a relationship is something we won't ever have/ why do I feel like I lost something that I never had? /" (L27-28) is directed in anger, it also reflects regret at not having a stable relationship with his mother before her death. Feuerstein shows the depth of regret he feels about how his relationship with his mother could have been, but never came to be; a fact that takes a toll on him emotionally and causes sorrow because the memory of his mother is tied to the feeling of pain.

Acceptance

The final stage of the writer's grief cycle is acceptance which includes exploring options and creating a new plan in place of sorrow. This is often represented through fond reminiscences, and moving on to acceptance that there was nothing they could have done and that the inevitable is impossible to control. 'Poem at Thirty-Nine' outlines Walker's acceptance of her father's death and how she is living with the happy memories instead of living in sorrow. In her second last stanza "Now I look and cook just like him/ my brain light/ Tossing this and that into the pot/ Seasoning none of my life the same way twice/ happy to feed/ whoever strays my way. /" (L34-40) she finds peace in cooking and finds in it a connection with her father. She uses the metaphor of "seasoning none of her life twice" as a reiteration of not staying in the past but rather to keep an optimistic perspective and move on from the hurt of her father's death. Walker uses the memories of her father to make sure she is living in the moment and not letting the past control her in ways it had before, as a pledge she has made in order to honor her father.

Unlike Walker, Feuerstein holds shameful memories of his mother. He has accepted her death but is in no way willing to forgive her yet as stated at the introduction of the song

"I know you gone but I can still feel you/"(L20). This shows that he hopes she is looking out for him even if he has realized that she is gone. Towards the end of the song his hope falters slightly when he says "Don't know if you hear me or not, but if you still watching why/"(L60) and precedes the chorus of rhetorical questions accepting that she is gone but not understanding why she would leave, a question, that may forever be left unanswered.

Alternatively in 'On My First Son' Jonson has no choice but to accept the death of his son. He has simply come to terms with it and shows no signs of moving on, a concept that only time can dictate. The tone of the poem suggests that it was written and published not long after the son's death as illustrated in "Rest in soft peace" (L9) which acts as a final fond goodbye to his son.

Conclusion

All three texts portray deep and various levels of grief. The writers use these methods to convey built-up emotion and coping methods that are employed to make them feel better about dealing with the death of their loved ones. These writers share a common use of language skills due to the portrayal of the effects grief has on a person. Much like art, music, and other forms of therapy, it is safe to say, proven by the above analysis, that these texts were used as a coping mechanism to reduce pent up emotions the writers were suffering because of their losses. Writing about one's losses and emotions has been seen to play a vital part in the progression towards and completion of the final stage of grief as well as finding closure.

I chose to do this topic because of my personal experience of writing poems as a means to release pent up emotion; analyzing these texts has confirmed my belief in the ways that humans respond to and behave during their grieving periods, and how words can play a role in the healing process as well as how completely different literary texts can all use similar techniques. The stages of grief summarizes the journey one takes through grieving, and the poems indicated that all stages can strike at once. Although I have been unable to find any definitive published works to justify my thesis, it is safe to conclude that writers grapple with inner emotions and portray them in ways in which they are comfortable, as if they are speaking to someone about their problems through the words in their texts to ultimately reach closure.

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Lauren Schooley



Visual Art

How does the use and composition of text in Barbara Kruger's Untitled (We don't need another hero) and Shepard Fairey's HOPE affect the communication of artistic intent?

Introduction

Text can be used powerfully in art. Two socio-political artists who combine text and imagery are Barbara Kruger, a 1980s feminist art icon, and Shepard Fairey, a key contemporary political artist. Although art critics have separately analyzed text use in both artists' work, comparing how they use composition and text to communicate their artistic intents may yield valuable insight into their work. Kruger's Untitled (We don't need another hero) (see Figure 1) (hereinafter "Untitled") and Fairey's HOPE Obama presidential campaign poster (see Figure 2) are ideal for comparison, as Untitled is central within Kruger's oeuvre, while HOPE is arguably Fairey's most famous piece.



Fig. 1: Barbara Kruger, Untitled (We don't need another hero)



Fig. 2: Shepard Fairey, HOPE

Kruger communicates her artistic intention through ironic interplay between text and image, directly addressing viewers with text. Her typography and style connect to advertising and Russian propaganda. However, which connection she intends merits discussion. Kruger's visual hierarchy facilitates interaction between text and imagery. Fairey communicates his artistic intention through image and text combination. However, changing his original text to an official Obama campaign slogan challenges whether the text represents Fairey's own intention. His piece is influenced by the same propaganda forms as Kruger's arguably is but subverts propaganda's typical characteristics. Fairey's visual hierarchy connects text and image, while his typography creates tone and links to the Obama campaign.

One key source for effective analysis is Kruger's recording, "Barbara Kruger: in her own words" - her personal explanation of her work. Its publisher, the National Gallery of Art, marks it as an important critical resource. Postmodern art critic Craig Owens' essays on Kruger's work are central to understanding text's effect on her intention. James Moll's "Obey Giant" documentary explains Fairey's work and process. Fairey's statements within "Obey Giant" and on CNN give personal insight into his use of text and artistic intent.

For this essay, "text" refers to both written words and typographic elements. "Composition" refers to the use of elements surrounding the text to influence the reading of it.

Cultural Influences

To understand Kruger and Fairey's text use, its overall role in art must be considered. Text allows art to convey explicit messages, articulating ideas through language rather than pure imagery. Typeface and font can subtly or directly affect tone. According to Bringhurst, a prominent typographer and author, typography "makes visual sense and historical sense" (9). The visual sense lies in type's aesthetic and legibility and their effect on the tone the reader interprets, as seen in how differently one reads the words in Figure 3. Typography's historical sense rests in typefaces' contexts. Referring to typefaces such as Fraktur, once the Nazi party's official typeface, designer Ben Hersh argues: "Typography can silently influence: It can signify dangerous ideas, normalize dictatorships and sever broken nations." While not all typography holds such power, the importance of typeface context and their effect on message is still relevant to typography in art.

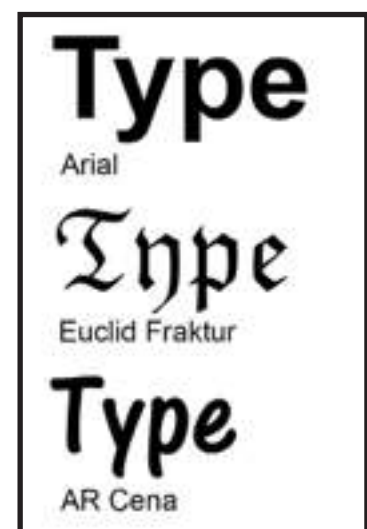


Fig. 3: *Typeface aesthetic and legibility (author's own)*

Syracuse University in 1964 and Parsons School of Design in 1965, Kruger worked as a designer and editor for several Condé Nast publications (Kruger) (“Barbara Kruger: American”). A year later, she became lead designer for *Mademoiselle*, where she used text and images to create page designs (“Barbara Kruger: American”). Page design’s cut-and-paste method shaped her early work and influenced her later style. In her recording, Kruger stated: “My job as a designer morphed into my work as an artist; with big differences on the level of meaning.” Drawing on the same paste-up method she used in page designs, Kruger commented on social topics (Kruger), connecting her to Conceptual and postmodern Feminist art (“Barbara Kruger: American”). Kruger first combined her own photographs with text but moved to found images in the late 1970s (“Barbara Kruger: American”), which eventually became part of her “signature agitprop style” of found black and white images combined with red-backed Futura text, easily traceable to her design background (Barbara Kruger).

Fairey’s tone and text link to his background in design, punk rock and skateboard culture. His text is particularly influenced by graffiti, as Fairey states: “Graffiti culture is all about lettering and putting your name up” (qtd. in Moll). He earned a BFA in Illustration at Rhode Island School of Design in 1992, which established “his emphasis on formal design, advertising, and printmaking” (Daichendt 72) and exposed him to artists such as Kruger (Moll). Her influence is visible in Fairey’s defining OBEY Icon, seen in Figure 4, featuring a simplified closeup image of wrestler André the Giant with the word “OBEY” in red-backed white Futura Bold Oblique letters. The colors and font are both signature elements of Kruger’s style; however, Fairey’s original imagery, rather than Kruger’s found imagery, is a marked difference. The OBEY Icon’s style continued within Fairey’s combinations of clean-lined images and geometric sans-serif fonts. The OBEY Icon and the first stages of HOPE were spread via illegal street art campaigns (Moll), connecting Fairey’s design and street art influences.



Fig. 4: Shepard Fairey’s
OBEY Icon

The direct and indirect messages conveyed through text’s visual and historical elements are applicable to both Kruger and Fairey’s use of text. Kruger’s style and use of type evolved from her work as a page designer and magazine editor, making her work more commercial in style, while Fairey’s evolved from influences such as punk rock imagery, graffiti culture and his own street art campaigns. Despite Kruger’s influence on Fairey, these differences make Kruger’s work sharper and shrewd and Fairey’s more rebellious and fervent.

Influence of Russian Constructivism

Both Kruger and Fairey share Russian Constructivism as an influence. Agitprop, derived from “Agitational Propaganda,” was a section of the Russian Communist Party dedicated to visually communicating with the illiterate working class (“Power to the Pictures”). Developed by agitprop artists, Constructivism emphasized functionality within propaganda art, favoring “simple flat colors, short, sharp slogans, geometric shapes and diagonal lines” (“Power to the Pictures”).



Fig. 5: Propaganda poster by Alexander Rodchenko

Both artists use harsh, geometric sans-serif typefaces and red, white and black palettes characteristic of Russian Constructivists such as Alexander Rodchenko, seen in Figures 5, 6 and 7 (“Barbara Kruger: American”) (Brand 23). Nearly all Kruger’s work follows these characteristics (“Barbara Kruger: American...”), while Fairey’s typical palette is due more to the limited ink colors at the Kinko’s where he printed his early work (Brand 23). Fairey’s composition and use of text, like Kruger’s, resemble Constructivist propaganda posters. In an interview with Co.Create, Fairey explained that he has always admired Russian Constructivism (Hart), and his critics called his early work “communist-style imagery” (Moll). Fairey states he wants to create “propaganda that is the start of a conversation, not the end” (qtd. in Hart).



Fig. 6: Barbara Kruger,
Untitled
(I shop therefore I am)

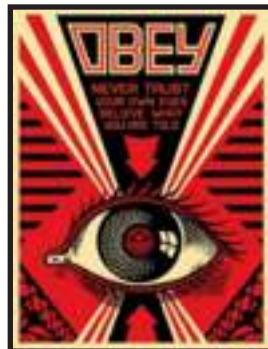


Fig. 7: Shepard
Fairey, Eye Alert

Propaganda art of Agitprop Russian Constructivism influenced both artists, which is visible in both their artistic styles and Fairey’s expressed admiration for the school. Since “Constructivists strove to turn art into a potent political tool capable of shaping mass opinion” (Hagen), the style’s influence on Kruger and Fairey fits into their socio-political artwork.

Artistic Intent and Use of Language



Fig. 1: Barbara Kruger, Untitled (We don't need another hero)

Through *Untitled*, Kruger forms a commentary on gender stereotypes using humor and direct address. Irony and resulting satire drive Kruger's communication of artistic statements on "how we are to one another" within society (Kruger). While the image in *Untitled* features a girl inquisitively poking a young boy's flexed muscles, the accompanying text proclaims: "We don't need another hero," refuting the masculine strength stereotypes the image perpetuates. The young boy's childish portrayal of masculinity, with puffed out cheeks as he watches for the girl's reaction creates the light-hearted element of the piece's "playfully powerful" message (Huntsman 238). The text's satirical refutation of the image gives the message power, suggesting girls don't need more boy heroes to admire. This arguably leaves viewers to wonder whether Kruger is suggesting society needs more heroines, heroes of all genders, or no more male heroes. However, when observing the piece, it seems Kruger is merely suggesting the stereotypical boy-hero/damsel-in-distress dynamic is outdated and laughable.

Kruger's direct address is central to her intention. Eye contact with the viewer or text personally addressing them "has been the motor of [her] practice from the very beginning" (Kruger). In *Untitled*, the text's direct address of the viewer "incorporate[s] the spectator" (Owens 192). The statement "We don't need another hero" addresses the audience. Read just after the recognition of the two children, it speaks to viewers and guides their understanding as they register the rest of the piece. Although who the pronoun "we" refers to is disputed, the personal pronoun connects the viewer to the piece. The text seems to have a persona behind it, which engages the viewer and allows them to receive the piece's message in relation to themselves individually.

Despite the pronoun's definite "incorporation" of the audience, the exact group of people to which "we" refers is often disputed, creating an unstable relationship

between viewer and artwork. Since 1980, all Kruger's pieces have included personal pronouns, such as "we" and "you" (Owens 192). According to Harrison and Wood, "we" is generally agreed to refer to "women in general" and "you" to "the male spectator" (1042). However, given its potential for the spectator's inclusion or exclusion, "we" yields different interpretations depending on the reader. While Owens, a greater authority on Kruger, agrees with Harrison and Wood on the genders to which Kruger's pronouns generally refer, he also argues that "we" swings between personal and impersonal, regardless of the viewer's gender. It can either denote union between the viewer and speaker or union between the speaker and a group to which the viewer does not belong (Owens 193). This creates instability in Kruger's direct address, with the viewer shifting between connection and distance, yielding multiple levels of personal and impersonal meaning (Owens 193).

Kruger's typography makes the piece into a form of satirical "advertising." Like many of Kruger's 1980s pieces, Untitled is "reminiscent of advertisements and billboards" (Harrison and Wood 1041). The typeface Futura ties the piece to 1980s advertising, when it was "so ubiquitous" that a collective of art directors called it "'the most overused typeface in advertising history'" (Gittlen). Kruger's placement of Futura text over the black and white photo creates a satirical "advertisement" which aims "to sell an idea [or concept] to the viewer" instead of a product ("Barbara Kruger: American"). Her social critique is fittingly delivered through a subverted convention of capitalist society.

The influence of Russian Constructivism and Agitprop on Kruger's personal style arguably connects her piece to propaganda ("Barbara Kruger: American"). Kruger's limited palette, geometric framing and short slogan connect to Constructivism. She uses these characteristics to critique socio-political situations and norms, in this case gender stereotypes, rather than to promote a governmental regime. Despite her Agitprop style, Kruger does not consider her work propaganda, describing it as more akin to "paste-up" magazine and media-related work (Kruger). Her work has stronger ties to media and advertising than propaganda.

Untitled's irony and direct address form Kruger's commentary on gender stereotypes and their presentation in children. The pronoun "we" simultaneously personally engages viewers and alienates them depending on whom they perceive it to refer, creating a multi-layered message whose ambiguity induces prolonged consideration by the viewer. Futura connects the piece to advertising, "selling" Kruger's social critique via social convention. Her style arguably connects her piece to propaganda art, but this seems secondary to its advertising connection.

Combining subtle imagery and a single word, Fairey promotes Barack Obama's presidential candidacy in HOPE. Discussing his intention with CNN, Fairey stated supporting Obama was "logical as an evolution of [his] opposition to ... the things [he'd] been opposing in the past" (Fairey). His work was so in line with Obama's ideals, Fairey could create work supporting him while maintaining his focus on protesting socio-political issues (Moll). Using Obama's pose and the poster's colors, Fairey makes the illustrated Obama look like a patriotic "leader with a vision and conviction" (Fairey). Derived from several iconic images of John F. Kennedy, Obama's gaze looks pensively into the distance (Moll). This looks impressive without being intimidating and "gaz[es] into the future" (Fairey qtd. in Moll). It visually represents Obama's "vision and conviction" (Fairey). This positive depiction sets



Fig. 2: Shepard Fairey, HOPE

a tone for the piece before the text is read. The red, cream and blues of the piece are a variation on the American flag's colors, symbolizing patriotism. Slight variation from the original hues and the addition of a lighter blue provides a more unique use of this symbolism, potentially representing the new quality of "hope" Obama is promising to bring to American politics. Writing "HOPE" in this lighter blue supports this.

The word "HOPE" clearly articulates the piece's meaning and is connected to Obama through its visual integration into the piece. Working with the image, the text ensures there is little debate over the piece's intended purpose of promoting the Obama campaign and its ideals. Despite its message, whether the word "hope" represents Fairey's original intention is debatable. Fairey's original 700 posters, seen in Figure 8, read "PROGRESS" (Schwarz). After approving the poster, the campaign suggested switching to "hope" or "change" - their main campaign slogans (Moll). "Progress" potentially better represents Fairey's views on Obama and his original artistic intent. "Hope" arguably represents the campaign's intentions rather than Fairey's, particularly since the artist's own "Obey Giant" logo is present in the "PROGRESS" posters, seen in Figure 9, but not in the final "Hope" posters. However, Fairey's choice



Fig. 8: First 700 posters



Fig. 9:
*Detail of Fairey's
logo in Obama
Progress poster*

of the symbolism of “hope” and its ties to Obama over those of “change” still indicates his own final artistic intention within his collaboration with the campaign.

HOPE’s formal elements make the piece propaganda, advancing Fairey’s intention. The short, all-caps sans-serif type and flat, printed colors connect it to Russian Constructivist works (Hart). Fairey states: “I love propaganda art from many countries and consider my own work to be propaganda because it’s designed to influence people so they see my point of view on issues” (qtd. in Hart). Rather than manipulation of people by those in power, Fairey’s propaganda

aims to promote people “believing in democracy” and calling each other to action to vote for a candidate (Fairey). His subverted use of typical tools of manipulation aid his intention of calling on the political voices of the masses.

Fairey’s carefully constructed image and single word portray Obama as a patriotic and visionary leader representative of hope for US politics at the time. Through Obama’s gaze and a variation on US flag colors, Fairey creates initial tone with this patriotic and visionary look. The single word establishes a resounding message, clearly connecting Obama with the idea of “hope.” While the word “progress” represented Fairey’s original intention, his choice of “hope” over “change” makes the text relevant to his final artistic intention. His style and stated intention make HOPE a subverted propaganda piece, encouraging support for Obama using positive visual rhetoric rather than negative manipulation.

Kruger’s and Fairey’s imagery and text combinations convey their differing artistic intentions. Kruger’s text ironically refutes the stereotypes in her image. Her direct address in the pronoun “we” makes the viewer unsure of to whom she is referring, giving her meaning layered ambiguity. Despite stylistic connections to propaganda, her typeface and stated intention transform her piece into a satirical advertisement. While Kruger arranges text over her image to satirize it, Fairey’s text and imagery work in tandem. The word “hope” reinforces the portrait’s symbolism and clarifies its meaning rather than causing debate. Dispute over Fairey’s text lies in the context of its creation and the artist’s intention rather than in its meaning. Instead of advertising, Fairey’s piece is a subverted form of propaganda. While propaganda fits Fairey’s purely political intention, advertising fits Kruger’s social one.

Composition of Text

Visual hierarchy within Kruger's Untitled involves text positioning and framing over the image. The audience views the faces of the girl and boy (See box 1, in Fig. 10) before reading the text (See box 2, Fig. 10), but then returns to the image before registering the children's actions (See box 3, Fig. 10). When first viewing artwork, "observers tend to look at



Fig. 10: Visual hierarchy (author's own)

those parts of the scene that contain high contrast and fine detail as well as items of significance and meaning - for example, human beings, faces and heads" (Kuisma et al. 32). The children's faces and the bold, red-backed text are therefore natural focal points. The area above the band is about 56% of the piece's height, while the band of text and the area below it constitutes about 44%. This difference in size and elevation of framed areas mean the children's faces - images of visual "significance and meaning" (Kuisma et al. 32) - are viewed before the text, even though the red band occupies the foreground, forming high contrast against the black and white. The image's context is perceived only after being partially observed. The viewer then looks back at the image, reregistering the children's faces before perceiving their stereotypical actions and fully understanding the text's context. Kruger's framing and text placement over the image establish a careful visual hierarchy, guiding perception of the piece's message.

Kruger's color and placement emphasize text. The piece's white text is placed on a vibrant red band over the monochrome image. Backing the white text with red makes it easy to read, and the red band creates contrast against the black and white image. The clean red line brings visual importance to the text, despite its secondary place in the visual hierarchy. The text's centralization emphasizes its visual importance, giving it a measured, even placement.

Kruger's Futura Bold Oblique font is central to the piece's tone (Heller, "Barbara Kruger" 112). A geometric sans-serif typeface, Futura looks angular and almost raw compared with serifed faces but is still refined enough to be called "the best of the sanserif faces" by Bringhurst (257). The typeface connects the piece to bold graphic design of the 1960s onwards, which favored sans-serif typefaces (Heller, "Barbara Kruger" 112). The bold oblique variety of Futura creates a proclamatory tone. Bolding the words makes them visually loud and heavy, and using purely Futura Bold would have created a loud, declaratory statement. However, the slanting of the characters in the oblique creates an equally forceful but less stark proclamation.

Within *Untitled*, the viewer follows Kruger's established visual hierarchy: looking to the children's faces, then to the text, and back to the children and their actions. This allows viewers to understand Kruger's message in relation to both the text and image. The piece's colors, clean lines and text arrangement emphasize the text. Futura Bold Oblique makes Kruger's text an accessible and loud proclamation that still retains subtlety and formality. These qualities make Kruger's piece stark in its visual communication but allows subtleties of tone and meaning to be conveyed.

In *HOPE*, Fairey creates visual hierarchy through scale, color and contrast, ensuring viewers associate the text with the image and person. Viewers first look at Obama's face, then to the text and eventually to the Obama campaign logo above the "E" in "HOPE". As discussed above, viewers are naturally drawn to the face, and the piece's portrait orientation further emphasizes this. The highlight color, off-white, is used in portions of Obama's face and shirt collar but in few other areas, furthering this emphasis. The text is the second focal point. Its size and contrast with the dark blue of Obama's suit make it prominent and clearly visible. In reading the text, the viewer's eye moves from the bottom left to the bottom right of the piece, towards the Obama campaign logo above the letter "E". This order of observation creates an association between the image of Obama and the idea of "hope." After this association, the ideal of hope and Obama are tied securely to his presidential campaign through the logo, promoting Obama's campaign.

Placement and color emphasize and integrate the text into the piece. Despite the contrast against dark blue, the text's light blue is the same color used in the left background and mid-tones of Obama's face. This pushes the text back, so that while emphasized, it does not overpower the image. Had the off-white highlight color been used, there would have been considerable emphasis on the text, and it would have competed with the face. Emphasizing Obama's face more than his slogan better serves the intent to promote him. Integrating the text with the rest of the piece and the use of a mid-tone ensures there is interaction, not competition between imagery and text. Fairey's use of the font Gotham Black helps create the text's serious, measured, yet optimistic tone, and ties it into the 2008 Obama presidential campaign. The font specification "Black" refers not to text color but indicates a font heavier than bold. Gotham was the official typeface of Obama's 2008 campaign. This sans-serif typeface appeals to contemporary graphic design for similar reasons to Kruger's Futura, but arguably has a more contemporary appeal, having been designed in 2000 rather than the 1920s (Hoefler & Co.) (Bringhurst 257). According to brand expert Brian Collins, it "has a blunt, geometric simplicity," making it appear "matter-of-fact" to viewers, but also "feels warm" (qtd. in Heller, *To The*). Capital letters give the text a loud, immediate

tone, emphasized by the Black font, giving more visual weight to the idea the poster attaches to Obama - "hope".

HOPE's visual hierarchy connects Obama with the idea of hope, tying this to his presidential campaign. The word "HOPE" forms enough contrast with the area around it to be a focal point but is pushed back, allowing Obama's portrait to remain most prominent, better conveying Fairey's intent. Using an official campaign font connects the poster to the campaign, while giving the text itself a blunt yet engaging tone which appeals to contemporary voters.

Kruger and Fairey use composition to establish visual hierarchies that aid their messages. Both pieces' hierarchies place faces just before text. Fairey does this to promote a persona while Kruger does so to acutely control her message's interpretation. While Kruger's ends with the actions within the image, Fairey's ends with the campaign logo above his text, serving the same purposes. Kruger's Futura Bold Oblique is noticeable and proclamatory due to the typeface used and its bolded font, but its oblique font makes it subtler in tone. Fairey's Gotham Black is powerful and straightforward. While Kruger's red against monochrome creates stark contrast between imagery and text, Fairey uses enough contrast to make the text a focal point while using colors from the imagery to push it back. These methods fit Kruger's text's removal from the image's actions and Fairey's text's consistency with his image.

Conclusion

Within Untitled and HOPE, both artists convey their intentions through text and composition. Kruger's text refutes the ideas within her image, and the proclamatory tone of Futura Bold Oblique and the red-backed text fits this stark contradiction. Futura also connects Kruger's piece to advertising, "selling" her ideas to viewers. Fairey's text complements his imagery's ideas, and his use of color and Gotham Black enable an engaging connection between imagery, text and campaign. Fairey's text clarifies the meaning of Obama's portrait, while Kruger's text contradicts her image, ambiguously incorporating the viewer. While Fairey's choice between two slogans arguably indicates final artistic intention, the extent of this could be further explored.

Both pieces share visual characteristics of Russian Constructivist propaganda. Fairey embraces this, calling his own work propaganda while subverting the art form's traditional uses. However, Kruger embraces her connection to advertising, never claiming a propaganda intention. Although both artists explain their artistic intentions, Fairey does so in more detail per piece than Kruger. While providing valuable insight into HOPE, Fairey's explanations might not be as reflective of how well his intention is

communicated. Although Kruger's pieces are heavily discussed by art critics, HOPE is not, leaving Fairey himself as the main source of information, possibly skewing analysis. Both pieces are carefully composed combinations of text and imagery conveying proclamatory socio-political statements. However, while Kruger creates an "advertisement" critiquing society, Fairey creates propaganda supporting a politician. Where Kruger uses text to contradict her image and create satire, Fairey streamlines the meanings of text and imagery to create one strong statement. Though both artists use text and its composition, they do so in differing ways to communicate fundamentally different artistic intentions.

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Gurav Vats



Literature

To what extent does Thomas Hardy make use of characterization to embed thematic elements in Tess of the d'Urbervilles: A Pure Woman Faithfully Represented in order to reflect the Victorian Era?

Introduction

Thomas Hardy (1840-1928) is a renowned novelist and poet in English literary history. His prolific career as an author spanned both the Victorian and Modern eras. *Tess of the d'Urbervilles: A Pure Woman Faithfully Presented* is one of Hardy's most celebrated novels and is a portrayal of the life of Tess Durbeyfield, the primary female protagonist, and describes her trials and tribulations due to her father's continued desire for an elevated standing in society. Hardy firmly bases the novel on the traditions and norms of the Victorian era. This feature of his writing is most evident in the character of Tess, who is consistently characterized as a pious woman, one who remains in dutiful subordination to the dominant male characters in the novel.

However, because of the complexity of the time period (The Victorian Era), Hardy uses numerous thematic elements in order to accurately reflect it. This is mainly due to the many facets of society at the time, encompassing everything from industrialization and economic changes, to the power of the Church and gender inequality. This gives rise to the research question: "To what extent does Thomas Hardy make use of thematic elements in *Tess of the d'Urbervilles: A Pure Woman Faithfully Presented* in order to reflect the Victorian Era?"

Even though there is a significant amount of literary criticism and analysis on the novel and its characters, a dearth of material exists when it comes to the how individual characterization provides the novel with the thematic elements needs to accurately reflect the Victorian Era.

Thus, the aim of this extended essay is to analyze the novel in detail along with a host of other reputable secondary sources in order to highlight the way in which Hardy has infused his novel with thematic elements that reflect the events and atmosphere of the time period in which it was written.

In order to fully understand Hardy's use of thematic elements it is important to have some context of the Victorian Era itself. The Victorian Era, as the name suggests, was the period of Queen Victoria's reign from 20th June 1837 until her death on 22nd January 1901 (New World, 2015). This time can only be described as a period of evolution in which significant changes occurred in most aspects of politics, economics and law and order in society. A predominantly archaic society was transformed into one which was highly industrialized and more democratic. By the time of Queen Victoria's death, London was the booming capital of an Empire that spanned a quarter of the globe. This rapid rise of industrialization and development meant that the families who held land quickly became some of the wealthiest people in the nation. On the other hand, there was the middle class which consisted of individuals in governmental positions, naval officers, and educators. Finally, there was the lower class which consisted of laborers and even child workers (Era.org).

It is apparent that even though development had taken place, society was very much segmented and had clear social distinctions. Income inequality fueled a sense of superiority for the wealthy while making the poor desperate to make ends meet. At the onset of the novel, Hardy outlines this 'thirst' that the lower class has for wealth and a higher standing in society. He achieves this through the characterization and dialogue of John Durbeyfield, Tess' father, who enthusiastically believes the word of a passerby named Parson Tringham who addresses Durbeyfield as "Sir John" and exclaims his apparent lineage to the ancient and knightly family of the d'Urbervilles (pg.3). This is only one of the many examples in which the characters of the novel are reflections of the Victorian Era.

The analysis of principal characters is a crucial step in identifying the thematic elements which reveal substantial information about the context of the novel even if many of the messages conveyed by the author are subtle. Thus, an analysis of the characters of Teresa (Tess) Durbeyfield, Angel Clare, and Alec Stoke-d'Urberville is vital.

Characters

Tess Durbeyfield

Tess Durbeyfield is the protagonist of the novel who documents her life from the age of sixteen to twenty-three. She is described as a dutiful, obedient and rather attractive

individual, who is the oldest child in a family that is drowning experiencing increasing levels of poverty as a result of the economic hardship of the time, and her father's drunken ways. Leading on from her father's encounter with Parson Tringham, Tess' mother, Joan Durbeyfield, also learns that they are "the lineal representatives of the ancient and knightly family of the d'Urbervilles" (pg.4). Upon obtaining this information, Mrs. Durbeyfield essentially takes advantage of Tess' external beauty and tries to persuade her to go to the d'Urberville residence and claim kin. In chapter four of Phase 1 of the novel, Tess holds herself responsible for the accident that kills the family horse, Prince. This event is of significance as it instills a certain sense of guilt within Tess that eventually obliges her to accept her mother's suggestion even though it is against her morality.

This insight that Hardy offers into Tess' character and her surroundings reveals a major aspect of the Victorian Era; For a woman, especially one who is unmarried and youthful, external, superficial beauty holds more importance than their inner qualities and substance. (Hughes) This is almost explicitly stated in dialogue between Joan and John Durbeyfield.

"What is her trump card? Her d'Urberville blood, you mean?"

"No, stupid; her face -as 'twas mine." (pg.61) (Hardy)

The above lines of dialogue further reveal the mindset of Tess' parents when it concerns her. A trump card is defined as, "a valuable resource that may be used, especially as a surprise, in order to gain an advantage." This medieval ideology, when it comes to daughters and young girls, is a defining factor of Victorian society and is clearly an area in which society has not seen any progression in some regions and countries. This can be further supported by Joan's reply as she insinuates that she possessed the same trump card that her daughter now does. This piece of dialogue further highlights how the same ideology has carried across generations and is ingrained in both men and women.

It is important to understand that Hardy's depiction of women in the Victorian Era has a high degree of accuracy as it is justified through the juxtaposition of Tess' level of education in the novel. It is known today that Victorian women at the time, especially those who lived in newly urbanized areas had a low level of education or were not educated at all. (Shepherd). The women of the Durbeyfield family share the same fate, as it is inferred that Joan did not receive education whereas Tess only completed her schooling up until the Sixth Standard in the "National School under a London-trained Mistress" (Hardy). This lack of higher education is reflected in the shallow ideology possessed by Joan and Tess' naivety.

As members of a working class family that is part of the lower echelon of society, the actions of Tess, her father and mother, are a reflection of the harsh economic realities for the poor in the Victorian Era and the consequences of these problems are further propagated as the plot progresses.

Under the influence of her guilt and ingrained subordinate attitude, Tess accepts her mother's offer and makes her way to Trantbridge, to the slopes to claim kin to the d'Urberville family. Once at their residence, through Tess' character, Hardy reveals the extent to which a lack of education can affect a woman's life. Naïve and inexperienced Tess meets Alec d'Urberville who can only be described as rapacious and possessive. Alec tries to impress his control over Tess once he has given her a job caring for his blinded mother's chickens. Eventually, Alec seduces and then molests Tess, who as a result, becomes pregnant with their child. However, once this takes place, Alec abandons her and their child. Sorrow, her child, is born while Tess is in dire circumstances. Ultimately, Sorrow dies in his infancy and Tess is left alone to grieve and bury the child who was a result of Alec's betrayal and promiscuous intentions.

Tess pays the ultimate price as the product of an unequal society where she is treated as a means for financial gain or domestic work. The anger and poignancy that Hardy perhaps feels about gender inequality in Victorian society is channelled through Tess' character and her dialogue when she returns to meet her mother.

"How could I be expected to know? I was a child when I left this house... Why didn't you warn me?... you didn't help me!" (Hardy)

Hardy's use of ellipses and repeated questions and exclamations adds a sense of lack of control and internal frustration to Tess' character, thus validating the intensity of her emotions and severity of this societal problem. For readers, at this point in the novel, it becomes very clear that Tess is a depiction of a woman in the Victorian Era. This is because, until this point in her life, she has always had to endure the consequences and punishments of 'crimes' and actions that were not carried out by her. She can be compared to the birds that are caged by Mrs. D'Urberville except she is restricted by the economic circumstances that surround her, along with the dominance of men in her life as represented by Alec d'Urberville and John Durbeyfield. This oppression of Tess and her lack of freedom is possibly an accurate reflection of the lives of other young women in Victorian society. One of the most significant analogies that Hardy uses to depict this oppression is of the caged birds at the d'Urberville residence. However, even the birds, as Tess states, have someone to put an end to their suffering and pain, whereas Tess has no one. More than anything, this analogy is a foreshadowing of the control that

Alec will possess over Tess' life. Embedding Tess' characterization with such analogies is one of the way in which Hardy draw's a parallel between Tess' life, and the life of a typical Victorian Era woman and how both their lives are strongly controlled by male figures.

Alec d'Urberville

Hardy's criticism and depiction of Victorian society becomes ever more apparent when Tess' character is compared to Alec's character. Alec d'Urberville is the antagonist of the novel whose original family name is Stoke; however, as a result of the modernization taking place, his father's wealth increases and his family adopts the d'Urberville name in order to be recognised better by society around them. This action of changing family names for acceptance into society as nobility underlines the importance of superficial things such as ancestry and paternal wealth in society at the time.

Alec exudes dualities in his character as even though he carries a noble name, through Hardy's creation of this dichotomy within his character, Alec is brutish and irresponsible. He takes advantage of his mother's blindness and Tess' financial condition to fulfil his own lust. Hardy documents how Alec nurtures Tess with strawberries and attempts to seduce her before her imminent debasement. With a publication date of 1892, Hardy released the novel into a very conservative society, and thus received a great deal of backlash from critics. However, through the depiction of the relationship between the aforementioned characters, Hardy challenges the conservative Victorian society and many have viewed parts of his novel as a direct cultural criticism of the era. The relationship of Tess and Alec, in particular, is a medium through which Hardy conveys a highly important message: men use women for their pleasures and when they have achieved what they desired, they abandon them. He further channels this message through more dialogue between Tess and Alec.

"You and those like you, take your fill of pleasure on earth by making the life of such as me bitter..." (Hardy)

Hardy supports his criticism of society by documenting Alec's life after he has abandoned Tess and it is important to note that both characters face drastically different consequences. On one hand, while Tess experiences the birth and death of her child in isolation, Alec is tutored by Mr. Reverend Clare, the father of Angel Claire, in order to guide him to abandon his immorality. He does so by leading Alec to St. Paul's teachings, with the result that Alec eventually becomes a street minister, a step closer to being pure.

Alec's character is penned by Hardy in a deliberate manner so that he is an embodiment of an elitist man in Victorian society dominated by the elite (Kathryn,2014). Even though he is immoral and repeatedly makes misuse of his fortune, it seems that society conforms to those who have been favoured financially and physically, by being a male. Admittedly, Alec is eventually killed by Tess when she stabs him in the heart, however, her action is due more to the evolution of her character and a further attempt by Hardy to go against societal norms through his novel.

Angel Clare

The other prominent character who reflects the Victorian Era is Angel Clare, the son of Mr. Reverend Clare and Mrs. Clare. The family is once again a part of the nobility and as a result, Angel's two brothers, Felix and Cuthbert, both receive higher level education and eventually graduate from prestigious universities, going onward to become high earning clerks. (Hardy)

On the other hand, Angel decides to shun tradition, expresses and follows his desire to pursue farming and agriculture instead of attending university. Once again, as a representation of stereotypical, elitist Victorian ideology, the noble Clare family discourage his ambitions and attempt to persuade him to wed a woman by the name of Mercy Chant, a lady who is described as being proficient at Bible classes and Antinomianism. Once again, Angel declines as he requires a wife who will be able to assist him with the farm. In contrast to Alec and other such aristocratic characters in the novel, Angel does not seem to give as much importance to social status and reputation. Later on, his eventual love for Tess as a milkmaid, supports his characterization.

Angel is also a character who endeavours to support gender equality as he despises "the aristocratic principal of blood" and thinks it necessary that he "ought to show respect to the spiritual ones of the wise". As the plot progresses once Tess has met Angel, he offers to help tutor Tess in a field of her choosing, thus going against the general trend when it comes to women's education. Since Hardy's novel is saturated with characters that represent the worst of Victorian society, Angel's character may be a way in which Hardy conveys the message of slow change occurring in society due to the actions of people such as Angel.

Regardless, Hardy is quick to establish Angel's faults and weakness to further reinforce the context of the novel. He does this through Angel's rejection of Tess when she reveals her past to him. His love for Tess seems to evaporate as soon as he learns that she has had intimate physical contact with another man, even though it was non-consensual. He simply refuses to accept her, despite the fact that he has had an affair with an older

woman prior to meeting Tess. Through this encounter between the two characters, Hardy draws attention to the shortcomings of Victorian society where once again, equal crimes are given varying punishments as society's moral values differ when it comes to men and women. Angel's inflexibility and irrationality are ironic as he seems to criticize the strict rules of religion but punishes Tess with even higher severity.

A recurring theme throughout the novel and its characterizations is religion, with many events and decisions revolving around it. Aside from its plot and characters, religion is possibly the most prominent reflection of Victorian society in the novel.

Religion is clearly a regulating force in society at the time and is central to Tess of the d'Urbervilles, so much so that Tess is first introduced to readers at the May Dance which is essentially an assimilation of some traces of Pagan culture into Christianity (Print,2015). Hardy frequently refers to religion in the novel, whether it be indirectly or through a direct event, but he does so because he wishes to accurately reflect the dogma and beliefs of the Church and the people. Perhaps the rawest reflection of the dogma of the church is through Tess and her child, Sorrow. Shortly after his birth, Tess baptizes Sorrow and the vicar that is present at the church confirms this baptism. However, when Sorrow passes away and Tess brings his corpse to the Church for the burial, the vicar denies Tess' requests to perform the Christian burial that she desires for her deceased child. After this incident, Tess vows to never return to the church and performs the burial herself.

Hardy's choice of name for Tess and Alec's child, "Sorrow", is not coincidental as the name is a personification of Tess' overwhelming inner emotion as well as a reflection of the sad and short life led by the infant. Furthermore, Hardy uses this subplot to criticize and bring to attention the harsh attitude of the Church and described it as the Church's "inadequacy of meeting new intellectual challenges". (Hardy)

Apart from the Church and its influence on society, Hardy uses religious symbolism to accurately convey Victorian society to his readers. Firstly, Hardy establishes, that even though religion is a driving force in society, there are true believers of religion and "sinners". Two of the characters described as being the true believers are Tess and Reverend Clare, whereas characters such as Alec are the sinners, who wear a mask of righteousness but are easily tempted by lust. This distinction between the two types of Christians, reveals one of the reasons Victorian society has had little ideological development. Besides societal reflection, Hardy also uses some religious symbolism in his novel to foreshadow certain events. An example of this is when Angel and Tess stay at Stonehenge, a temple used for worship and human sacrifice. The time that

Tess spends at Stonehenge is a foreshadowing of her imminent execution. This use of foreshadowing and symbolism, reflects the then common occurrence of women, being treated unjustly by society; many times being punished severely for "mistakes" that were committed by men.

Conclusion

It is apparent that Thomas Hardy, as a novelist and poet born in the Victorian Era, allowed his works to be influenced by the environment in which he grew up. Furthermore, he also used his novels to voice his opinions on society and challenged it to change by presenting new ideas into a conservative environment.

Analysing Tess of the d'Urbervilles with the focus of identifying reflections of the Victorian Era, allows one to reach a much deeper understanding of the novel, for without considering the development, progression and overall context, Tess of the d'Urbervilles would just become another typical story between a virtuous female protagonist and an evil, male antagonist.

The reason for this is because Hardy has very thoroughly used certain thematic elements to reflect the Victorian Era which forms the entire basis of the plot. There are certain limitations to this Extended Essay as the majority of all secondary sources are criticisms on the characters in the novel, but very few that focus entirely on Hardy's use of thematic elements for the reflection of the Victorian Era.

However, using secondary resources to learn more about Hardy's context and the Victorian era have helped to formulate an essay which provides a different perspective of analysis for the novel.

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